Cumulus Working Papers

Paris–Sèvres

27/11

A? Aalto University
School of Arts, Design
and Architecture

Contents

Jean-René Talopp
Welcome speech

Hello and warm greetings to everyone.

Welcome to Strate Collège. It is a genuine pleasure for me to host you, and through all of you, our international association Cumulus for this "Crossing Talents" event.

I am extremely happy because this event is truly representative of the relationship we all have with one another, as I believe that each and every one of us, with our cultures and our educational projects, share the conviction that design is at the heart of all changes taking place in our twenty-first century societies.

We all know that the society of Men (or Humans to be politically correct), in all its dimensions – be them decisional, organizational, professional, but also and specifically its everydayness – will need now, more than ever, the critical eye of the designer.

However, we must take into account at the same time the growing complexity of today's world, as well as the quality of life for today's men and women.

But let us remember that this very complexity, and in particular this attention to Man, require new analytical tools, new methods, new schools of thought. Only thanks to cooperation between disciplines, crossing of talents and skills, we will strive for a more sustainable and responsible world.

Right brain, left brain, emotion and method, sensitivity and calculation: mixing and sharing our knowledge and educational methods will allow us to train our students as designers, artists, creators, and teach them to collaborate with people from other fields, with other knowledge.

Tomorrow's world can be nothing but collaborative, and that is the challenge for our schools. This is why we have chosen this theme for these three days, what we call the transversality of disciplines, "Crossing Talents".

Some words about the Study program of Strate:

Strate Collège Designers:
 • 5 years after Bac
 • 4 Departments:
   Innovative usage & product
   Mobility & Transportation
   Packaging Branding & Retail
   Interactive Systems & Objects

Strate Collège Modelers
 • 3 Years after Bac
 • Modeling & numerical Sculpture

Strate Collège Masters
 • 1 year
 • For Engineering & Business Graduates

And a new course:
 • Strate Collège Research

Last but not least, Thank you Sylvie, Luis, Maurille, Sébastien, Mélanie, Karine, Philippe, Omar, Joel, & also the permanent staff of Strate, & all the students.

Express them my gratefulness

I wish you all very enjoyable and good moments here at Strate Collège.

Jean-René Talopp
President, Strate Collège

François Kosciusko-Morizet
Welcome to Sèvres

Good evening to you all,

I was really personally pleased when I heard that Strate Collège was moving in at Sèvres, and did everything I could to encourage the project. And it was also a pleasure to push forward Cumulus's project within the Conseil Général des Hauts de Seine, for several reasons.

Firstly, because I know how much life students can bring to a town. This is why this student residence is being built next door: Sèvres is not only a city where people work but also where they enjoy living as it offers a variety of services in a privileged and preserved environment, near Paris.

Secondly, because, upon closer examination, industrial design is about understanding matters and aesthetics. And you can't have missed that the mastery of forms and matters is Sèvres's hallmark. The city of the royal porcelain manufacturing has recently become "Sèvres, City of ceramics" under the impetus of its energetic director, David Cameo, who was your host yesterday.

Then, because Sèvres also hosts the Centre Technique des Industries de la Fondrie (ctif), another institute of excellence, which masters the arts of fire and metals. Its director, Philippe Malle, is here with us tonight.

As mayor of this city, and as a trained engineer also, I am very pleased to see that, thanks to Cumulus's initiative, the most emblematic skills of Sèvres are gathered in the same place and collaborate together, but also that your institutions keep teaching our young generation how to combine beauty and efficiency.

This reminds me of another French engineer and industrialist, father of the French aircraft industry, Marcel Dassault, who said that "a beautiful plane always flies well". This gave the "Mirages", but also business planes "Falcons", and of course the "Concorde" with British partnership.

And last but not least, I am convinced that the cultural intermingling of your organization fosters tomorrow's evolutions.

I take the liberty to bring to your attention on the fact that you are also in the heart of the Greater Paris Seine West conurbation, at the centre of the triangle designed by Paris, La Défense and Saclay plateau. This will surely become the most dynamic economical area of the Greater Paris metropolitan area.

To sum things up, I hope that the quality of the trainings you give in your already renowned schools can become a standard, and that your international openness would bring even more exchanges from one continent to another. Finally I hope that you will keep from Sèvres the image of a landmark city for your disciplines and for its quality of life.

Thank you.

François Kosciusko-Morizet
Mayor of Sèvres, Vice-president of the
"Conseil général des Hauts-de-Seine"

OPENING SPEECH Christian Guellerin

About Transversality

I've already had the opportunity to address the major challenges that design schools are bound to encounter down the road.

It is now up to designers to tackle increasingly complex issues.

And the contexts are particularly relevant to challenge. In the context of globalization, we have to find new values, rethink our lifestyles, companies must reconsider their grounding industrial and financial paradigms, the green economy will oblige us to rethink how we consume, (the consumer will become a contributor more than a consumer), …and we have to consider water scarcity, global warming, aging of the population, news technologies, social network… So many challenges that make the job of designer exciting and essential for humankind.

Design schools already hog the limelight because they have made humankind into THE central issue of all issues, because they fiercely believe in crossdisciplining technology (engineering schools) and economical development (business schools), and because to take up such sizeable challenges as those we are now faced with we must imperatively get together, all of us – sociologists, philosophers, artists, engineers, finance experts, marketers – and think about tomorrow. A tomorrow that has turned slippery because it lacked landmarks… A tomorrow that must be made more secure.

The designers have to face technological issues though skepticism around progress continues to climb, economic ones though globalization has called into question all industrial and market paradigms, societal ones though culture shock has turned all values upside down.

Design schools hold their ground by proving to be the most relevant for they consider science and meaning as one. The designer possesses both a scientific background and an intuitive conscience, therefore creating an "intuitific" conscience bred from renewed compatibility between technology, business and Love, a couple of three, and we know a couple of three… it is a challenge… But, despite these opportunities, it goes without saying that we must deal with extreme care when it comes to developing our competencies, and namely in two areas: Within our educational institutions, there is a need to not only improve upon the skill to produce, but also demonstrate the relevance of the thought process generated there within. For some of us, it symbolizes the chance of becoming real innovation and incubation centers for new projects.

And for the rest, it has to do with improving our ability to produce knowledge and make it available to all, about furthering research capacity. And we know that we wont be able to do that alone, we will be obliged to work with others.

Design as a research discipline can be a managerial one capable of offering to all other areas the means to attain greater transversality, a greater humanity, and to bring with it a conscience that exact sciences do not inherently possess. As a practical discipline, it gives the best scenarios for tomorrow and give a vision to the progress and development. It gives a vision to Humanism, whose responsibility is no more to use the nature but to protect it.

This is why we have here for this meeting in Paris, to evoke how to manage the transversality with others without losing the great opportunity we have, to be designer. How to be designer, how to manage the way in between exact sciences and human sciences and to bring something that will enrich the others.

We have to think the world of tomorrow, thinking it differently, thinking it better. Fortunately, we have talented students, talented professors, and we are definitely enthousiast.

Christian Guellerin
President of Cumulus
General Director L'ecole de
design Nantes Atlantique
c.guellerin@lecolededesign.com

Keynote speakers

Anne Asensio

Anne Asensio joined Dassault Systèmes in November 2007 as Vice President of Design Experience. In this role, she will launch DS's Design Experience strategy with the mission to define and implement "best in class" design solutions for enterprises, Dassault Systèmes Identity, Design & Brand studios activities, as well as to foster a Design Excellence culture within Dassault Systèmes. Prior to her DS appointment, Anne held influential roles at General Motors and Renault, and won several prestigious accolades for her talent and experience.

Most recently Anne worked as Executive Director of Design, Advanced Design, at the General Motors Design Center, also in charge of vehicle design at GM's Michigan, Los Angeles and England design studios. She led the development of a number of recent auto show concepts including the Cadillac Sixteen and the Hummer H3T, and others, the latest one being the Chevrolet Volt, presented in 2007 in Detroit. Anne joined GM in 2000 as Executive Director of the Brand Character Center, and later was responsible for Interior Design, Quality and Brand Character. She began her career at French automaker Renault, where she was responsible for driving the design of small and mid size cars, such as the Megane range.

Her work illustrates a consistent interest in innovation and imagination of future design practices. Focused on brand character building, Anne brings a unique ability to establish the right environment for creativity, fostering collaboration and cross-fertilization among teams and delivering Design concepts with meaningful benefits for people

In 2001, *Fortune* magazine featured Anne in an article entitled "25 Rising Stars", which highlighted next-generation global leaders, all age 40 or younger. *Automotive News* named her "Automotive Woman of the Year" in 1997, and recognized her in 2005 and 2000 as one of the top 100 women in the North American automotive industry. *Crain's Detroit Business* included her in

its list of "Michigan's Most Influential Women" in 2001. In 2008, with Dassault Systèmes, Anne is honored as 25 leading women honoring Europe's best from Automotive News Europe.

Anne is also a member of prestigious committees such as Eyes on Design, the Festival de l'Auto, Louis Vuitton Design Award, ADC Super Design Awards, "L'observeur du Design", APCI club, Car Design News competition… ; she is a member of Paris Tech Research Chair "Modelisation des imaginaires "and Ecole des mines Research chair "les nouveaux regimes de l'innovation".

She is an independent administrator on the administration Board of the Automotive supplier Plastic Omnium.

Anne holds several degrees including: a Bachelor of Arts in transportation design from Detroit-based Center for Creative Studies; a Master of arts plus a degree in technical sciences industrial design from Paris-based *Ecole Nationale Supérieure des Arts Appliqués*.

KEYNOTE SPEAKER

Fabienne Cammas

Vice-president and managing director
of the Plan Créatif Group.

Having trained as an engineer and designer, she set up Plan Créatif Bees'Net in 1996, a fully-owned subsidiary of the Plan Créatif Group. She managed this subsidiary for 10 years and subsequently was promoted to Managing director of the Plan Créatif Group in 2007 and to vice-president in 2011.

Plan Creatif, a communications agency, works on major company issues, putting the emphasis on 3 key elements; digital, user experience and innovation and ethical communication.

http://ww.plancreatif.fr

KEYNOTE SPEAKER

Jean-Claude Charlet

CPI Program Director, entrepreneur

Jean-Claude is a graduate from Stanford Business School (where he earned his MBA, after completing his first years of studies at ESSEC and La Sorbonne in Paris), and an eclectic and passionate entrepreneur. After starting his career in the non-profit sector in Cambodia, he spent 10 years in publishing (Le Seuil, Hachette). At the end of the 90's, he participated in the launch of one of the first online travel agencies in France (anyway.com) and then started one of the first online digital music store (mzz.com), funded by Bernard Arnault. In 2003, he left the Internet to go back to the retail world, and created a new concept store of "modern herbalist", called Le Carré des Simples, that he manages and actively develops today. Parallel to his entrepreneurial ventures, he created in the early 2000's the CPI Program ("Creation of an Innovative Product"), a pioneer joint initiative between Strate Collège, ESSEC and Ecole Centrale Paris (3 leading schools in design, business and engineering in France), dedicated to Open Innovation, Design Thinking and Corporate Entrepreneurship.

Synopsis:

In 2004, the CPI Program was the first educational program in France dedicated to innovation in a pluridisciplinary approach, mixing students from 3 of the leading graduate institutions: Strate Collège (Industrial Design), ESSEC (Business School) and Ecole Centrale Paris (School of Engineering). Every year since then, 12 teams compete on 12 different projects given by partner companies, to invent tomorrow's new services and products. Jean-Claude will tell us more about what has made CPI's short history, its methodology, organization, successes and failures!

Cathy Huang

President of CBi China Bridge

Cathy is dynamic entrepreneur, respected thought leader in the design industry. Under her guidance, cbi has become a primary design research and innovation strategy firm in China.

Aiming to improve and grow the value and quality of Design motivates Cathy to take part in judging and speaking for renowned design events and awards. Including: iF Design Award China, Pentaward, Chinas Most Successful Design Award, China Innovative Design Awards. She also speaks for international conferences in America, Europe, Asia and frequently lectures in the leading universities around the world, like, The Danish School of Art & Design, Hong Kong Polytechnic University, China Europe International Business School, China Central Academy of Fine Art, Tongji University, etc. Her design views have been featured in cnbc, Fortune China, Design (Korea), id magazine and many other Medias.

Today Cathy is actively involved in promoting the effects and value of design for business by publishing two books: Mobile Inspiration and Managing Design for Business Success: Readings & Case Studies on Design Management, and many business and design articles.

She was the first Marketing Director of ge/Fitch China, and the former Project Manager of Haier Design Centre.

KEYNOTE SPEAKER

Yo Kaminagai

Yo Kaminagai is 52. He has been working in the ratp since his graduation as civil engineer (Ecole Nationale des Ponts et Chaussées) in 1980. He began in the Marketing team and was in charge of innovative projects, and specialized himself in passenger information. He was the first manager of this domain in 1990, before being invited to build the design management function in the company. A dedicated team was created and its growth allowed to integrate progressively all the creative disciplines participating to the transport environments design (product design, information design, architecture, cultural and art management). In March 2011 he was named Design manager beside the Director of Environments, Property and heritage, to coordinate the design policies and promote the role of the environments in the corporate strategy, for the company and for the ratp Group.

KEYNOTE SPEAKER

Mark Lloyd

Mark Lloyd is English, and studied Engineering at Cambridge University before completing a Master's Degree in Automotive Design at the Royal College of Art in London.

He started his career at Jaguar, and then moved on to Citroen in 1989. He has been involved with the concept car's Acitiva 2 and Xanae, and several production programmes.

He was then made responsible for concept cars and advanced design from 1999 to 2005, during which time he was responsible for C6 Lignage, Osmose, C-Airdream, C-Sportlounge and C-Airplay among others.

Since 2005, he has been responsible for running international and European programmes, most recently including C3 and DS3.

Abstracts

Gabriela Hertnagel and Tanja Oraviita
Bridge Over Creative Blurriness –
Experiences of creativity-led teaching
towards innovation

Creativity and innovation are regarded essential fac-
tors for the competitiveness of a society. Many studies
have recognized the importance of cross-disciplinary
and multicultural approaches on creativity-led innova-
tion, and identified elements enabling and hindering
creativity. Yet the challenge of preparing students to-
wards economically and socially sustainable innovative
and creative thinking remains. How to overcome the
challenges of physical, economical, technical and cul-
tural limitations? In this paper we reflect our findings
and experiences of learning models on creativity, lead-
ing to consumer orientated product development and
innovation. The practical examples are derived from
three educational practices (CreaCIT, ECE and RMDD),
which touch creativity, learning-by-doing, narration,
product and process development, entrepreneurship as
well as combine different disciplines and cultures. First
we identify elements in the three educational practices
that enable and hinder creativity, and reflect these to
the existing theories. Secondly we analyze and com-
pare the findings with existing practices in educational
institutes. Finally, based on both theoretical and prac-
tical viewpoints, we will draw conclusions and present
suggestions for practical implications how creativity
and innovation can be taught. Our findings suggest that
academic thinking could profit from narrative and so-
cial pedagogical elements as well as learning-by-doing,
while bridging towards creative and innovative thinking.

Gabriela Hertnagel
Assistant Planner International Projects
gabriela.hertnagel@aalto.fi

Tanja Oraviita
Planner International Projects
tanja.oraviita@aalto.fi
Aalto University of Art and Design, Western
Finland Design Centre Muova, Finland

Peter Stebbing
Schesiology: an introduction – A tool
for thinking beyond the design box

A new word is required to encourage design students to rigorously consider the consequences of their design decisions. The author believes that words such as 'systems theory,' or 'networks,' etc are inadequate due to the meanings and preconceptions already associated with them. A new word is coined from the Greek word for relationship "*schese*" or "*ΣΧΕΣΗ*" and the familiar "*logos*" to give *schesiology*, the study of both relationships and their consequences.

As a design force nature always works with endless time and complete 'information.' In contrast, human design activity is always limited by the finite knowledge and skills of the designer and the parameters of the design brief and the knowledge acquired during its execution. Although, design can be quite good for producing design solutions in the short term, nonetheless, further problems subsequently arise due to working with incomplete information.

Schesiology extends conventional design thinking to consider the consequences of decisions beyond the "design box". It encourages the perception of a design solution more as an intersection point or node within a multidisciplinary and multidimensional web of relationships ultimately and intimately linked to the biosphere. Schesiology can also help predict areas for future innovation by considering the relationships between contemporary developments and their future consequences. The paper includes illustrative schesiological examples and students' results using schesiological thinking.

KEYWORDS: Schesiology, relations, consequences, beyond design box, future innovations

Peter Stebbing
Professor, Basic Design
Hochschule fuer Gestaltung
Schwaebisch Gmuend, Germany
stebbing@hfg-gmuend.de

Panel 2
Innovation in entrepreneurship

Jamie Brassett
The Uncertainty Project – Managing
Uncertainty in Innovation Education

On MA Innovation Management at Central Saint Martins College of Art and Design, the importance of experimentation, learning from failure, dealing with risk and managing uncertainty coalesce in *The Uncertainty Project*. In the first three years of our existence, this project has run with live briefs coming from a number of commercial and public sector organisations and – during Spring 2011 – in collaboration with UK Sport, the University of Ghana (Accra) and the University of Development Studies (Tamale). It is important that the students engage in creative risk-taking and experimentation in ways which are not only valuable in and of themselves, but which are able to be synthesised into meaningful, contextually appropriate and culturally, socially or economically relevant outcomes. The up-coming collaboration is particularly interesting. While – at the time of writing – this project has yet to be finished, the significance of cross-cultural collaborations and the spanning of different disciplines (including Business, Humanities, Social Sciences, Cultural/Creative Industries, Development Studies, Sport, Engineering and Sciences) is already noticeable. This presentation seeks to show our experience of running *The Uncertainty Project* using these examples and to highlight successes, failures and responses to these failures, with the aim of showing that innovation in an educational context (as in any other), risk-taking and failure can be managed to achieve successful creative outcomes.

Jamie Brassett
Course Director, MA Innovation Management,
Central Saint Martins College of Art & Design,
University of the Arts London, UK
j.brassett@csm.arts.ac.uk

Lou Yongqi, Zhu Mingjie and Yrjö Sotamaa
Sino-Finnish Center of Tongji University:
A strategic paradigm of innovative education,
research and practice

Together with the socio-economic changes of the new era, the demands of the new knowledge of design are emerging. The role of the designer has extended from being a professional to being an initiator of change, a strategic business planner and a mediator of social innovation. Accordingly, the paradigm of design education should also extend from instilling design skills to fostering comprehensive design capabilities.

The paper introduces the Sino-Finnish Centre (sfc), a joint effort between Tongji University and Aalto University, aimed at creating a strategic paradigm in innovative education, research and practice. The Center is generating interdisciplinary innovation by combining a variety of resources. It acts as an innovation hub: open, international and interdisciplinary, which attracts cooperation and activities among universities, companies, organizations and experts. It encourages the creation of human-centered and interdisciplinary approaches to the development of product and service. Based on a creative and interactive environment, it inspires learning by means of dialogue among students, professors, researchers, industry and business to experiment, prototype and interact between theory and practice. It provides a concrete example of how to cultivate next generations of creativs through integrating and prototyping design thinking and entrepreneurship into the educational process.

Lou Yongqi
Vice Dean of College of Design & Innovation,
Executive Director of sfc of Tongji University,
Shanghai, China
louyongqi@gmail.com

Zhu Mingjie
Ph.D candidate,
College of Design & Innovation of Tongji University

Yrjö Sotamaa
Tongji-Forever Chair professor,
College of Design & Innovation,
Executive Director of sfc of Tongji University

Panel 3
Design by international
and cross-cultural teams

Chiara Colombi
SENAI Design Future – From Know-How
to Know-Why to Innovate Brazilian Design
Culture

The research activity of the Design System of Politecnico di Milano, focused on the analysis and the codification of the implicit Italian know-how in design, allows mapping the "Made in Italy" phenomenon identifying its actors, processes and channels. This ongoing research represents the reference to develop tools for codifying other territorial systems (nationally and internationally) and creating "ad hoc" strategic actions for developing innovation processes in specific territorial contexts.

Among the internalization projects, senai Design Futures is an initiative of international cooperation that aims to promote the innovation of the Brazilian industry in furniture, footwear and leather goods, fashion and textile as main industrial sectors pulling ahead the Brazilian economy as since many years have undertaken a design oriented process for high added value products.

The main interlocutor is senai, an organism taking part of the Brazilian Industrial Association and in charge of activity of professional continuing education and consultancies to support the entrepreneurial development in Brazil. The project aims to promote a "value economy", through a strategic and cross-sectorial design vision, to establish a virtuous relation between knowledge, productive and commercial systems.

The paper will explain in detail the approach and educational model and its results in terms of dissemination of a new innovation culture inside senai, looking at a new organizational structure, and outside senai. considering its potential national and international collaborative network.

Chiara Colombi
Assistant Professor, indaco Dept.,
Politecnico di Milano (Italy)
chiara.colombi@polimi.it

Theresa De Lobo
Integrating an Interdisciplinary
Experience into Design Education

The intension of this paper is to show the collaboration of design disciplines to instill a broader sense of design for students through intercultural service learning projects. The interactions at a global scale, has heightened the need for graduates to learn to interact more effectively with people from different cultures. This approach combines the concern of addressing a need for design in a real world situation, with learning how to understand culture, place, and experience through a collaborative project. Referencing a specific international service learning project, and drawing from literature on internationalization of education, this paper explores key concepts, learning objectives, methods, and challenges faced in addressing the need to prepare students for practice in an increasingly integrated workplace.

KEYWORDS: collaboration, international service learning, design-build, studio pedagogy, community engagement, interdisciplinary design

Theresa De Lobo
Associate Professor, School of Design,
Unidcom/IADE, Portugal,
tlobo@netcabo.pt

Nansi Van Geetsom, A. Milligan and G. Savage
GIDE: The sustainable future of a group
for international design eduction

This paper describes the innovative work of GIDE, Group for International Design Education; a consortium of Interior / 3D design institutions. GIDE exists to promote intercultural collaboration and exchange across education bringing ethical design issues into applied working practices, transforming curricula and promoting multidisciplinary experiences across the European Union and beyond.

To achieve this aim GIDE organises annual workshops, symposia, exhibitions and, crucially, research publications that describe diverse responses to shared project themes. GIDE, partially funded through the LLP/Erasmus programme, offers an alternative model to traditional Erasmus student exchange programmes. It argues that international collaboration at this level allows us to gain new perspectives for 'local problems' and to maintain solidarity through such collaboration.

We speculate on the sustainability of GIDE in the face of severe cuts and academic restructuring and argue that without such international, educator-led initiatives, design education will become vulnerable and unsustainable.

KEYWORDS: GIDE, sustainability, internationalization, collaboration

1 Members include: Politecnico di Milano – School of Design (Italy), member of Cumulus; Leeds College of Art (UK), member of Cumulus; Lessius Mechelen University College (KHM), Mechelen (Belgium), member of Cumulus; Hochschule Magdeburg-Stendal Institut für Industrial Design (Germany); SUPSI Scuola Universitaria Professionale della Svizzera Italiana Dipartimento Ambiente Costruzioni e Design, Lugano (Switzerland); Academy of Design, Ljubljana (Slovenia); Duncan of Jordanstone College of Art, Design, Dundee (Scotland).

Nansi Van Geetsom
international coordinator interior design and
educational coordinator Design & Technology
Lessius Mechelen University College, Design
& Technology department, Mechelen, Belgium
nansi.van.geetsom@mechelen.lessius.eu

Panel 4
Working with business on open innovation

Heikki Jylhä-Vuorio
Open Innovation Space – It Really Works!

Interest in human-centered design and multidisciplinary design process has increased considerably during past two decades. Design has come a long way from product and designer oriented form of art to Interaction Design, Service Design, Design Thinking and Open Innovation. (Aminoff, Hänninen, Kämäräinen, Loiske, 2010). The rapid changes in the society, business life and communication has lead to a chance in the way designers think and work. Design schools have a challenging task in keeping up with the development and to determine the new skills that are needed in the future. The transition creates a need fo changes both in pedagogy, curriculum and operating cultures.

The forthcoming challenges and opportunities for design education are detactable, but what exactly should change in design education? One of the essential questions is, how sould we manage the expansion of service design? During observing a service design workshop in Kuopio in 2010, the co-founder of Humantific Garry vanPatter set a question: What if the service design process results to a need of a physical product instead of a service? The question extends to a concern about the freedom of creative design process and also about content and structure of curriculum in design schools. Differentiation to professional domains and schools seem to be happening already. A border line between service design thinking and human-centered product design however is artificial. All human-centered design processes come from the same origin, which is empathy and compassion towards other people.

Heikki Jylhä-Vuorio
Head of School, Kuopio Academy of Design,
Savonia University of Applied Sciences, Finland
heikki.jylha-vuorio@savonia.fi

Ana Margarida Ferreira, Luiz Salomao Ribas Gomez and Américo Conceicao Mateus
IDEAS [R]EVOLUTION methodology –
Practical considerations based on two case studies

This paper presents the first and main results of the implementation of IDEAS (R)EVOLUTION model through two case studies. This model, presented in Genk Cumulus Conference in 2010, was developed in UNICOM / ID-ICOM-IADE and LOGO-UFSC in collaboration with several international researchers and companies. The IDEAS (R)EVOLUTION model aims at helping managers, companies, stake-holders, schools and lands to develop their innovation culture and brand identity. It is based on the main assumptions that: innovation is a context dependent process which success depends on co-creation processes; Design Thinking methodology helps people getting high levels of motivation, promoting creative, collaborative and entrepreneurial skills, all necessary conditions to innovation.

Since 2007, the IDEAS (R)EVOLUTION methodology has been totally or partially applied in academic context. In 2010, after tested on design research projects at different domains, the model was applied on real context in Portugal and Brazil. These model practical experiences, reported in this paper, supported business strategic planning and promoted social interactions to innovate products, services and brands. The model also expresses a new understanding of society considered as a whole, a main concept for designing and teaching for a sustainable future.

Ana Margarida Ferreira PhD

Luiz Salomao Ribas Gomez PhD

Americo Mateus MPhil, researcher
UNIDCOM/IDIMCOM – IADE, Portugal
americo.mateus@iade.pt

Panel 5
Social Collaborative Projects

Teresa Franqueira, Gonçalo Gomes and Rui Costa
Intergenerational Relationships –
An academic design project at the
University of Aveiro

This paper aims to show the design process of a project being developed by the 3rd year students of the Licenciatura in Design of the Universidade de Aveiro. The project is part of a wider challenge launched to all Portuguese Design Universities called "Action for Age", an initiative of the Royal Society for the encouragement of Arts, Manufactures and Commerce (rsa) in partnership with Experimenta Design and sponsored by the Caloust Gulbenkian Foundation.

This initiative intends to raise awareness amongst Portuguese young designers to the problematic of population ageing and its consequent social transformations, as well as to prompt reflections on Design's contributions in this new framework.

Hence, and using Strategic Design tools, it is intended to showcase new approaches to the process of project in design, focusing in Service Design, contributing towards the consolidation of an emerging field in the Design area.

As brief, the students were asked to identify a place and design a solution that would stimulate intergenerational relationships. Following this research phase, students were prompted to define their own brief, which led them to develop flexible solutions: a service, a network, an environment, a structure, an infrastructure, an object, a shop, a function or initiative. The purpose was to conceive an integrated solution that could respond to the identified need of enhancing intergenerational relationships, resulting in better integration of the elderly, as well as other individuals, in the community.

To kick off the project, students had to pinpoint all characteristics of the selected place and then proceed with the mapping of its ongoing activities. Those activities were regarded as social innovations, and as such their goal was to analyse them thoroughly and propose ways to perfect, strengthen and connect them.

On a second phase, students were first engaged in scenarios' building, which worked as a tool to facilitate a strategic discussion amongst the different stakeholders involved, and later designed the toolkits that would enable the implementation of those scenarios.

The results of these projects will be presented, although the focus of this paper is more the process and tools used for their development.

Teresa Franqueira
Professor, Head of the Design Degree
at the University of Aveiro (Portugal)
teresa.franqueira@ua.pt

Gonçalo Gomes
Rui Costa

Cynthia Lawson

DEED – A Case Study for Meaningful
and Socially-Engaged Design Education

The past decade has seen an increase in design curricula focused on social and economic development such as designMatters at Art Center and University of Florida's Design 4 Development. Since 2007 Parsons The New School for Design has been engaged in DEED: Development through Empowerment, Entrepreneurship, and Design, a multi-disciplinary university-wide program that brings together students and faculty of design, management, and development. In DEED, teams of students are prepared on campus for international fieldwork during which they work with artisans in emerging economies and local professional designers to support the artisans in establishing sustainable income-generating opportunities through craft-based services or products.

This paper provides an overview and discussion of the beforementioned programs and focuses on DEED's successes and failures as a case for social collaborative projects. It specifically looks at the student experience in this kind of work and, through surveys and conversations with DEED students and alumni, discusses the long-term educational value of such collaborative and social projects. This paper argues that institutions must offer these types of experiences to better prepare their students to position design, not with products as the end-goal, but as a process for innovation, collaboration, and social change.

Cynthia Lawson
Assistant Professor of Integrated Design,
School of Design Strategies,
Parsons The New School for Design
(United States of America)
LawsonC@newschool.edu

Paul Woodruffe

Suburban Interventions – Understanding
the values of place and belonging through
collaboration

How can a socially defined project facilitate meaningful knowledge transfer between community, corporate and institution?

In order to address this question, this paper focuses on an ongoing live project in suburban Auckland New Zealand begun in 2010, undertaken by a post-graduate student and researcher collective. The collective currently creates subtle interventions sited within local cyberspace, and through this current project will employ impermanent and small-scale design to advocate for a series of neglected and disputed sites. It explores the impact and value the presence of artists and designers working within local communities can have, and "champions the role of the artist in the development of the public realm, and their intuitive response to spaces, places, people and wildlife." (Wood 2009, p.26). The significance of this project is that it promotes a collaborative and multi-disciplinary methodology that works with community groups to advocate to corporate entities for a wider social and environmental awareness of specific sites. This paper aims to explain the processes and findings of the project to date through both its successes and failures. It also proposes the possibility of the methodology being transferred to under-graduate and post-graduate study as a tool to promote multi-disciplined collaborate project briefs that focus on community well being.

Paul Woodruffe
Lecturer, Department of Design
and Visual Arts, UNITEC, New Zealand
pwoodruffe@unitec.ac.nz

Panel 6
Failure & Innovation

Loredana Di Lucchio
Design 'for' Food – A critical reflection
on the role of Design in the next future:
the case of Design for the food industry

The paper explores which could be the opportunities for Design to improve its capability to produce innovation, while giving responses to specific needs in order to face real challenges, developing possible alternatives and imagining new productive connections for the societies of the future.

The focus is on the role of Design within the Agri-Food Industry, as one of the most critical and determinant human activities: not only because it meets the primary needs of nutrition, but because from an economic point of view it represents one of the most complex and vast sectors in the world.

Nevertheless, until now, Design has been more connected with the cultural vision of Food rather than its productive and consumer issues: an approach that represents, not only an specific interest of designers, but overall an emblematic "drift" of Design epistemic boundaries.

The paper reports, in a sort of paradigmatic transition from Food Design to Design 'for' Food, a vision of the Design role to overcome the classical vision of the food sector as a simple producer of food stuff and instead considering the relationship between production (agriculture), social needs (nutrition) and the technological and environmental conditions (innovation).

Loredana Di Lucchio
Researcher Professor,
Department DATA – Section Design,
Sapienza University of Rome, Italy
loredana.dilucchio@uniroma1.it

Patricia Ribault
Comprehensive Systems – Manufacturing, Design and Product Lifecycle

The question of failure versus innovation is that of *fundamental research* versus *applied research*: no science, no knowledge and no skill can be learned without failing, therefore experimenting. It is the inherent condition of our perfectibility. One way to address this issue is to cross-study the relationship between the craftsman and the designer. Learning a craft – or any technical skill – necessarily involves observing, trying, failing, repeating and finally embodying a gesture that is also an attitude towards the creative process. We will present the results of a research project at ESAD de Reims that will have been completed by the end of May: in the perspective of an exhibition at Villa Noailles in July 2011, the 4th year design students, led by designer David Dubois, will conceive and make a series of glass objects, in partnership with the glassblowers of the Centre International des Arts Verriers of Meisenthal. One of the most interesting aspects of this project will be to see how they handle their relationship with a demanding material they cannot manipulate themselves but through the mediation of the craftsmen, who are not the simple executioners of their projects but also the interpreters of their intentions, with their own sensitivity, personality and technicality.

The question of failure versus innovation is that of fundamental research versus applied research: no science, no knowledge and no skill can be learned without failing, therefore experimenting. It is the inherent condition of our perfectibility. One way to address this issue is to cross-study the relationship between the craftsman and the designer. Learning a craft – or any technical skill – necessarily involves observing, trying, failing, repeating and finally embodying a gesture that is also an attitude towards the creative process. Designers too are confronted to the making of things – sketches, prototypes – but their approach is more visual and conceptual than manual and physical.

Patricia Ribault
ESAD de Reims
12 rue Libergier, 51100 Reims, France
http://www.esad-reims.fr
+33 3 26 35 36 40

Panel 7
Art & Science

Georg-Christof Bertsch
Product Design & Water –
towards a vision for education

Water has yet to be understood as a distinct conceptual task within the discipline of product design. Design is called upon to deal with water in numerous thematic fields, but these have not been synthesised into a common strand of practice. The drastic implications of the water problématique on the eco-social dimension, and the massive impacts of designerly activity on ecosystems, compel us to articulate this synthesis, and to envision water design as a coherent subject in the near future.

For a number of years, Georg-Christoph Bertsch has been dealing with this theme in workshops, seminars, symposia and lectures on all five continents. The present paper starts by presenting an overview of the tasks and challenges of product design in relation to water design. It proposes a possible structuring of the thematic complex of water design based on a differentiated set of aspects. finally, making reference to a selection of ten of the author's projects from the last seven years, it elucidates practical methods of teaching the referenced aspects.

The concluding resumé advances some possibilities for cooperation and proposals for curricular approaches. In addition the paper contains an extensive thematic bibliography.

KEYWORDS: Design education, water, water design, sustainability, intercultural design, interdisciplinary collaboration

Georg-Christof Bertsch
Hochschule für Gestaltung Offenbach – Academy of Art and Design, Department of Product Design, Project Field – Intercultural Design
Honorary Professorship, Schlossstraße 31
63065 Offenbach/Main, Germany
+49-69-26493101, Fax +49-69-29493099
bertsch@hfg-offenbach.de

Panel 8
New materials, recycling & waste

Norma Coral
Plastic Revolution through Design –
Resource Reuse

XXIst Century Design recognizes environmental issues never previously confronted. This is one of the important motivating factors that impose inter and multidisciplinary links to analyze, consider and propose solutions. (Chiapponi, 1998 in Buchanan, Doordan y Margolin, 2010).

The purpose of the current research's is to create a new life cycle for polyethylene terephthalate (PET), that because of its short lifetime is daily disposed of in vast quantities in Mexico City. With this new life cycle, we can create an efficiency in the use of the plastic, focused towards a renewable point of view based on sustainability (always respecting the social, economic and environmental commitments).

Norma Coral
Master Degree Candidate,
Industrial Design, Architecture Faculty
National Autonomous University of Mexico (Mexico)
ruacoral@gmail.com

**Keneilwe Munyai, Wairimu M. Maina
and Dr Mugendi K. M'Rithaa**
Recycling to preserve natural resources –
Urban versus Indigenous knowledge
systems in South Africa

Recycling is viewed as a modern phenomenon in developing countries to deal with the issues relating to pollution. Modern recycling is exacerbated by large corporations and ngos in an effort to minimise the rapid depletion of natural resources. However, there are serious implications in the process due to the materials being recycled. In South Africa distribution of resources is aligned to social hierarchies more especially in urban areas, whereas in rural areas it is articulated through culture. This paper looks at recycling from an Indigenous Knowledge Systems (iks) perspective and the role it can play in the urban perspective of efficient use of natural resources. The research draws inferences on the implications of incorporation intuitive knowledge within strategies for promoting sustainability in South Africa. The study further articulates the various methods that can be applied through iks in the process of material recycling and how conservation of energy through the production process can apply cradle-to-cradle principles to utility in the value-chain process. Through a qualitative method of collecting data; semi-structured interviews and participatory observations are used to ascertain the need for a new approach toward dealing with reuse and rebirth of new materials from waste. The study argues for the need for modern approaches to learn from the older more progressive methods of preserving resources.

key words: Culture, Design for Sustainability, Indigenous Knowledge Systems, natural resources, recycling, rural areas, South Africa, Traditional Knowledge.

Keneilwe Munyai
Researcher
Munyaik205@yahoo.com

Wairimu M. Maina
Researcher
MainaM@cput.ac.za

Dr Mugendi K. M'Rithaa
Lecturer Industrial Design
MugendiM@cput.ac.za

Cape Peninsula University of Technology
Cape Town, South Africa

Panel 9
Designing for Life/ Designing for Humanity

Ela Adital
Designing Sustainable Prosperity

As designers we have the unique capacity to envision, illustrate and enable the realization of new and inviting life habits that can thoroughly reform the encounter between man, object and environment. Nowadays we also have a role of mediation – to support the rehabilitation of the developed world inhabitants from the destructive lifestyles we have embraced for only a few decades.

This mediation process includes creating fresh and creative alternatives to this lifestyle which offer not only social and environmental benefits but also illustrate appealing, sensual, experiential and inspirational concepts, products, services and systems.

This paper is the tale of a journey towards design for sustainable prosperity. It shares the exploration through my own work as a designer and through working with groups of design students in the last six years. The paper describes some of the work done at the social-environmental study program at hit – Holon Institute of Technology, Israel.

Various study cases will be presented according to five sustainable design strategies based on 'The Bridge' sustainable design methodology which the author is developing since 2004. The five strategies were designed with the intention of addressing the individual, communal and environmental scopes, offering an invitation to a holistic, yet applicable, view of sustainability through exploring its various layers and interdependencies.

The study cases that will be presented strive to a wide scope of exploration using product design in search of a role designers can adopt to support the path towards sustainable prosperity.

The paper will be formed according to the five bridge strategies: Dancing with Chi; Revitalizing Objects; Creating Mediators; Discovering abundance; Designing Sharing.

Ela Adital
Sustainability Design Lecturer,
hit – Holon Institute of Technology, Israel
contact@aditalela.com

Audrey Dodo, Jessy Gemayel and Louise Pédel
Same, same but different –
A workshop at the ESADSE

Amongst several research activities, the six Post-degree research students at the *École Supérieure d'Art et de Design* in St-Etienne, will organise and lead an intensive workshop entitled "Designing for life and humanity". (scheduled in march 2011, during 5 days)

Open to the 2nd and 3rd years students from the ESADSE, this workshop will first aim at (i) questionning and criticising concepts involved in nowadays globalized industrial design system: which means standard and universal objects or practices, and, "forms of life", (as said Wittgenstein): material culture(s?), modern and/or post-modern condition, humanity, etc.

(ii) In its programatic, analytic and interpretative phases, the workshop will also focus on the educational means and strategies that would help (?) the designer to conciliate, in one hand: the economical imperative to create objects, services for an universal (and abstract) user – humanity at large – ; and in the other hand, the precious ethical design principle: designing for the humain.

This short and dense working format seeks to stimulate the students to diverse explorations while encouraging at the same time the sharing and exchanging of ideas between them, which is a good way to deal with this theme focused on the Human.

Finally, our lecture at Cumulus will present an analysis of the methodologies that we have experimented.

Nota bene: the workshop will concern two main fields: product design and graphic design.

Audrey Dodo, Jessy Gemayel, Louise Pédel
Research students, ESADSE (École Supérieure
de Design de St Etienne), France
post.diplome@esadse.fr

Panel 10
Interdisciplinarity/Transversality

Anders Brix & Nicolai de Gier
Method or Material – A discussion
of designerly competences

The notion of design is expanding as new areas of application and new approaches are being developed. Today's concept of design-activity include e.g. the conception of strategies and services, work modes like co-creation and design-thinking and even scientific design-inquiries and transformation design. As design teachers and researchers we need to navigate in this expanding and blurring field in order to devise clear strategies for the development of design knowledge. This raises the important question of defining the key competences of design. What is the core of design knowledge? (as coined by prof. Ezio Manzini in Cumulus session in Shanghai). Design methodology is often assigned a central role and design hence seen as problem solving (as in Simon's definition: 'anyone designs…').

This paper argues this not to be a false notion: The methodology of creative problem-solving is generic, and no design methodology exists that is shared by all design-disciplines, yet is distinctly different from those at work in all other disciplines. Rather, the shared portion of methodology is equal to a number of other disciplines' creative processes, for example those of structural engineers, software programmers, composers and even politicians. Through analysis of exampels of student's work-processes in furniture and graphic design, this paper aims to clarify the role and significance of the iterative, problem-solving process as opposed to that of the actual material of any design task. The paper concludes that the material aspects of design and the act of form-giving is the core of design knowledge.

Anders Brix & Nicolai de Gier
Professor, The Royal Academy of Fine Arts,
School of Architecture (RASA), Denmark
anders.brix@karch.dk

Carlos A. M. Duarte
Rhythms and Innovation in Industrial
Design – Kondratieff Cycle Concepts

This paper is presents a new perspective about important factors that characterize the history of Industrial Design.

Such a perspective correlates the evolution and identity of the history of Design with the theory of Kondratieff's economic waves which have a periodicity of 50 to 60 years.

By using this theory, one is presented with the opportunity to inter-relate the economic, political and technologically dominant events – which are referred to as the social-economic indicators – of each of these periods.

With the help of this theory, one can conclude that there are similarities between the different transition phases of Kondratieff's economic waves, with combination of innovation and new technologies – towards a new technological transformation, the development of new industrial activities and a deep transformation of human behavior and the different periods in the history of Industrial Design.

Carlos A. M. Duarte
Professor Associated, IADE –
Design School, UNIDCOM,
Av. Dom Carlos I, n.º 4,
1200-649 Lisbon, Portugal
carlos.duarte@iade.pt

Laurence Mauderli
Design desire (About desire, design,
designers and the "new object")

Design is a multifaceted discipline closely intertwined with economical, technological, social, cultural, environmental and political issues. In that sense design infiltrates everyday life. However, compared to other areas, design is still a young discipline.

This paper sets out to describe the shift from the applied artist (as practiced from the late 19th century) to the emergence of the concept of designer for industry (as it appeared in the late 1920s) and reflects on how the idea of the designer shaped our understanding of design. It goes on by exploring why the designer of today has become such a cult figure and how this occurrence impacts on the profession of the designer as well as on the public. Is it the potential 'bankability' attached to the figure of the designer or rather the commitment to contribute to building contemporary societies and environments that makes the discipline so desirable? What are the criterias of a sensitive design education through which a design student can naturally develop and position himself? What is the role of an art and design college? What is design desire and what are the circumstances for its development?

Having mapped out and explored some ideas about the practice of design and how design is taught today this paper argues that it is through a full embracement of design history and theory as well as research in and on design that design desire germinates.

Laurence Mauderli
M.A. (RCA), Design Historian
Tutor/lecturer in the history and theory of
design DNSEP/Master level at the ESAD, Reims
(Ecole supérieure d'art et design), France
laurence.mauderli@free.fr

Selected
full papers

Panel 1
Multidisciplinary
educational
program

Nanthana Boonlaor,
Woranooch Chuenrudeemol
and Daranee Lehtonen

Design for the Underprivileged

The case study on Multidisciplinary
Approach in Design Process

Introduction

Design Innovation

According to Kumar (2009), organizations have tried to develop design innovation based on *user needs* in order to maintain its competitive and innovative edge. This has replaced the traditional concentration on old-time efficiency-orientated innovation. Apple and Nike are good examples of companies who no longer focus on technological devices, such as an iPad for Apple or on "experience of running" in the case of Nike, but rather on the user feedback of product use. As the scope of design innovation becomes wider, various disciplines will need to build up their own multidisciplinary team to work together pragmatically and appropriately to ensure successful innovations (Cleland, 1996; Kumar, 2009).

Multidisciplinary Approach in Design Process

Many studies have stated that multidisciplinary courses have advantages over single disciplinary courses. For instance, a study of the influence of multidisciplinary teamwork on student design learning cites the need for various skill areas to meet the project goal successfully, recognizing importance of other disciplines, and introducing to a real working situation (Gruenther, Bailey, Wilson, Plucker, & Hashmi, 2009; Carrion & Thorn, 2005). At the School of Architecture and Design, King Mongkut's University of Technology and Design (KMUTT), the industrial design program, in collaboration with the school of engineering (the School of Control System and Instrumentation Engineering), have conducted various successful multidisciplinary-approach courses for its undergraduate students. Working collaboratively, indus-

trial design and engineering students propose new innovative design solutions for complex problems posed by a local sponsor – Electronic Appliances Company. It is more or less considered as an 'exercise' for students practicing their design and engineering skills with professional input and feedback. However, even though the benefit of the collaboration has been seen as a great step forward towards multidisciplinary design, it was not fully tested in the context of real world practice.

This paper aims to explore the mechanism and benefits of multidisciplinary approach in design process by looking at the collaborative project between KMUTT industrial design students and the professional engineers of the National Electronics and Computer Technology Center of Thailand (NECTEC). With the support from NECTEC networks, specialists from various disciplines: physician, physiotherapist, linguistic experts, and psychologists are also taking part as the project consultants. Through a design studio platform that focused on cognitive human factor, students and NECTEC staffs set out to co-develop a series of technology-embedded everyday utility products: real world products like a home electrical appliance controller system and communicative devices for underprivileged in Thailand. NECTEC's anticipation towards industrial design students' contribution is an archetypical product designer's expertise, an ability to 'humanize' those bare-skin mechanics by adding more ergonomic concerns and styling it with some senses of aesthetics. Apparently, the project concept in terms of mechanism was then handed in at the beginning of the course by NECTEC head of engineers. For KMUTT, this collaboration can be considered not only as an opportunity for students to practice their industrial design skills, by which the final design outcomes are subjected to make their way to the real production, but also a chance to see how creative thinking could be stimulated through the collaborative process among us and all the stakeholders.

Research Objectives and Methods
The study proposed to compare the two groups of students, pursuing different design approaches: *"single-disciplinary approach"* and *"multidisciplinary approach"* through their 15-week design processes. The main objective of this study is to investigate the notion of how 'Multidisciplinary Approach in Design' provides design constraints, and to what extent that the same approach enhances creativity, practicality, and feasibility in archetypal design process and outcomes of collaborative project.

In the study, the studio instructors divided up the students into two groups – one group was instructed to utilize the single-disciplinary approach while the other was encouraged to use the multidisciplinary approach.

Through observation, class tutorial session and discussion, the data from both groups were collected and after the course finished, they were compared in terms of design brief, design process and design outcomes. Conclusions were made by the design studio instructors based on accumulated data gained from group discussion among mentors, engineers, students and ended-users throughout the study as well as lesson-learned reports by students at the end of the course.

Design Project for the Underprivileged
A design project for the underprivileged was also another important element of the industrial design course in junior undergraduate program. The study focused on two groups of students who were placed in charge of design daily-aiding devices for underprivileged in Thailand. While the first group of students conducted their project through "Single-Disciplinary Approach" by exploiting a regular user-centered design framework, the students in the second group had taken utilized the "Multidisciplinary Approach" that resulted in the collaboration between NECTEC and KMUTT.

Since the Industrial Design course at KMUTT has focused on Human-Centered Design principle, either with or without the multidisciplinary approach, both of student groups had then started their design project by conducting a series of user observations and in-depth interviews to gain design insight for outlining their project focus and assuring the design success. It was clear that in terms of the design brief, the single-disciplinary approach's research questions were more open-ended (such as 'How can the underprivileged's quality of lives be elevated through design?') and exploratory in order to search for new product concepts, similarly to so-called 'Blue Sky Project', while the multidisciplinary approach had been assigned with specific task to explore design opportunities in improving NECTEC home electrical appliance controller system and communicative devices for the underprivileged.

In the single-disciplinary group, students were solely guided through a user-centered design process. They conducted user-field research including user-observation and in-depth interviews to gain insight directly from their end-users – the blind. They were then steered through creative design process to design communicative devices according to the needs of the blinds' different lifestyles. Any predetermined or regimented design methodology was deliberately left out at the beginning of the project by the instructors so that the students were forced to "discover" how the blind prioritize their needs to pursue their daily routine.

In the multidisciplinary group, students were also guided through the same user-centered design process except that they worked with other disciplines

instead of working alone. Throughout the project, students had to integrate secondary research data and requirement advised from all the experts including engineers, physiotherapists, psychologists and doctors with their firsthand knowledge acquired directly from end users: paraplegics and a quadriplegic from spinal cord injury patients, to design home electrical appliance controller system and communicative devices. This compromise between the design constraints and the real world needs was made to ensure creative, functional and desirable, yet practical and feasible.

By exploiting archetypal design process, both groups of students were guided through four design stages of (1) Initiation & Analysis, (2) Conceptualization, (3) Finalization and (4) Evaluation. In the first stage, Initiation & Analysis, all students employed user-centered design process to collect data, analyze, synthesize and conclude it in order to come up with their individual design brief. Except for the students in multidisciplinary design approach group, students had more opportunities to gain additional essential knowledge of physical treatment principle for each patient condition and psychological therapy from the doctors and experts' viewpoints, as well as the information of how provided technology system worked in the real home-used devices done by the NECTEC engineers. In brief, the first group of students searched out a more open-ended project brief while the second group of students received a specific project brief.

During the second stage of Conceptualization, the students of user-centered design group explored their project concepts by looking at various usage scenario and technology possibilities as well as performing concept feasibility by mock-ups testing with their ended-users. The students in multidisciplinary approach group had their explorations within the NECTEC requirements, since NECTEC researcher head had envisioned the outcome of the design project to be economically produceable and innovative. Similar to the other group, they also performed concept feasibility by mock-ups testing with all the therapists, doctors, ended-users and proving with engineers for whether what they were doing was feasible enough for usage and production.

Finalization stage was to some extent occurred similarly for both groups of students. While students in the user-centered design approach group had no access to "experts" to prove their designs with so their stage of finalization occurred unconcernedly like other typical studio project. Whereas students in the multidisciplinary group needed to fine tune and negotiate with all the stakeholders involved in the project. Some students also tested out their final design with the real users to verify some usage scenarios and details in their final design. At the last stage of Evaluation, all students had their final design prototypes. The first group students could hardly validate them with the real users, only the simulation while the second groups had more chance to conduct users' validation, allowing users' to try on and collecting their feedback. The second group consequently had more opportunity to improve their design before completing their final design proposal.

Results

Design outcomes

GROUP 1: SINGLE-MULTIDISCIPLINARY APPROACH GROUP

With user-centered design framework, students in Single-Disciplinary Approach group identified their design brief themselves by conducting user observation and interview as well as carry out a literature review in communication device technology for the blind. Design outcomes of this group of students were quite innovative in the terms of adapting inexpensive technology to use in their design scenario. For instance, "Space Indication Assisting Tool for the Blind" by Mr. Chaipat Intawong, the student utilized sonar technology to allow the blind to generate the click of tongue for indicating the distance between the blind and the obstacles. The aiding device can assist the blind through the unfamiliar surroundings yet still relying on the remaining superior sense of hearing. During the project, the student had explored different possible contexts where his selected technology could be used. His working approach was quite similar to the multidisciplinary group. The only difference is that the students in this group carried out everything alone without any technical support from other disciplines. Other interesting project of this group was "Color Perception Tools for the Blind" by Ms. Tanyathip Boonamnuayvitaya. The designer tried to fulfill needs of the blind, especially in terms of ability to see colors. The ring-like object guides the users through the clothes shopping context without intrusive physicality. By embedding Bluetooth, the ring transmits the code of color frequency into meaningful sound delivered to the user through indistinguishable ear phone. This conceptual design was developed first from users' physical and psychological needs and then the student searched for appropriate technology that can fulfill her design functions and features. However, without technical support form other disciplines, her design is very conceptual and cannot be produced with today's affordable technology.

GROUP 2: MULTIDISCIPLINARY APPROACH GROUP

Through multidisciplinary approach framework, students of this group had been assigned with a more specific design brief of developing: 1) a home electrical appliance controller system and 2) home telephone for

paraplegic and quadriplegic with provided technology by NECTEC, "scan mode" technology and some product concept. The set of home electrical appliance controller included 3 main parts of an individual electrical appliance input box, an 8-channel remote controller, and a wall-attached receiver, while the home phone set used the mobile Sim- card technology as the platform, operating with detachable big soft button for activating.

Students have generated various different levels of solution, but to some extent, during the Conceptualization stage, students of this group were struggle to come up with the new typology of the devices' form since they encountered a preconception of the device they are designing which lead to other problems in finding new "creative" usage details. Though during the Finalization stage, this student group had more chances in testing out their usage details with the real users. With feedback and faster process of "being assigned with provided technology", they could elaborate their design further. "The Compact 8-Channel Remote Controller with Detachable Emergency Button", by Mr. Korakit Silathapanasakul and Mr. Visarut Taweevorasuwan, was one of the work mentioned above. Their device generally was designed as a typical remote controller over home electrical appliances. The supplementary functions – the nurse calling and the emergency alarm activator – were added as well as the devices controlling tasks in terms of ergonomics and cognitive understanding. This design was seen as a minor change for NECTEC's existing solution improvement.

Other students also had to expand their project scope to cover more user groups to differentiate their work from the original product as seen in the work of Ms. Chidawan Kimawongdachai and Ms. Wiriya Mana-anantakul, "Home Phone for All". With the Tilt-able Screen", the design can serve various viewing angles of different laying/sitting positions. Patients activate each command through the dialed number by hitting the red pad during the moving signal light scanning all the buttons. The main concept developed according to NECTEC's existing telephone and technology was then further explored for wider range of underprivileged of the blind and the deaf, as well as people around them such as their family and assistants. By allowing users to plug-in different input and output devices, for instance, voice command input and vibration feedback for the blind made the device suitable for different type of users and can be produced with today's affordable technology.

The most distinguish project in this multidisciplinary approach group were "Voice Activated Home Electrical Appliance Controller for Quadriplegic" by Ms. Prangthip Visarnkij and Mr. Chaya Hantaweewongsa, and "Photo-Sensor Home Electrical Appliance Controller for Paraplegic and Elderly" by Mr. Kittikorn Worawitayakran and Mr. Naroot Pitisongswat. Both group of students ex-

plored with alternative input technology for users who suffered from weak limbs. In order to aid paraplegic to perceive the choices of the device they would like to activate/deactivate, the Voice Activated Home Electrical Appliance Controller enabled users' sense of hearing and sight by emitting the descriptive sound calling the plug-in electrical appliance names together with illuminant base when identifying the devices. The devices are not only efficient in terms of users' cognitive perception and ergonomically practicality, but also well blended with the environment as if they belong to the surrounding. The design also can be produced to fit with NECTEC's provided mechanics and today's affordable technology.

For the "Photo-Sensor Home Electrical Appliance Controller for Paraplegic and Elderly", the remote controller allowed the use of users' wrist to handle the device through rotating and pressing movement, the efficient postures for common error reduction among such patients. They also expand their project scope to cover the elderly whom also suffered with weak limbs problem. Users can easily move their arms across the motion-sensor base for browsing the choices of electrical devices with no need to stare at the controller panel. Instead, the visual feedback of the movement can be seen on the display located in the noticeable area such as at the top of the television. This design was not developed based on technology NECTEC had given; instead it was developed based on user needs and today's technology.

Discussion

1) Open-Ended Versus Specific Design Brief

The comparison between the design outcomes of two groups of students indicates the following: at the beginning of the project, both groups of the students encountered different problems. Students in the single-disciplinary group receiving an open-ended design brief – "A communicative device for the blind" – had difficulties in scoping their project brief because the given design brief was extremely broad and apparently needed longer time to elaborate those new information they acquired during user observation and interview. Without strong analysis and synthesis skills, students may turn out their design brief, design criteria, product's function and feature inadequately which can be leaded to failure of the project.

Whereas students in the multidisciplinary approach group receiving a more specific design brief – "Improving NECTEC home electrical appliance controller system and communicative devices for underprivileged" – were overwhelmed by unfamiliar given information related to needs and limitations of the disables as well as NECTEC's provided technology such as "scan mode" and original printed circuit board. During the design

and development phase, most students in this group used given project requirements to guide them what to do and where to go. For this reason, most students in this group, to some extent, during the Conceptualization stage, were struggle to come up with the new typology of device's form since they had preconception of the device they are designing which lead to other problem in finding new "creative" usage details of the Finalization stage.

2) Single Discipline Versus Multidiscipline

DESIGN OUTCOMES
The design outcomes of both groups were remarkably different. Most of the final design of the single disciplinary group is considered as conceptual and futuristic when comparing to the multidisciplinary group's final design that is practical and feasible. Working alone on such a complex project was rather difficult for the students in the single-disciplinary group to come up with thorough design solution while collaborating with other disciplines gave the students in the second group enough support to master their project. The single-disciplinary design outcomes are apparently fairly conceptual due to the lack of technology knowledge input as seen in the project "Color Perception Tools for the Blind". Based on this finding, it becomes clear that students actually needed assistance from other disciplines to develop their design outcomes to be realistic.

DESIGN CONSTRAINTS
Based on the design outcomes, multidisciplinary teamwork were very accommodating for most students in the multidisciplinary group. Nevertheless, from the authors' observation and the discussion with students of this group as well as from the deliveries of their design outcomes, it had implied that some students had difficulty to work with other disciplines and encountered with frustration because they perceived the "given engineer's technical requirements" as "design constraints". It was seen, by students of this group, as "creativity constraints" as well as their confidence seemed to be reduced from time to time due to their lack of technological understanding. In the other hand, such design constraint can be considered as enhancing students' creativity by means of encouraging them to differentiate their design from the original design with greater effort. As a results, students had expanded their project scope to cover more target users, more universal. Students receiving specific design brief were strained in the search for "creativity" in the next design stages. The pivoting point in each stage of the design process then acted as "a creative arena" for the students to quest for the new design solution.

DESIGN INNOVATION
From the viewpoint of experts from NECTEC and KMUTT, user-centered design approach was viewed as one of the keys to new opportunities for innovation that their engineering-orientated approach hardly provided. Instead of focusing on the products – the "Voice Activated and Photo- Sensor Home Electrical Appliance Controller System for underprivileged" and the "Color Perception Tools for the Blind" – all of these design teams had employed user-focused design – the same approach recommended by Kumar (2009) – to explore new promising design that meet the users' needs. Furthermore, the multidisciplinary approach, particularly among designers and engineers in this study, takes a great role of bridging the gap between technology and the users' need to complete the whole process of design innovation. Without one another, the technological- based design solution could be ended up either as alienated functional object to its user, or exclusive conceptual gadget which will never been made for the mass.

3) Appropriate Collaboration

STAGE OF INTERVENTION
For multidisciplinary approach design process, apart from occasionally check point, there was a specific "intervention" from other disciplines for instance engineers, during the Conceptualization stage, when the design direction was shaped. While for the single-disciplinary approach, there was none of the intervention. In this study, neither such an intervention brought the interruption for the design improvement, nor scope down to only the practical design process. It rather generated opportunity to creatively consolidate the design for the optimal, yet realistic scenarios. Taking the project "Home Phone for All" by Ms. Chidawan Kimawongdachai's and Ms. Wiriya Mana-anantakul's case as an example, the design direction initially was geared specifically towards NECTEC's original telephone model specifically for the Paraplegic and Quadriplegic. After the discussion among engineers and product designers has been made, all had agreed on developing the design based on the same technical platform but added more functions to become universal design, serving broader group of users including the elderly, the blind, the deaf as well as the others around them. The input from other disciplines or the "intervention" therefore had seen as a benefit in terms of help probing the assumption occurred throughout all design stages.

PROJECT MANAGEMENT & ROLES
The collaborative project started with each project partner's enthusiasm for each discipline's contribution that could complement one another. At the beginning of the project, all partners planned the project together how-

ever a role and workload of each discipline was never been defined clearly. During the project, each discipline mainly worked based on their own expertise but when it came to the decision making stage, the course instructors needed to act as a "decision maker" and "moderator" to compromise between NECTEC's requirements and encouraging student's creativity. In addition, instructors' role were altered to be as "a facilitator", to set up questions for students to inquire, to assimilate complex "knowledge" acquired from experts to the students, and to finding tune between professional engineers and design students.

FACILITATION

During the multidisciplinary project, other disciplines including engineers, therapists, doctors, and others were very willing and helpful to facilitate the students to some certain extent. Their supports had guided the students, shortened the students' time for mastering the project, as well as ensured the usability, practicality and feasibility of the design outcomes. Nevertheless since the collaboration agreement was never made officially, many supports such as printed circuit board programming and prototyping, which had been offered and agreed on at the beginning, finally were not contributed by other disciplines due to "no-promise agreement" and "time constraint". As a result of this, the students ended up making prototypes by themselves. Furthermore, because they did not have skills to write the workable programming, they only managed to use Adobe Flash program to simulate their design at the final design review session.

EQUALITY

Unlike other multidisciplinary design process occurred in other courses, the collaboration employed an unequal role in the partnership. As there is high cultural hierarchy in Thailand, when negotiating how to develop design with other disciplines, who are professional and older, students were not bold enough to insist on their design. Even though cultural hierarchy seems to hold back the collaboration, for some extent, it has also given students some "second thoughts" during their decision making stage. Not only the hierarchy of age and profession but the hierarchy of ranking in an organization also had some effects on the design outcomes. Good examples of this included there were only NECTEC's junior engineers participating in the design concept selection session and they were moderately hesitated of making a decision on the behalf of their senior engineer. Nevertheless, NECTEC's junior engineers were given a very supportive input during the Initiation and Analysis stage for the students. With their hands-on demonstration and detailed explanation, they had given both instructors and students the great understanding

of the "unknown-knowledge". Further during the Finalization stage, they were very accommodating in assisting students in probing the production feasibility part.

Conclusion

The research result has proven that multidisciplinary approach has several advantages over single discipli- nary. With the appropriate collaboration among the tutors, or so-called project *facilitators* , engineers, or the *interventors* in this sense, and the students, in other word the *designers*, in terms of roles and contribution, the multidisciplinary cooperation not only shapes the design outcomes to be more realistic, practical and feasible, but also can enhance the level of creativity and innovation rather than created constraints. However, such a result is presumably applicable to the design topic that involves specific expertise such as physiotherapists and electronic engineers. For the other types of design topics such as life-style based products, in which the design principle is not relatively based on user-centered, the results of the study could be different. Further investigation upon this assumption is, then, worth pursued for the next step.

The multidisciplinary collaboration project was extremely beneficial to the students and had raised their awareness of the capabilities and limitations of their discipline as well as the other disciplines. Furthermore the design outcomes ranging from good-looking skinning design, usable and feasible product design, to design innovation was another sign of success. After the course ended, some projects have been selected for real production while some have been encouraged to take part in the International Convention on Rehabilitation Engineering and Assistive Technology (i-CREATe) 2011 competition. Because of the success of this collaborative project, the projects partners including SOAD's Industrial Design Program, KMUTT's Control System and Instrumentation Engineering Department as well as NECTEC's Rehabilitative Engineering and Assistive Technology Institute have decided to continue their collaboration in other projects.

Nanthana Boonlaor

Woranooch Chuenrudeemol

Daranee Lehtonen

Lecturers,
King Mongkut's University of
Technology Thonburi, Thailand
Nanthana.kul@kmutt.ac.th

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Ursula Tischner

Educating Agents of Change

Design for Sustainability needs
truly holistic and trans-disciplinary
educational programs

Sustainable Development
History and Context

The world sees two major crises at the moment: the financial/economic and the climate crises and it seems that both are connected. The difference is that we can still be hopeful that, by implementing better regulations and control mechanism for financial institutions, we can overcome and avoid future financial crises. However, once we have destabilized the climate of our planet, no regulations will save us anymore from the dire consequences scientists are predicting carefully. Even without knowing the total scientific truth about how much climate change is man-made and how the planet will react to increasing levels of CO_2 and other greenhouse gasses in the atmosphere, the probability of us being a major part of this problem should be enough to follow the precautionary principle and establish effective measures to avoid the worst. Climate change is not just an environmental issue but has severe social consequences as well, from displacing people from the regions where they used to live for generations to increasing food prices. In addition Climate Change will pose economic threats to a lot of countries in a magnitude that is comparable to world wars (Stern 2007).

Even without talking 'climate change' the third severe crisis we are already facing is the depletion of limited natural resources. For mineral oil the problematic is well known but the same applies to a lot of other natural resources. An increasing number of wars and conflicts are occuring around availability of land, water, food, oil and mineral resources, which is an obvious proof that the highly resource intensive production and consumption systems of industrialised and emerging countries are reaching natural limits and cannot be a model for our planet to nurture 9 Bio. People in 2050. Despite some efforts in increasing efficiency still the industrialised nations consume around 70% of all resources world-

Sustainable Development is not a static situation but a state of dynamic equilibrium between human and natural systems. The document in which this principle is laid down is the 'Agenda 21' the blueprint for sustainable development where tasks for the fields of production, consumption and policy are formulated and possible steps are suggested. While a broad and complex issue, there are six principles describing how a sustainable community should interact with other communities and with nature:

Environmental protection: Protection of the resources and life support systems needed for continuance of human well-being and all life
Development: Improving 'quality of life' of which economic development is part but not the sole objective
Futurity: Considering the interests of future generations in what we leave behind
Equity: Sustainability will not work if the world's resources are unfairly distributed or if the poor pay a disproportionate part of the costs of the transition to sustainability (as everyone has a part to play)
Diversity: Diverse environmental, social and economic systems are generally more robust and less vulnerable to irreversible or catastrophic damage. It also allows individuals to chose more sustainable options
Participation: Sustainability cannot be imposed but requires the support and involvement of all sections of the community and all communities. This requires ensuring opportunities for participation in decision-making.

Furthermore Sustainable Development is a process with the following features:

- **Conservation of resources**
- **Respect for all stakeholders' viewpoints**
- **Following the precautionary principle**
- **Encouraging subsidiarity:** Decision-making at the lowest practicable level
- **Promoting personal freedom:** Meeting needs without harming the environment or people
- **Addressing aesthetics:** Protecting and creating places and objects of beauty.

Table 1: Principles of sustainable development,
Source: United Nations 1992

wide, while they host only 20% of the world's population. Especially three consumption domains are responsible for the environmental consumption of industrialised nations: Food/Agriculture, Mobility/Tourism, and Housing/Energy consumption in buildings. These three domains cause about 80% of environmental impacts of European countries (European Environment Agency 2007).

Since the Brundtland Commission has formulated the paradigm 'Sustainable Development' in 1987 (World

Commission on Environment and Development 1987) as a development that meets the needs of present (generations living on our planet) without compromising the ability of future generations to meet their needs, and over 170 nations have agreed in 1992 to strive for Sustainable Development, a lot of activities have been started and efforts undertaken to move towards a more sustainable society. Nevertheless, it seems that progress towards triple bottom line thinking, which means to marry the three dimension of people, planet and profit, i.e. to search for solutions that are beneficial for society, the natural environment and the economy, has not been reached. We are still far away from having a protocol on climate change with real CO_2 reduction goals that all nations agree on. We are not moving towards reaching any of the Millenium Development Goals on fighting poverty (see http://www.un.org/millennium-goals/). The few rich are getting richer the poor are getting poorer in developing as well as industrialised countries, and multi-national corporations are out of control of national governments.

The Design for Sustainability Movement

Since Rachel Carson was a major actor in starting the environmental movement in the US with her publication 'Silent Spring' in 1962, in which she described the human- and ecotoxicity of DDT and other pesticides, a small but growing group of Designers started focussing on Sustainability issues in theory and practice, such as Victor Papanek, who published 'Design for the Real World' in 1971 and 'The Green Imperative' in 1995, and internationally active experts like Ezio Manzini from Milan Politecnic, Han Brezet from Technical University Delft, Chris Ryan from University Melbourne, John Thackara, Founder and Director of Doors or Perception, Fumi Masuda from Tokyo Zokei University and other designers and authors around the world. There have been important networks set up such as O2 global network of Eco- and Sustainability Designers (www.o2.org, founded in 1988 by Danish Designer Niels Peter Flint), and more recently most larger design networks and institutions have started some kinds of activities in Design for Sustainability.

While a lot is still relatively superficial talk and some initiatives especially by large companies can be detected as greenwashing, the movement in Design for Sustainability is definitely growing. Meanwhile the North-American IDSA (Industrial Designers Society of America), which has expelled Viktor Papanek in the 70ies for his harsh criticism of the Industrial Design profession has published an own guideline on EcoDesign (see http://www.idsa.org/okala-ecodesign-guide) etc.

And indeed there are strong drivers for Design for Sustainability such as

- The crises mentioned above and thus more consumer awareness for these issues and demand for Sustainable Solutions,
- More legislation requiring more producer responsibility from companies, and public as well as private Green/Sustainability Purchasing Programs,
- Companies taking the lead receivig considerable competitive advantage,
- And the urge of business owners and consumers alike to invest their money and effort into something sensible and useful for people and the plant, thus the LOHAS (www.lohas.com) and Sociopreneur (an entrepreneur with a social-environmental cause) movements.

Thus it is surprising that the design professions are still lacking behind the current market developments and demands, and that there are too little educational programs available for the growing number of young and enthusiastic students who like to get involved in Design for Sustainability.

So far design professonals are still much too often part of the currently predominant economic system seeing quantitative growth as the only goal, encouraging growing consumerism, wasteful throwaway concepts, inducing massive resource flows from nature to waste dump within a shockingly short period of time and selling 'stuff' that no one needs in advertising and communication that promotes the modern throwaway lifestyles as the only adorable model of well being to everybody around the world. So far not much has changed since Papanek's criticism – or things got even worse.

Unfortunately designers are often not the decision makers in companies but work at the end of the chain of command designing a nice aesthetic for a solution somebody else has invented. To make a real change, designers have to move up the chain of command to sit at decision making tables. They have to be equipped with Sustainability knowledge based on research and evidence, and analysis as well as guidance tools to enable evidence based design decisions. They have to know about the history, the problems and drivers of DfS practice and theory, and they have to adopt a more participatory design practice by listening to stakeholders first, understanding their problems and motivations, and then trying to develop more sustainable solutions.

It has to be understood that Design for Sustainability is more than Green-/Ecodesign (all to often people just substitute both terms) and DfS is not equal to Design for Longevity and Durability (see Tischner et al. 2000). Instead DfS looks into the larger consumption and production systems, starts with real demands and problems, and tries to find solutions that are good for socio-economic systems as well as natural environments. Don't try to be less bad, try to be good, as Mi-

chael Braungart and William McDonough the founders of mbdc promoting Cradle to Cradle Design are suggesting (www.mbdc.com).

Design for Sustainabilty normally looks into global, local and personal dimensions of problems and solutions and is created in teams consisting of several different experts and stakeholders. DfS is searching for radical solutions and improvements and that is part of the reason why we see more Sustainability innovations in companies moving into a new field of operation or in start-up and small companies than in large corporations. That large companies do not develop more radical innovation is normally not due to a lack of creativity, but it is because they are locked into systems that hinder change. Those systems are mainly

- Infrastructure, such as production facilities, logistics, machines, investment goods, public infrastructure (power grid and plants, buildings, streets, lack of railway etc.),
- Economic systems: the micro, meso, and macro economic systems, which are mostly neo-liberal and capitalistic and the main interest is shareholder value in the short term,
- Values and believes, of owners, managers, staff (and clients), e.g. the 60 years old manager who only waits for his retirement and does not want to try anything new and risky anymore to be safe in his position,
- Inertia of large systems to change, e.g. for large companies very often change is connected to higher efforts and perceived risk, thus higher transition cost.

This is why Sustainability experts looking for radical change towards sustainability are engaged a lot with methodologies like Transition Management, Change Management, Strategic Niche Management, Learning Organisations, Game Theory, Scenario Building and Backcasting, Roadmapping, Participatory Design, Social Innovation etc.

Designers applying Design Thinking and knowing how to think out of the box and work in creative ways could be excellent candidates to specialize in helping organisations to create change towards Sustainability. They only have to be trained as such and learn the right skills and tool sets. (See also score project, www.score-network.org, and its 4 publications 'System Innovation for Sustainabiltiy 1, 2, 3 and 4', the first summarizes the state of the art and knowledge in System Innovation, the other three focus on three domains: Housing/Energy, Mobility and Food, http://www.greenleaf-publishing.com/productdetail.kmod?productid=2590).

Design for Sustainability at SCAD

Savannah College of Art and Design (scad) has implemented a Design for Sustainability program in 2009 that embeds the philosophy of Design for Sustainability as described above. scad offers a Bachelor minor, a Master of Arts and soon a Master of Fine Arts program in Design for Sustainability (see http://www.scad.edu/design-for-sustainability).

Design for Sustainability at scad is a truly cross-disciplinary program open to all creative fields of study, from architecture and product design to creative writing and graphic design, from engineering and design management to marketing. The program embraces Sustainability as an integrative framework:

- By synthesizing the strengths of various design disciplines;
- By dealing with 2-D and 3-D design as well as system and service design, communication and education, business models, and social innovation;
- By focusing on holistically addressing personal, local and global challenges to the human condition in the 21st century.

Students learn to transform short-term thinking into long-term design solutions that address social, cultural,

Fig. 1: SCAD's Design for Sustainability MA program

environmental and economic problems. Thus the Design for Sustainability program develops students into committed leaders and passionate agents of change for economic prosperity, ecological health and social equality. They work with a wide range of clients, from corporations to nongovernmental and community organizations, to solve real-world problems.

By distilling complex issues through proven tools, methodologies and strategies, students focus on creative solutions to actual problems, formulating innovative answers rooted in real demands and needs. The program infuses social and environmental science methodologies into design disciplines, seeking to educate and advocate the economic benefits of sustainable practices.

Practices of creating short-lived products and environments, overusing nonrenewable resources, and producing materials that require toxic processes are being recognized as unnecessarily harmful methods of design. The ability to change the traditional development process, adapting it to current and future needs while applying Sustainability practices, is at the heart of this undergrad and graduate program. Therefore, students in the program learn to design solutions, integrating the 'triple bottom line' of sustainability – environment, economy and socio-cultural issues – in the development process. Students strive to strengthen the interconnectedness between business and environment, human beings and nature, becoming experts in communicating with others and educating others about all aspects of Sustainability.

Recent student projects have included:

- A water conservation project for Tybee Island focusing on water conservation at the beaches.
- A collaboration with JCPenney on eliminating all plastic bags from their stores;
- The design of a more sustainable and attractive transportation system for Savannah, the SAVexpress, with the goal of motivating more people to lessen their use of private cars;
- The design of a new clothing brand, Savannah Blues, using locally grown organic cotton and local organic indigo, eliminating all toxic chemicals in the process;
- The design of a system, called 'This Ain't Junk', to harvest building materials from old structures in Savannah that are scheduled to be demolished, transforming them into useful and attractive objects;
- The creation of a multiplicity of products that use sustainable materials, such as a soap dish from recycled glass and eco-resin, 'bull sheet' paper made from cow dung, a biodegradable bird house made from garden waste, firefighter boots from cork leather etc.

In SCAD's DfS program Sustainability research, analysis and evaluation are assigned a prominent position. It is very important for design students and designers to be able to understand and evaluate, what is not sustainable in the current situation, to develop suggestions for improvement, and at the end evaluate, if their solutions really move the system towards more Sustainability. This issue is a little complex and there are typical misbeliefs such as 'plastics is bad', 'natural is always good', 'local solutions are always better' etc. These need to be questioned, researched and verified or falsified for each specific situation. Students learn for instance to apply different Life Cycle Assessment methods and tools, are introduced to LEED, the American Green Building Standard, and other environmental and social standards and evaluation systems.

In addition SCAD's DfS program enables students to work in two directions and to combine both:

Sustainability Signature Projects AND Everyday Sustainability in Design

There are two major ways of practicing Design for Sustainability:

A. Carry out unique DfS projects, where designers invest all their creativity and energy in working on obvious Sustainability problems and try to improve the situation – Sustainability is the premier goal of these projects. Most SCAD DfS projects are geared towards furthering development in terms of economical, environmental as well as social improvements. These projects include also disaster relief initiatives for New Orleans and Haiti.

B. Practice 'Everyday Sustainability in Design', i.e. the integration of Sustainability issues in any project designers carry out, even if the project itself is not focused on Sustainability. In these projects it is essential for students to learn how to 'sell' Sustainability to the clients they work for, even if these do not focus on or ask for Sustainability. Here economic benefits reached by DfS become very important.

Upon graduating, SCAD's Design for Sustainability students have a competitive advantage, possessing the skills and abilities to direct and integrate sustainable practices in multiple creative fields. They are empowered to become professional Sustainability consultants as well as Sustainability leaders in corporations and other organizations. After successful completion of the MA/MFA Design for Sustainability the graduates are able to fulfill positions like the following:

(Product, Service, System, Interior, Architectural, Communication) Design with integration of Sustainability aspects within a manufacturing or construction company: This is a 'normal' design position

but with a specialization on Design for Sustainability, Ecodesign, Design for Recycling etc. This can happen as an employee of manufacturing/ building industry, in design studios, or as freelancer. Graduates are able to do just good product, service, communication… design, architecture but whenever and wherever possible will introduce sustainability aspects in their work.

Strategic planning/Sustainability consultation: This more strategic position is included in marketing, design or product management departments. It is geared towards consulting companies how to become a more sustainable business, survive on the market long term, how to identify future opportunities and how to integrate sustainability and consumer/customer demands more intensively in product and service development. This can be carried out as an employee in industry and consulting companies, or as a freelancer.

Sustainability and Eco-design research positions: This typically is a position in research institutes or research departments of industry, where designers are involved in technical research, but potentially also market and sociological research, future scenario development, roadmapping etc. Here designers are especially in need for integrating the Sustainability and the user, and market perspective in research activities that normally are not yet directed towards practical application or market demand.

Design for Sustainability Education: As the amount of design for Sustainability Educational Programs is increasing there is also more and more demand for faculty in the field. Thus Design for Sustainability experts are urgently needed to teach at design and art schools and universities.

And of course graduates can start their **own DfS consultancies** alone or in networks and act as agents of change towards making the world a better place.

Ursula Tischner
Program Coordinator Design for Sustainability,
Savannah College of Art and Design, USA
u.tischner@econcept.org

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Panel 2
Innovation in entrepreneurship

Lorenzo Imbesi

Design Comes Out of Industry

New Critical Approaches for Design in the Economy of Post- Production

Introduction

The maturity of the contemporary society of knowledge along with the spread of the new technologies of information produced an historical turn, making us to rethinking few of the ideas related to the activity of the designer and his position within society. The emergence of international finance and advanced services and the decline of industrial capitalism, taken as the main contractor for the "operator of the project", marks the end of the centrality of the factory as a single reference point for the production and the project itself (Castells, 1996; Florida, 2003). If the Taylorist-Fordist paradigm of mass production was a vital figure for industrial design in twentieth-century memory, generations of youngsters have already seen and come to terms with deindustrialization and the affirmation of the services sector (Rullani, 2004). While fathers and grandfathers had a role in the "assembly line" in close contact with the manufacturing process from which they drew objectives and stimuli, their sons and grandsons – who are in contact with the fluidity of the new tools and technologies for the project – have instead become aware of their role of service and innovation strategy.

Rullani observes the born of the 'factory of the immaterial' which produces the symbols and the knowledge associated with the related manufactured objects, while combining expertise, economical investments, creative imagination and ability to communicate (Rullani, 2004). That is, the factory of the immaterial comes from an organized system of collective intelligence (Levy, 1999), which creates and multiplies the value of the meanings assigned to the objects: the economy connected with the material transformation still remains the "base", which continues to be necessary, but on which has grown an immaterial economy that has become the most decisive and important economy (Gorz, 2003).

Manufacturing Knowledge

Manufacturing, namely the canonical place for the material transformation, is losing weight with respect to more intangible services. Moreover, even within manufacturing, the processes that matter from an economic standpoint, are increasingly intangible. In fact, the physical transformation is not made straight from work – with its muscular power – but through machines. And these are driven and fueled by the knowledge of the designers who have designed them, the engineers who built them, the operators who maneuver them, not to mention the background of engineering, research and management skills from which the energy employed originates. The factory equipment works because there is an immaterial economy that produced it behind, generating and spreading the effective knowledge (Rullani, 2004).

Therefore, man's work no longer consists in transforming physical things, but now it is almost entirely in producing knowledge that will be used – through machinery and artificial energy – to transform and produce material things. If an idea may be the result of a singular person thinking and the product of fortune, it is a complex and integrated arrangement of characters, skills, supports and infrastructures that transforms the idea in a valuable product. This happen not to be the result of a coincidence, but the outcome of the work of a network of may people and competences together.

The tools and and practices of design are changing: the digitilization permeates every segment of the professional activity of the designer, while scanning timing and terms and thus reducing the entire design process to the production and processing of information elaborated by the knowledge and creativity at work. The computer becomes the total working tool which is able to create new forms of expression which cannot be included within the design standards.

The emergence of new forms of art based on the innovation in the world of electronic media – such as graphics, video and communication, modeling softwares and new materials for product design, fashion and body, the environmental and interactive exhibitions, electronic music – actually have created a climate of widespread and open creativity through the years. This dynamic condition is being fed through experimentations in images, languages, shapes, interactions, processes of hybridization, while being connected with media and the society of consumption, rather than with the economy of labour and production (Imbesi, 2007). A new factory is raising with its workers, machines, market and products.

Crisis

Together with the category of second modernity, Ulrick Beck testifies we are entering in the risk society, where we are leaving the state of upward growth and wealth which characterized the first modernity. A growing sense of fear and anxiety then would accompany the growing awareness of the risks connected with environment and pollution, the uninterrupted local and global wars, unemployment and social inequalities, the crisis of the financial markets.

But furthermore, it is the understanding to live in a state of scarcity, where the resources are limited and inadequate to guarantee the dream envisioned from the first modernity of a wealthy existence to humanity (Beck, 1992). Then, the society becomes reflexive because it learned to reflect on the consequences of its modernity and the tight relationship between the production of new risks and the growth of society (Beck, 1994).

Along with the analysis of many critics, it is often the negative trait which is prevailing after the positive visions of the future and the production of the risks are taking place of the optimistic projects for tomorrow. Then, the question would be: is there still any space for the development of the 'positive' project? Giving an answer to a crisis seems often not to leave much room to planning a new everyday... or it could be an original chance for envisioning the future?

In addition, when reviewing the term Post-Industrial, the first remark emerging is that the prefix 'Post-' or 'De-' (as many other categories, such as Post-Capitalist, Post-Modern, Post- Production, as well as De-Industrialized or De-Territorialization) establishes a negative question rather than a positive discussion, so reproducing the uncertainty related to the configuration the future society will take. Then, the negative wording often implicitly involves a difficulty in identifying what are the positive characteristics and the future forms that will characterize it, but at the same time there is no denying that any new movement can express its complete configuration in detail only when looking back from a state of advanced mature age, while initially it is only possible to think to it 'by difference', while comparing to what preceded it.

Working on the Differences

Secondarily, the term Post-Industrial evokes the prevalence of a new way of producing. We owe the diffusion of this term especially to Daniel Bell (1973), who focuses on the configuration of a new order of society (the so-called 'service society'), which isn't anymore centred on industrial production, but on the production of services, in particular those connected with public interest. The development of the service society would arise the progressive emergence of the tertiary sector and the following growth of the demand for skilled labor, particularly engineers and professionals, together with the new centrality given to knowledge and technology, taken into account as a source of innovation and competitiveness.

The same construct, however, had already been used few years before by Touraine (1969), who used it to em-

phasize the change of the role of industry in contemporary society.

The big transition that began in the seventies of last century to a 'new capitalism' variously defined as Post-Fordist, Cognitive, Post-Industrial, Flexible, and so on, among the many aspects defining it, we should highlight at least two basic factors. First, the twin processes of globalization and dematerialization of the economy and the increased importance of the technical-scientific and symbolic-cultural factors, which come to act as a motor for innovation and a tool to manage the growing turmoil of markets. This should be considered as a shift of the paradigm of production, which can be represented with the transition from a model based on the large production of hard and durable goods for mass consumption and the vertically integrated organization of industrial labour, towards a pattern based on the production of services and knowledge, which can be organized on orizontal multi-level networks (which can be international, transnational or sub-regional) (Castells, 1996; Coriat, 1991; Rifkin, 2001).

Living in a Finite World

The dynamics of the post-Fordist production and the reorganization of enterprises in the direction of transnationalization of the industrial processes and all the integrated upstream and downstream activities, from design to distribution, allow the fragmentation and the deterritorialization of production segments on a diversified range of national realities, leading to the decentralization and the fragmentation of the cycle of production onto a fragmented network of more convenient local realities (Castells, 1996). In addition, the awareness to live nowadays in a state of "finite market", namely to cohabit with a slow or even no growth, pushes to radically rethink the production strategies in the direction of the needs of the market, which should be considered such as a fluctuating and unstable variable and then subject to sudden changes and irrational environmental factors (Coriat, 1979).

On the contrary, the Fordist model of production used to move along the opposite philosophy of growth as it was measured quantitatively as unlimited as per extension of the volumes of production and its presence on the territory. Its pattern of expansion was substantially locally territorialized and made reference to a locally settled audience to absorb an ever-increasing share of durable commodities. Namely, it was for a long time an economy of scale related to the exponential expansion of the volumes of products. The consequent search of lower prices was then achieved by mass production and the rationalization of the processes of manufacture.

The Fordist economical philosophy would expect the mass production to have reached stably every segment of the market through standardized artifacts, which should have been necessary, useful, proper, efficient and economical. As a direct consequence on everyday life, the reduction of the best shape to the most economical way to meet the satisfaction of a necessity, made possible the development of standardized objects for standardized habitats, which in turn made possible the definition of standardized practices of living. This would be the warranty for the fulfillment of basic needs for an healthy and peaceful human existence, as a repetition of a static reality: a form and an order to be reproduced forever and indefinitely, as the inevitable result of an absolute progress.

The awareness of the inner limit inherent within each market and the constraints for an unlimited quantitative growth of the volumes of production, which came with the economic instability and saturation of demand, induced the industrial strategies to review the Fordist-Taylorist system: *"penser à l'envers"*, namely thinking an inversion beside the massification and standardization, in order to offer customization and small series in a wider geographic scenario: "this is a situation which is exactly the reverse of the Fordist one: there we had a market which was geographically limited (de-limited) and commercially endless, here we have a market which is geographically global (il-limited: without boundaries), but commercially saturable in the medium-short time." (Coriat, 1991)

Then, it's the market to embody the complex system of independent variable of "production- consumption", while decentralizing and articulating a demand which is no longer still, but impermanent and in constant motion through a plurality of scattered nodes on the global networks. The paradigmatic notion imposed by the Fordist model of development for which it is the production to produce the market, comes to be in contradiction with a market that, through fickleness, inconsistency, mobility and transience of the demand, binds the production to continually review its strategies to flexibly adapt them to the contingency of the moment.

The post-Fordist organization of production essentially refers to the Japanese model, which is derived from the *Kan-Ban*, namely the management of the stocks of American supermarkets that provided supplies directly commissioned by the sales (Ohno, 1988). Seeking for qualitative rather than quantitative objectives, the Japanese model focused on economies of diversification, as opposed to the economies of scale that characterized the Taylorist factory. The Toyota system designed by Taiichi Ohno – a technical manager of the Japanese car company that raised its fate – has globally revolutionized the philosophy of production through words as "lean manufacturing", "integrated factory" and "total quality", but especially the research on the production of small numbers, the differentiation and variety of products to move from standardization, in order to

respond 'just in time' to the quantitative and the qualitive fluctuations of demand. Ohno's slogan was "to produce cheaply a small number of many different models" and was to understand a global market that was constantly changing, increasingly demanding and diverse, to be answered with differentiation, personalization, performance (Ohno, 1988). The awareness of living in a finite world becomes the chance for the reorganization of the way to produce and to live, while developing design answers. And this was just the beginning…

Mixed Routes

As previously stated, we should not mix up the expression 'Post-Industrial' with the disappereance of industry itself, as the term comes not to be the negative of manufacturing: industry is still working, but with a new and different organization and weight. On the contrary, the turn towards the Post-Industrial society refers to the historical shift of its role within innovation processes towards activities connected to the service industry, while involving knowledge labour.

The world of the old twentieth century industry we were used to, cannot be resetted from one day to another, and furthermore the new flexibility and decentralization of the new economic development model is not always incompatible with the old Fordist factory of mass production. Old and new worlds often coexist together and we should take into consideration all possible hybridizations between the two orders, as well as their hard differences (Appadurai, 1986). At the same time, we should detect the presence of ambivalent trends, mixed routes, strong contradictions and processes of decomposition and fragmentation that characterize both the productive and economic sphere, as well as the social, cultural and institutional processes upon which much of the contemporary thinking has been focused (Beck, 2000).

For many critics, Fordism does not necessarily identify with the rigidity of the assembly line, nor with mass production; rather it relates with the ability of the capital to permeate production, so becoming synonymous of capitalist production, as well as with the flexibility of mass manufacturing and technological innovation to take several different forms. According to this, many authors on the wake of Touraine (1969) argue that the crisis of mass production does not involve the loss of industry and even of the relevance of its model to organizing work, nor the meaning attributed to it (Kern – Schumann, 1991). For many, the passing of Fordism marks the transition to a phase where must be highlighted a radical transformation rather than a celebrated death.

Again following this view, despite the undeniable advance of the tertiary sector, industry and industrial work are still essential, not only for the functioning and the reproduction of society, but even for its own understanding. At the same time, its organization and

products are completely different, with an emphasis on its intangible factors, connected to the narrative and the meaning implied and along with the innovation in technology and materials.

In any case, after being subjected to fractioning and decentralization, the old Fordist factory changes its look, image and organization, by adopting more flexible forms of management to coordinate and comprehensively respond to the changing markets and the demands for innovation.

According to any analysis of the present shift we are experiencing, there is no doubt that in order to face the dual challenge of market globalization and dematerialization of value, the former 'territorial' manufacturing capitalism is called to a great change. In this context, creativity and design are represented as a crucial resource to accompany the production system towards the new phase.

Producing while Consuming

With the entry of new technologies of comunication into production, the design practices are subject to a great change in their processes and approaches: as a consequence, few of the old controversial dychotomies brought to us from the twenty century serial production, such as the conflict between original and copy as absolute values, come to an end. At the same time, the concept of sampling, and the practices of cut-up and replicability are able to contain together industry and creativity and to open up to new languages. As a result, the character and the role of the designer seem altered towards society and work practices, while displaying a load of innovation and creativity.

The now achieved democracy and horizontality of technologies bring closer the character of the producer with the consumer: they both can potentially own powerful technologies and easily handle them, while giving way to the notion of productive consumption (namely, you produce products and meanings, while you perform an action of consumption).

A different role to the consumer was already recognized by Karl Marx, who recognized his influence along with the processes of transformation of products into goods for consumption (Marx, 1970). As well more recently, Gilmore and Pine put the direct and active involvement of the user at the centre of the process of creation of the products and their the value through the category of 'experience economy' (B. J. Pine, J. H. Gilmore, 1999) and furthermore, Alvin Toffler created the oximoron of the 'Pro-sumer' which is an hybrid character merging together the producer and the consumer (Toffler, 1980). Producers and consumers are combining their roles and activities: the consumer joins within the production process as an external worker of the factory, while contributing to the co-creation of

the products and the cultural/economic value, even if he is not aware (Codeluppi, 2008).

The upcoming character of the Pro-sumer, rather than creating a form from a primary raw material, works by manipulating the forms and the languages already in circulation, through practices of productive recombination and conversion, while drawing from an ever-expanding and accessible catalog. Rather than creating new forms, he better re-use and re-work the existing ones, while creating new aesthetics.

As a result, we come up with objects in-formed by other objects and then concepts of originality (namely, being at the origin of) or even creation (creating something from nothing) are slowly fading. In this new cultural landscape, the twin characters of the DJ/VJ and the programmer emerge, while taking the task of selecting cultural objects and placing them into new contexts, also creating a new aesthetic of repetition (Imbesi, 2009). One more time after the age of mechanical reproduction (Benjamin, 1936), the concept of originality seems to loose its 'aura' and can be traced back to the inheritance of the romantic aesthetics that valued the unique and the unrepeatable against any attempt to serial duplication that would violate the "sacredness" of the original project.

Again, the character of the designer changes through the different cultural scenario: the philosophical and aesthetic ideology of originality was based on the exclusive work of a "genius" creator, which in turn becomes the guarantor from any cloning. Rather, each object that seems to be "given" or "created" from nothing, it is the result of an open network of references that makes it a cultural product. Namely it should be considered the product of a collective heritage which has been involved somehow in its physical and cultural construction, while integrating earlier creations as well as future perspectives, through practices of interpretation and processes of negotiation. The designer is never alone in his individual expression, rather he is part of a larger network along the organization of his work and taking advantage of a wider collective intelligence and the related cultural interactions (Levy, 1999).

Designer as a Mass Profession

While the designer seems to have taken off the clothes of the positive hero, who creates unique shapes for the salvation of society, at the same time a widespread demand of design is emerging for the service economy, consisting primarily of intangible factors and creativity. This may also explain why the category of project is now often replaced by the concept of creativity, which opens the field to new dynamics and objectives.

If creativity previously simply referred to an attitude, which was employed in somehow within the project, nowadays it becomes a "portemanteau word" of high-er order, in which even the project, at this time in second place, finds forms and applications. Namely, we are moving from the culture of project – which is the organized study of the possibilities of implementation of an idea through the tools and resources available – towards scattered, fragmented forms of creativity, where to apply innovation and creativity to experiment or solving specific situations, rather than assuming an utopian meta-universal dimension to achieve permanent solutions, or drawing absolute macro-systems (Branzi, 2006).

The designer is no longer able to cover the entirety and complexity of the project: now part of a collaborative network of characters, where each segment supplies a contribution to the final result, the designer covers specific sections to solve specific issues and is loosing the control of the entire product "from cradle to grave". Similarly, the massive entrance of a great amount of young people in the so-called creative professions, changes his aura of authorship and of the act of creation itself.

If we consider that the design practice is now fully treated as data processing in which the electronic brain plays a central role in every segment of employment, accessing to a computer and its related applications also means accessing to the tools of the project and then becoming a potential designer. With the democratization of the design tools and technologies for production, design ceases to be a professional elite, to become a "mass profession" that expresses itself in the management of processes rather than products.

If we could previously count on a few number of great masters, who were universally recognized as celebrities who are remembered forever in the annals of design history for the creation of masterpieces and furthermore if these great professionals were able to give continuity to their production – enough to be recognized driving schools of disciples – the upcoming new generations of spread creativity seem to be characterized by a large number of smaller names, which in turn fail to provide much more than a short production, though often of great intensity.

Copy & Paste

Nicolas Borriaud in 2001 developed the notion of post-production, while connecting the concept to contemporary artistic practices that are emerging from the proliferating global culture of the information age, characterized by the multiplication of the supply of works, images and shapes. Borriaud argues that the growing service sector is opposed to the previous sectors related to agriculture and industry by the fact that their products were the direct result of the elaboration of raw materials. In contrast, post-production – with reference to the activities related to the service sector and recycling – would relate to reworking the existing products, as usually happens in the audiovisual sector. In fact,

Post-production is a technical term drawn from the vocabulary of the audiovisual activities, often used in television, film and video, and refers to a set of processes applied to a pre-recorded material: the assembly, the inclusion of other video or audio materials, the overlapping of subtitles and voice-overs, or any special effect.

By analyzing the works of artists from the early nineties, Borriaud outlines the emergence of a relational aesthetics, which cannot be considered the result of a singular creation from a primary material, but the result of a collective sensibility to manipulate objects which are already in circulation in the market. Internet can be considered the interactive mental space in which to organize the production and at the same time an incredibly extensive catalog of shapes from which to take advantage: "(…) the question is no longer 'is there anything new we can do?', rather 'what can we do with what we have?' In other words, how can we still produce singularity and meaning from this chaotic mass of objects, images and references that is now our daily lives?" (Borriaud, 2001. Translated by the Author)

As said before, the horizontality and democraticy of today's technologies turn towards a form of 'productive consumption': producers and consumers are closer as they have the chance to manage the same tools in hand: the consumers have taken control of a more sophisticated technology which he was previously excluded from and at the same time which is the potential producer of images, forms and meanings, besides of artifacts. Equally, the practices of production and consumption resemble each other as per the use of media, techniques and processes. The power of the software is to connect consumers and designers all in one person: the designer acts as a consumer, while processing data through the use of the computer, but also to the consumer is allowed to assume the role of the designer, thanks to the immediacy of the use of software. As a direct consequence, rather than using raw materials to build new forms, new technologies manipulate shapes and styles readily available by allowing actions and practices of consumption, while at the same time redefining the same act of production itself.

Sampling Creativity

Based on the concept of sampling, as on the practices of cut-up and replicability, the new systems of aesthetic reproduction break the historical opposition between the categories of difference and repetition construed as absolute values, such as between equal and different, original and copy, containing creativity and industry while opening up new languages, displacing those of the past. That is, the reproductive technologies allow the recording of visual fragments, formal pieces, linguistic or textual parts, even sound themes, and then play them after an action of subjective handling, while authorizing

the reorganization and free interpretation together with the creation of copies that change the original piece.

At this end, the Latin American anthropologist Néstor García Canclini observed the dynamics of deconstruction of the images from their contexts of reference, relating them to the mechanisms of reproduction that manipulate messages, facilitating at the same time the displacement and the contamination: these may be considered as processes of deterritorialization and reterritorialization, that allow at the same time a subjective and creative interpretation.

Canclini examines some devices and technologies of reproduction and the effects they produce on the original semantic: in particular, he analyses how the Xerox machine allows the incidental reorganization of the text outside of the logic of the original chapters provided by the original authorship; or furthermore the way the VCR allows to mix different genres displaced from the original framework of reference, to produce individual collections and interpretation (Canclini, 2005). Extending the analysis to more complex devices: the MP3 player allows the composition of personal playlists; or even the more sophisticated samplers are able to record audio signals and combine them into different frequencies or speeds; or the universe of software for recording/reproducing/processing any digital information.

Here, the line between production and reproduction fades to highlight the concept of post- production which summarize and exceeds them. Still, the category of post-production helps to overcome the traditional distinction between production and consumption, creation and copy, readymade and original, by developing a set of processes applied to a pre-recorded material with the mechanism of "copy and paste".

Self-Capitalism

While observing the transformation of the nature of labour and enterprises in Italy, Bonomi and Rullani state the emergence of a new form of "personal capitalism", where people may organize autonomously smaller entrepreneurships, while sharing locally and globally skills and knowledge, as well as resources and tools, to the accomplishment of projects and products. If the big Fordist corporation was self-sufficient with a pyramidal structure of organization, the model highlighted by the Italian industrial districts is made of a number of little and medium enterprises, networking each other horizontally and geographically positioned (Bonomi, Rullani, 2005).

At this end, the crisis of the big multinational companies seems to re-evaluate the experience and the organization of such 'personal capitalists', then leaving a special space for the self- organization of the individuals, with their unique trait and special contexts. Knowledge and creativity raise to be important levers with the support of the new technologies, to create innova-

tion and value and to develop new autonomous experiences of production. At the same time, this is affecting also the way the young designers operate and manage their work. In a world where the number of designers are increasing and then the competition is more difficult – and without mentioning, at the same time the crisis of industry is restricting the spaces and the chances for them to work – the younger generations try to explore alternative professional approaches, also becoming themselves "personal capitalists".

In the knowledge society, if it is true that the computer has become par excellence the tool of production, also its liberated accessibility is bringing closer the worker and his product, then opening up to new economies and new design experiences. This *'homo flexibilis'* of project often becomes an entrepreneur himself, building new biographical and production scenarios by experimenting with new forms of self-production that develop new critical keys beyond the immediate marketability (Imbesi, 2008).

With the help of information technology and the advancement of rapid prototyping and its related accessibility, for the first time the designer is in the position to close the circle of production, playing on his own every segment, ranging from design, to production, distribution, communication and even sales. The young designer – who has now learned to exploit his abilities to individually connect to a collaborative network of peers – can integrate every productive segment in his office, as a real entrepreneur, and even his name appears be used as a real brand.

The design studio happens to be renewed in a design office management; the prototyping workshop becomes a factory that produces small series of products; the tasks of the agent for distribution can be executed through Internet portals and e-commerce, just as every aspect connected with communication, such as designing the packaging, processing the corporate identity and all strategic aspects of product marketing may be handled by the same design office. The work of the designer may be extended even to curating the exhibition design of the points of sale and the selling itself, as it often happens in many international design fairs, where young designer are often self-promoting themselves.

Thus, the creative "cognitariat" of design discovers new capabilities for experimenting new experiences of self-organization and self-brand, while releasing a spontaneous and alternative space beside the official production, which may still be intertwined with, and then disseminating power for design.

Lorenzo Imbesi
Associate Professor, SID | School of Industrial Design – Carleton University, Canada
lorenzo_imbesi@carleton.ca

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Birgitte Geert Jensen and Merethe Kruse

Supporting the emergence of female student entrepreneurs

Introduction: About Aarhus School of Architecture (AAA)

Aarhus School of Architecture (AAA) was founded in 1965, and is a university institution under the Danish Ministry of Culture.

AAA has 750 students and employs 160 employees. Overall 60 % of the students are women. Out of the 750 students around 80 specialize as designers, and in this field, almost 70 % are women. AAA is one of only two Danish Schools of Architecture.

The international accreditation of the AAA has been quality approved by the highest European Standards. AAA offers academic, profession-oriented graduate programs at the highest level of architecture, postgraduate masters as well as and Ph.D. degrees in architectural professional fields.

The graduate and postgraduate programs are based on research at the highest level with the aim of continuously classifying training, professional practice and architectural interdisciplinary integration. This research is carried out in cooperation with internationally highly acclaimed institutions such as the Royal Melbourne Institute of Technology (RMIT), Melbourne, Australia, Harvard, USA, IFU in Paris, France and the Aalto University, Helsinki, Finland among many others.

Aarhus has 250.000 inhabitants, and is the second largest city in Denmark.

The city of Aarhus has a very high concentration of architect- and design studios. In fact, the city of Aarhus has one the highest concentration of architects and designers in the city area in the world.

Entrepreneurship at AAA and close collaboration with external partners

It is part of the core strategy at AAA to strengthen networks and collaboration with external partners e.g. industry, companies and organizations. This is partly to promote customer and cooperative relations in ensur-ing the quality of the education, and partly to qualify the learning situation with real life experience and the creation of real opportunities.

It is also a key aim of the School of Architecture to take responsibility for ensuring candidates from AAA the opportunity for jobs and self employment, bearing in mind that female candidates from AAA have a relatively higher risk of unemployment than male graduates. In Denmark, statistically, +/– 75% of the unemployed architects and designers are women.[1]

Self-employment, or the possibility to be partly self-employed, greatly expands the variety of job possibilities for students from AAA, enabling them to design their own work life, rather than just having the option of getting employed.

For more than a decade AAA has held a variety of courses in innovation and entrepreneurship, both addressed at students and teachers. In the 2009/10 academic year were offered 4 courses in entrepreneurship at AAA, and 54 % of students participated in the courses. AAA is the educational institution under the Danish Ministry of Culture, which offers the highest number of courses in entrepreneurship – and also the educational institution where the highest percentage of students take part in these courses.

Ark:Idea and 'Knowledge on demand'

For the last 3½ years AAA has run a student growth house Ark:Idea, where students have participated with their own nascent entrepreneurial business. The first two years of developing and running the growth house, was founded by the Danish Enterprise and Construction Authority.

Ark:Idea has proven to be a success, and up to now 114 students have taken part in this facility, and 50 % of these have been women. This means women are still underrepresented in Ark:Idea, compared to the gender distribution at AAA as a whole.

Many of the students, who have participated in Ark:Idea, have started their own business since. What we consider to be Ark:Idea's main result, however, is that all of these students have experienced a considerable expansion in their own ability to act out, their self-efficacy.[2]

1 Kandidatundersøgelsen (2006), AAA, page 39
2 Bandura, A (1997): Self-Efficacy: Toward a unifying theory of behavioral change, Psychological Review, 84, p.191–215

Our didactic focus in Ark:Idea is based on a concept we call 'Knowledge on Demand'. This concept aims at giving students experience with interacting with the real world in practice, rather than learning about entrepreneurial disciplines on a theoretical level. During the first year of Ark:Idea, we learnt that too much entrepreneurial knowledge overwhelmed them. In fact, it inhibited their ability to act out, thus reducing their experience from acting out. We learnt that just enough knowledge, provided at just the time when it is needed, gives good leverage to the students' enterprising behavior. By putting 'Knowledge on Demand' as a framework, the new knowledge becomes relevant knowledge for the individual. We see the students transform their knowledge into concrete action, rather than hold an abstract knowledge that takes up space and energy at the expense of working with their nascent entrepreneurial business. This learning concept has proven very conducive for students' enthusiasm and self-efficacy.

They gain confidence and get the urge to develop and mature their business ideas in interaction with advisors, mentors and external collaborators. As they interact with the real world and gain enterprising experience, they build a new enterprising self image revolving around increasing self-efficacy.

Many students, particularly female students, also report that they experience themselves as more professional, after taking part in Ark:Idea, altering their self image, and in a way making them more focused and effective as students. Through interviews with female students who participated in Ark:Idea, we have formed some ideas of the barriers to entrepreneurship, which is prevalent among female students. These ideas are contained in the recommendations, which are a result of a more extensive mapping of female barriers to entrepreneurship, SPRING and METASPRING (see later).

Relatively, more designers than architects have participated in Ark:Idea, estimated half of the students who have participated, are design students, a rather large number considering design students represent only 10 % of the total number of students at AAA. The relative over-representation of designers who harbor a desire to become independent, is the reason we have chosen the design faculty as a testing ground for the integration of entrepreneurial learning elements, as in the Q:Ark project.

The integration of entrepreneurship in the education, as an extra enterprising dimension to enrich and expand the discipline-specific learning, is the next step at AAA. Simultaneously, we assume that the integration of entrepreneurial elements is a way to 'reach' those last female students who represent an unused entrepreneurial potential. Since many women do not perceive themselves as having entrepreneurial characteristics, these tend to be dominated by male archetypes, a lot of these women will not find out about their entrepreneurial potential by themselves. We will need to unveil this potential to them by integrating entrepreneurial elements in the education.

SPRING and METASPRING projects

To investigate why women are proportionally underrepresented among student entrepreneurs, we launched the following 2 parallel projects in cooperation with The Royal Danish Academy of Fine Arts and Copenhagen Business School along with representatives from 4 other Danish student growth houses. Both projects were funded by the Danish Secretariat for the Student Growth Houses, and were executed during 2010.

The SPRING project consisted of 3 1-day workshops with altogether 22 female student participants, primarily from the two Danish schools of architecture, Copenhagen Business School and the University of Copenhagen. They were all relatively new to acting and thinking entrepreneurially, and were encouraged to discuss and express their individual barriers and incentives for becoming entrepreneurs. The SPRING project describes the general experience gathered during workshops held within the framework of SPRING, including the participants own experience of participating in workshops, themes they have experienced themselves, convictions, resources and obstacles.

Whereas the SPRING project was situated in the core of our experience, METASPRING was a learning-related meta-perspective, with the purpose of reflecting and verifying the experience gathered during SPRING on the basis of a large critical volume gathered from several fields of study and several educations.

The participants in METASPRING were:

Merethe Kruse, Aarhus School of Architecture
Ida Adler Olsen, Copenhagen Business School
Pernille Skov, The Royal Danish Academy of Fine Arts
Lone Stubdrup, University of Aarhus
Marie Rollof Christiansen, University of Copenhagen
Peter Ottesen, University of Copenhagen
Jesper Nørskov, Business Academy Aarhus
Margrete Bak, Solo Job design

SPRING and METASPRING recommendations

The produce of the SPRING/METASPRING double project was a list of recommendations to promoting female entrepreneurship, representing an interpretation of the experience gathered within the framework of our respective student growth houses as well as the project SPRING. The recommendations are consequently not based solely on empirical analysis but also on qualitative statements and feedback from participating students, they are our best possible interpretation of the reality we encounter in the student growth houses.

The target group for the METASPRING recommendations are:

- Employees and decision makers in student growth centres / "incubators"
- Organisations / institutions that work to further (female) entrepreneurship at higher educations
- Educational establishments that aim at promoting (female) entrepreneurship.
- We only address political decision makers to a lesser extent.

Based on the experience from SPRING, we recommend the establishment of a space for learning where participants are allowed to experiment, receive feed-back, receive support and where students are given a push forward. Pushing and supporting should be weighted equally. We are of the opinion that this learning can be directly observed in the form of an increased confidence to act and an ability to create and use a wider range of opportunities. On a deeper level there is also an expanded identity with regards to entrepreneurship; 'I now see myself as a person who is able to …'

It is most significant that the range of opportunities is widened by using self-selected stakeholders. The attitude should preferably be one of openness towards the fact that many developments are possible, and one should avoid attempting to control the construction of activities taking place within the learning environments to too great an extent.

Knowledge is made available in cases where lack of knowledge creates fear and obstacles. Knowledge can also be made available in the form of a structural tool-box, i.e. aids for setting priorities.

In general, we want to establish a learning environment which supports a state of being possibility-oriented. A state which allows you to recognise what you are already capable of and which is self-appreciative. It is subsequently important that you are given an opportunity to test this on a small scale, that you reduce it and initiate it through affordable loss clarification. The aim is to establish a new state of mind using effectuation as a framework for articulating what you need to do, this should be based partly on what you have learnt through individual action and partly based on coaching and group learning. Experience, whether good or bad, is viewed through an action oriented fail-forward frame of reference which results in the acceptance of mistakes and which focuses on future potential.

This will provide ways of loosening up the established sense of self and will provide an opportunity for forming a new identity. At the same time, creative students are shown that their creativity is relevant and valuable also in an entrepreneurial context. Thus, the prior understanding that creativity is a content element and not a part of the form is negated.

If we want to communicate successfully with female students, we need to adjust the way we communicate very specifically to the target group. We need to neutralise words, and we need to adjust gradually to the world as it is experienced by females. Language must be combined with experience. Illustrations must create identification with the target group.

Communication through different approaches is preferable in order to target people who are not "natural entrepreneurs", including women, "one word fits all" is the wrong approach. There should also be more non-committal offers.

We have reason to believe that, with a few gender specific exceptions, the recommendations for promoting female entrepreneurship will also fit many males, who are not 'born' entrepreneurs. However, we have not had a purely male test group of not 'born' entrepreneurial students, to prove this.

Assumptions about teaching methods for promoting an entrepreneurial mindset among people who are not 'natural born entrepreneurs'

- To create a space for learning that provides you an opportunity to learn based on your own experience of success and gather new experiences
- To participate in the experience others have accumulated through role models and teams.
- To use appreciative feedback
- To create a culture which is supportive and optimistic as well as fail-forward opportunity-oriented
- To use communication which is specifically adjusted to suit the target group

The recommendations on promoting female entrepreneurship among students can be further grouped in four focus areas:

Expanding the traditional understanding of entrepreneurship

- Visualising creativity as an entrepreneurial resource (and not just as content)
- Addressing the understanding of balance/time of respectively entrepreneur and employee at an early stage
- Female role models who display different ways of being entrepreneurs
- Materials for communication that specifically address the target group
- Using a language which feminises / expands the understanding of entrepreneurship
- Addressing worries with regards to maternity leave from the beginning / lack of knowledge which hinders entrepreneurship

- Strategies for handling specific lack of knowledge which inhibits entrepreneurship (maternity leave, unemployment benefits)
- Challenging the cultural understanding of own possibilities and limitations

Creating a space for the forming of a new identity

- Role models must reflect the target group in order to further the possibilities of identification
- Achieving self-efficacy / confidence to act –– increased self-awareness through own abilities
- From Lonely Rider to community, focusing on networking skills

The application of an appreciative and action-oriented teaching method

- Effectuation: Make it smaller, "Bird in the Hand", think less and do more
- Identification of competences, recognising and showing in a way that is forward-looking and action oriented
- Group relations must be facilitated, they do not occur spontaneously
- Training the use of fail-forward (breaking with the demand for perfection)
- Addressing the fear of making mistakes / the fear of rejection
- Mapping affordable loss, concretising losses
- Interplay between pushing forward and contemplation
- Toolbox / tools for providing structure (structural-?)
- Stage specific segmentation + offers directed at the relevant stage
- Target group adjusted communication in words and images, in order to feminise the concept of entrepreneurship, creating identification.
- Coaching effectively
- Creating a balance between comfort / challenge
- Influencing positively through appreciative expectations
- Slightly longer clarifying courses including groups / meetings
- Training the personal use of networking with regards to "Self/selected Stakeholders"
- It is a good idea to hold one-off events for women AND mixed groups

Politically!

- Promoting the development of a more flexible labour market which permits different degrees of entrepreneurship

- Removing existing rules which apply to job activation and which inhibit or make it directly impossible to test entrepreneurship and other types of self-employment.
- Setting up a fund to provide income support to self-employed pregnant women which will open up the area to female entrepreneurs

Q:Ark – a pilot project testing the incremental integration of enterprising elements in the curriculum at AAA

Based on the sum of experience partly from our various enterprising courses, partly from the students growth house Ark:Idea and and partly from the 2 projects SPRING and METASPRING, we applied for the project Q:Ark. Q:Ark is a project, testing the integration of enterprising elements in the curriculum at the Faculty for Design at AAA. Q:Ark is funded by the Danish Foundation for Entrepreneurship - Young Enterprise.

As formerly implied, at AAA, we saw integration as a means to 'reach' the last not 'born' entrepreneurial female students, representing an unused entrepreneurial potential. Since these female students would not sign up for an enterprising course by themselves, the enterprising elements need to be fully integrated in the curriculum.

Q:Ark represents a model for integration of enterprising elements into an existing curriculum or study structure, an incremental innovation of the existing curriculum. The modular structure intends to make it easier for the teachers to include enterprising elements in the existing, without starting from scratch.

The specific activities in Q:Ark consists of 3 one-week workshops integrated into the overall theme at the Institute of Design in spring 2011, 'Health'.

The three workshops are aimed at all 4th year student (m / f), and they address the specific experience and competence, we have identified as critical factors for promoting entrepreneurship among women students.

Courage and confidence:
Experience with interacting with the surroundings. These experiences and the feedback the students receive in their interaction with the outside world, is an affirmation that they have substantial professional qualifications and are professionally interesting as collaborators.

Network:
Establishing external network extend the field for the creation of enterprising opportunities and provides an understanding of the market, and an insight into to where they can seek information and advice as entrepreneurs.

Role models:
Exemplify different approaches to being entrepreneurial, including some which women often value highly: to have a balanced work/life and is this a possibility as an entrepreneur. Role models have proven to be a very powerful instrument to inspire entrepreneurship, in Q:Ark primarily female role models are involved.

Economy, taxes and legislation etc.:
We intended to demystified these issues through the presentation of simple tools for financial management, information about intellectual property rights, copyright and patents, types of business constructions, etc..

Team cooperation:
It is our experience from Ark:Idea that women often want to start with other people, that being in a team strengthens their self-efficacy.

Interdisciplinary collaboration:
Being part of an interdisciplinary team, make students more aware of their own professionalism, and instils confidence and awareness about their own abilities. An interdisciplinary approach is a well known innovation generator, and having a multidisciplinary network increases the chances of realizing opportunities / projects as an entrepreneur.

**Workshop 1: Interdisciplinary Workshop
'User Driven Innovation'**
In interdisciplinary teams, the students develop practical solutions to user-driven innovation within the theme of 'Health'. Interdisciplinary cooperation partner is the Engineering College of Aarhus.

Workshop 2: Meeting with the practice dimension
Visit to a wide variety of role models, working in entrepreneurial way, of which the majority is female. Meetings with management consultants, group reflections, elevator speeches, and factual knowledge about economics, legislation, business construction etc.

**Workshop 3: Development of specific
project ideas.**
To be solved in collaboration with outside companies. Group Counseling and coaching by two external management consultants.

Moreover there is also and an extra dimension, a consistent 'awareness' on the creation of possibilities in cooperation with the outside world, articulated by external business counsellors, we invite to follow the program, and who are present at milestone presentations.

Conclusion: From the horses own mouth
To conclude this paper, we would like to give the floor to 2 female design students, Lene Schoedt and Janne Lykke. We asked them what they gained from being part of Ark:Idea, the student growth house at AAA.

Lene: 'What I really got out of being part of Ark:Idea, which was very much worth it, was something I do not think we are taught at the school, which is a big mistake indeed. And that is to get off the ground and get into contact, and dare to tell about yourself and your project, and to make those phone calls and to dare to network. To get an external network! I think it was really rewarding, and it has made me think, that if everything goes wrong and I suddenly get the urge to become independent, then there is no problem in that, I can do it.'

Janne: 'Especially in relation to project presentation, I have gained much from my participation. Now, I believe in myself and the project I'm working with, and I concentrate on communicating it clearly. I have practiced presenting the essence of the project. This is probably what I gained the most.'
Lene: 'It's a great way to meet the students from other faculties, and learn how we can use each other, maybe not directly, professionally, but as a network. I thought it was interesting to keep up with the others' projects.'

Lene: 'I think it gave me a lot of confidence, being somewhat ambivalent about what I really am capable of and am I actually capable of anything? And can I allow myself to say it? Women are generally good at put their light under a bushel, and that is just of no use! You have to get off the ground and tell others you what you can do and how good you are. I think being a part of Ark:Idea gave us a lot in this direction. It gave us some confidence, which we used during our subsequent presentations. We learned how to use the criticism we got in a constructive way instead of being discouraged by it.'

Janne:"Our latest project at school has been much more realistic. We've both worked with contracts and have had contact with many different partners. This is certainly due to the fact that we have been a part of the Ark: Idea, that we had a distinct idea about what we wanted out of the individual contacts, and how we could be of use to each other.'

*Lene: We may be trained to be creative and to be de-
signers, and this is what we should be trained to do.
But it is pointless, if we can't sell our expertise and
our work as designers.'*

Birgitte Geert Jensen and Merethe Kruse
Associate Professor, Industrial Designer
Process consultant, Master of Arts in Architecture
Aarhus School of Architecture, Denmark
birgitte.geert.jensen@aarch.dk
merethe.kruse@aarch.dk

Panel 4
Working with
business on open
innovation

Carolyn Barnes, Simone Taffe
and Andrew Hateley

Design education, research and knowledge transfer beyond the university

A case study in the pursuit of design
innovation through industry partnership

Introduction

Transferring knowledge and expertise to the socio-economic sphere is an increasing expectation of universities internationally, the development of professional skills and research experience becoming linked in higher education. This requires approaches to design education beyond conventional vocational education. Our paper argues that having honours, masters and doctoral students collaborate on applied research projects with experienced researchers has a number of desirable effects in achieving this goal. Incorporating research exposure for honours and masters students raises the professional competency of design graduates and hence their value to industry, government and the community in driving design innovation. It can encourage a questioning attitude towards established design practices and values in graduates. It can model the important of evidence and its rigorous analysis in design practice.

This paper explores these claims through a case study describing a commissioned research project undertaken in the Faculty of Design at Swinburne University of Technology, Melbourne. The 'Gen Y Money' project used participatory design to explore the perceptions, behaviors, values and motivations of members of the 18–25 market segment to superannuation. It engaged members of the target audience in a process of open-ended design as the first step in the development of new superannuation service products. The literature of participatory design (PD) claims PD to be innovation in design in requiring the involvement and reciprocal decision-making of end-users and other stakeholders in combination with designers and clients. Despite a history of application going back to the 1970s, there are

still many unanswered questions about methods in PD and its use in certain design fields. The Gen Y Money project looked at end-users' capacity to adapt to and apply the design methods of user personas and scenarios of use, considering the need for external tools and design facilitators in helping participants generate ideas.

The paper begins by examining the changing policy frameworks for university education and research in Australia and their implications for teaching and learning in coursework degrees. This is followed by a description of the case study, which shows how working on applied researchers projects can 1) provide a higher level of active, problem-based vocational learning in design, 2) allow honours and masters students to see design research as a career possibility, thus increasing the numbers of doctoral qualified workers for the design industry and 3) enable knowledge transfer between researchers and industry. The closing discussion concludes that for tertiary design education to fit Australian governments' policy focus on the knowledge economy and innovation means that students need direct exposure to research and researchers. It argues that where research experience is part of vocational learning, the transfer of new knowledge and innovation in practices to sectors outside the university is more likely, as is the development of a culture of collaboration between academic researchers and industry.

Research design and method

The research uses case study method, an established qualitative research approach in the field of education. A case study is an empirical inquiry that explores a contemporary phenomenon within its real-life context, accommodating its unique dimensions and issues (Yin, 2009). Welch, Piekkari, Plakoyiannaki and Paavilainen-Mäntymäki (2010) argue that case study suits the investigation of disciplines in practice, enabling the development of rigorous, context-sensitive, theory. There is some doubt over the scope of case study method. Flyvbjerg (2009, p. 219) notes the perception that case study is most suited to creating hypotheses, only methods that use a greater number of samples enabling hypothesis testing and theory building. Welch, Piekkari, Plakoyiannaki and Paavilainen-Mäntymäki (2010) observe that case study is typically valued for its rich description and scope for exploratory, inductive theorising, but argue for its successful application as a natural experiment and source of evidence to support hypotheses and theory.

The research used a single case to investigate issues in the nature and use of PD and to observe what honours and masters students experience though involvement in an industry- based, applied research project. The Faculty of Design and Swinburne University have been pioneers in industry-based learning in Australia, but is very early in the Faculty's development of ways

for honours, masters and doctoral students to experience industry-based learning in the context of applied research projects. The case study is the third instance where this has been trialled. It describes aspects of the Gen Y Money project as an interrelated vocational and research experience for students rather than seeking to evaluate the effects of such exposure. The use of case study method is confined to the initial, exploratory phase of research, with the paper linking evidence from the empirical world to theoretical argument on the value of first-hand exposure to research for coursework students. Early-stage, inductive theory-building research seeks to identify relationships between propositions and contextual variables so they can be later tested for generalisability and theoretical propositions developed. The hypotheses in this paper are provisional, the research presently only seeking to identify effects in respect of research exposure in design education, not their underlying causes (Welch, Piekkari, Plakoyiannaki and Paavilainen-Mäntymäki, 2010). The framing and conduct of future design research projects involving students will enable us to posit causal claims and theorize, using case study for 'explanatory' rather than 'exploratory' purposes (Yin, 2009).

National Research and Innovation Priorities in Australia

National research and innovation priorities in Australia stress the responsibility of universities to contribute to Australia's prosperity, economic strength and capacity to compete in the global economy through knowledge and skills transfer from research or research related activity (see Adkins, 2009). Announcing the National Innovation System Review in 2008, Australia's federal Minister for Innovation, Industry, Science and Research, Senator Kim Carr, argued:

> *we need to find ways to increase innovation performance across the economy, to ensure that business has better access to new ideas and new technologies and to bridge the divide between industry and research. In short, this review is about building a strong, robust and truly national innovation system to bolster Australia's innovation performance, boosting productivity and helping secure high-wage, high-skill jobs for the future (Quoted in The Warren Centre E-Bulletin, 2008).*

The report *Building Australia's Research Capacity* (Standing Committee on Industry, Science and Innovation, 2008), highlights research training as integral to improving Australia's research and innovation capacity, commenting that, 'The value of research and innovation in today's 'knowledge economy' cannot be overestimated. (p. 6)' The report stresses that the availability of sufficient skilled researchers to drive national research and

innovation initiatives in the public and private sectors depends on attracting and training successive generations of new researchers. Australian design education has significant issues in developing a research workforce in design.

In Australia, the politics of market liberalism have resulted in significant structural change and budget stringency for universities and heightened expectations of productivity across university operations (Quiddington, 2010, p. 477). The requirement for continuous growth in research funding, timely doctoral completions, patents and peer-reviewed publications are markers of such performance for the majority of academics and academic units. Meeting the objectives of national innovation and research priorities is a challenge for design on a number of levels. Historically, vocational education, not research, has been the focus of the higher education sector in design. In Australia, design entered the university sector as a result of changes to the number and type of institutions counted as universities in late-1980s and 1990s. From 1987, some colleges of higher education that focused on vocational education became universities in their own right; others merged with established universities in which the academic culture mixed teaching with research activity (Quiddington, 2010, p. 477). Simultaneously, the nature of innovation and Australian governments' expectations of universities' role within a national innovation system changed, creating heightened challenges for researchers.

The government report *Venturous Australia* (Cutler, 2008, pp. vii-viii) describes innovation policy in the 1980s as seeking to 'increase the supply and accelerate the commercialisation of research, scientific discovery and technological advances', that is, knowledge production. By contrast, it described current innovation as involving 'much more than the transmission of knowledge down the pipeline of production from research to development to application (ibid.)', positing a model of open innovation in which new knowledge and ideas emerge in collaboration with industry and community partners. This is the context in which Australian design academics and faculties must develop their strategies for research, doctoral education and the organization of research experience for coursework students. The latter is vital if design is to attract the numbers of new doctoral students required to fulfill the National Innovation Priority of providing 'a strong base of skilled researchers to support the national research effort' (Department for Innovation, Industry, Science and Research, 2009, p.4).

In Australian design, there is a significant deficit of research-trained workers. A main contributing factor is the very low ratio of doctoral qualified staff by comparison to other disciplines, providing few research qualified staff to conduct research, supervise doctoral students and teach in the undergraduate degrees

that provide a path to research training. Design departments and faculties will only become equal contributors to the research effort of individual universities and the Australian university sector as a whole when they successfully engage in knowledge production by forging knowledge relationships with industry and the community. One part of a comprehensive strategy here is to produce research experienced honours and masters graduates to fulfill the immediate research and innovation needs of Australian society.

Research experience as integral to university education

Offering undergraduate and coursework masters students research experience is often seen as vital to the pedagogical success and socio-economic value of higher education. The Boyer Commission on Educating Undergraduates in the Research University (1998:11) argues that, "Undergraduates who enter research universities should understand the unique quality of the institutions and the concomitant opportunities to enter a world of discovery in which they are active participants, not passive receivers." The report argues that immersing undergraduates in disciplinary knowledge is still important in university education, but increasingly the "skills of analysis, evaluation, and synthesis" provided by research activity are "the hallmarks of a good education (11)". Honours is a primary pathway to a research higher degree, although research experience in an honours year takes many forms (Zeegers and Barron 2009; Kiley, Boud, Cantwell & Manathunga 2009). Differing disciplinary needs and student interests also create other uses for honours (Kiley, Boud, Cantwell & Manathunga 2009:2). In vocationally-oriented degrees such as design, the honours year can seek to enhance students' employability and career opportunities through the acquisition of higher professional skills. It may provide intellectual extension by encouraging students to engage more deeply with disciplinary knowledge and practices (Kiley, Boud, Cantwell & Manathunga 2009).

Design is frequently seen as a creative calling as well a job with teaching and learning in honours affording the opportunity for deeper aesthetic and conceptual exploration through practice. Design students may enjoy pushing their creativity, but this is unlikely to replace interest in vocationally-relevant activities in honours. Moreover, it is often the self-directed minor thesis that exposes honours students to research in design education. Tynan and New (2009:297) report strong resistance from design students to this humanities model of scholarship, its rejection entrenching designers' identity as makers and the integrity of practice over scholarship, an attitude common in the design industry. Segregating research exposure to a thesis subject with an attendant lack of integration of research skills development and ap-

plication in practice-based subjects impedes designers'
capacity to see the relevance and value of research to
practice and to act as advocates and agents for knowl-
edge transfer from research in their professional lives.

Industry-based learning in design

By comparison, industry-based learning is often well-
established in design degrees. Including professional
learning, where students work in industry or on real-
world projects, is thought to make learning more rele-
vant and better prepare students for work. In the Faculty
of Design, industry placement and work on industry
projects have been integral components of undergrad-
uate study for decades. The honours and masters stu-
dents participating in this research were based in an
in-house design consultancy called Design Centre in
which work on external projects with real clients and
real financial, production and time constraints seeks to
familiarize students with industry conditions and in-
crease their employability. Learning activity is meant to
advantage students and clients, clients hypothetically
gaining access to the latest perspectives on practice and
a reflexive approach to the conduct of projects (Boud
and Costley, 207, p. 124). Yet the design projects avail-
able for student involvement can have limited creative
and intellectual range. They can provide narrow scope
for vocational learning and exclude any emphasis on
research and innovation, especially as framed by Aus-
tralian government policy. While the design education
sector often has active reciprocal links with industry
through alumni networks and universities' role as a
source of design workers, the failure to integrate re-
search experience into industry-based learning rep-
resents a lost opportunity to forge close collaboration
between universities, research institutes and industry.

To address these shortcomings, the model of teach-
ing and learning being trailed in Design Centre seeks
to introduce coursework students to the generation of
high-level, disciplinary knowledge through involvement
in real-time research and development projects with re-
al clients, extending students' experience, expertise and
strategic value to society. The model of teaching and
learning is that of inclusion in a community of practice.
Participants with different degrees of research profi-
ciency – coursework students, doctoral students, design
managers and researchers – work together on industry
projects that involve high-level judgments and decision-
making based on the analysis of evidence and the struc-
turing of research-based design proposals. The model
involves the novice researcher working with a range of
researchers of different experience to understand the
trajectory of knowledge development in research, en-
abling students to become increasingly knowledgeable
and capable in the practice of research and innovartion
(See Barron, Zeegers, Jackson, Barnes & Taffe, 2010).

For the Australian government, a national innovation
system involves both the development and diffusion
of new knowledge and ideas *and* its adoption and adap-
tation through use in real world contexts (PhillipsKPA,
2006, p.45). The Australian Government report *Power-
ing Ideas* (Department for Innovation, Industry, Science
and Research, 2009, p. 40) also argues that effective in-
novation involves a range of creative, management, or-
ganisational, teamwork and entrepreneurial capabili-
ties. The following case describes honours, masters and
doctoral students' involvement in an industry research
project that exposed them to the emerging role of the
designer in identifying and leveraging user knowledge
through participatory design. In addition to developing
research skills and experience of new and challeng-
ing design methods, the Gen Y Money project tested
students' skills in planning, collaboration and project
management and design production.

The Gen Y Money Case

In an era in which the boundaries between the provision
of consumer goods and service activity are shrinking,
services are likely an important part of most commer-
cial innovation. The Gen Y Money project, conducted in
2010 for a major Australian financial services company,
used PD to explore the perceptions, behaviors, values
and motivations of members of the 18–25 market seg-
ment in relation to superannuation. Superannuation is
compulsory in Australia, but superannuation provid-
ers do not currently target 18 to 25 year olds although
Gen Y is the future of superannuation and a source of
important market intelligence about social trends and
upcoming consumer needs and expectations.

The Gen Y Money project began with the research
client wanting to investigate the value of PD as an addi-
tion to the existing innovation tools used in their busi-
ness to plan customer services and develop new finan-
cial products. The research enabled the first and second
author of this paper to extend their research in PD, be-
ing one of a series of research projects conducted since
2007 into the application of PD in communication and
service design. Two series of three design workshops,
each of two hours duration, were held. The first, which
served as a test run to check approaches, used the hon-
ours and masters students from Design Centre as par-
ticipants, the students sitting within the age range of
the target market. The second used 22 paid participants
provided by a market research company. Representa-
tives of the research client observed all six workshops,
being impressed by the level of participants' engage-
ment in workshop activities and discussion by compar-
ison with focus group research.

Conventional design practice identifies designers
with an authoritative expert class that has little need to
consult users on what constitutes functional or pleas-

ing design. Proponents of PD cite this absence of knowledge as a failure to identify and accommodate users' needs and preferences. Significant sections of the PD literature link a lack of knowledge of users to the absence of democracy in design, ideals of democracy, social inclusion, individual engagement and personal empowerment being the foundation of PD (see Sanoff, 2005). PD proponents theorize that allowing representative end-users to contribute their creative ideas and contextual knowledge directly to the design process addresses this lack. PD methods vary widely, as does the degree of stakeholder involvement in design and decision-making. Currently, PD is used to develop diverse products and systems in varied fields involving health, education, community building, engineering and in various design disciplines including architecture, urban planning and product and interface design, but rigorously described cases in PD are relatively rare. This leaves significant unresolved questions about the inclusion of end-users in design, limiting the further spread and effectiveness of PD. Service design is an example.

Service design is an emerging, interdisciplinary field in competition with the more established field of service marketing. Service marketers have business backgrounds and stress the commercial aspects of service products. Knowledge of customers' needs and preferences is a framework in marketing-led service development to the extent that it uses market research methods to deliver qualitative and quantitative information about consumers. Service design presents itself as an advance on service marketing in advocating user-centred design. It claims to put people at the centre of the service product cycle, but designers often predict customer needs and experience in isolation based on their intuition. At the same time, the field of service design has a rich range of tools and processes to support the complexity of service development. Service design tools are adaptable, self-organizing and promote creativity and risk taking. They can be used with a diversity of groups and individuals to provide a neutral ground in which project stakeholders can collaborate to transfer diverse knowledge to design with little self-consciousness about their status and background.

The Gen Y Money project used the common service design tools of persona and scenario building to create detailed profiles of indicative consumers and relevant aspects of service development, thus exploring the capacity of non-designers to engage in design (See Figure 1). Grudin and Pruitt (2002) argue that personas and scenarios of use forge a sense of empathy with the eventual customers for products and services by contrast to designing for an undifferentiated mass. Usually, persona and scenario development harnesses quantitative and qualitative data sets from market segmentation studies, field studies and focus groups to reflect

the characteristics and experiences of actual people. In the Gen Y Money project, prospective customers created personas and scenarios from their knowledge of their own actions, attitudes and circumstances. The authenticity of the personas and scenarios helped the industry partner to understand who ordinary 18–25 year olds are and what they really need and want, avoiding the influence of corporate agendas that may lead to distortions in perceptions of customers.

The workshops produced an extensive body of qualitative data for the industry partner. The participants expressed low trust in superannuation, seeing superannuation companies as faceless organisations that give poor service and lock customers' money away for decades, especially when customers need it. The participants had very limited knowledge of superannuation or personal finances. They expressed feelings of confusion and apathy in relation to savings and investment. The workshops showed that superannuation is intangible for them, where their everyday experience is grounded in the reality of their immediate social circles and work. By comparison to saving for retirement through superannuation, spending on consumer items and leisure activities is a real and effortless activity that the participants understood well. Some common ideas about the nature of superannuation products and their delivery modes emerged from the workshops. Many of the suggested features and qualities were predictable requests for good service and clear information, but the workshops also provided valuable creative ideas about information delivery, touch points and product features. The key idea was that this market segment would be much positive about superannuation if companies provided token pleasurable bonuses during the pay-in period, not just giving back when customers retire.

In terms of researching PD, the workshops served as a natural experiment in the capacity of everyday people to engage in design (see Figure 2). It represented the researchers' first use of PD with end-users who had no previous involvement in the project or any particular commitment to its outcomes. Recently, much research has been conducted on the ability of user research to enrich the design process. Using marketing knowledge from focus groups and questionaries is one approach, as is employing social science methods that observe people using design in everyday contexts. Lately, participatory designers have focused on including end-users in the generative stages of design, seeking to develop methods to enable non-designers to design (Sanders

Fig. 1: Participants working with design tools to develop personas for the Gen Y Money project. December 2010. Copyright the authors.
Fig. 2: Participant working with design tools to develop personas for the Gen Y Money project, December 2010. Copyright the authors.

2000). As most stakeholders have no experience of design processes (Darses 2002), the PD literature generally supposes that designers should create tools to facilitate idea expression and record design ideas.

There are few suggestions in the PD literature that end-users should participate in tool development within PD. Sanders (2006), for example, argues that participants should adopt and learn the tools created by designers, allaying the frequent concern that PD will make designers redundant. The authority designers have in the interpretation and presentation of findings is largely unquestioned. Darses (2002) is one of the few authors to show that when designers are absent, participants can generate ideas without external tools and can develop their own rudimentary methodologies to evaluate them. The Gen Y Money project did not take this position, but opted for broadly scripted workshop sessions that used tools in the form of worksheets, card sets and stickers to prompt discussion and capture ideas. Group discussion was audio recorded. The designer facilitators who worked with each group used a low-key approach to keep things moving. The workshops found that end-users moved effortlessly into design activity, with the tools playing a role here. The act of choosing cards, selecting stickers and working out personas and scenarios prompted fluid, casual conversation among the participants across a range of interconnected issues in their lives including their attitudes to money, the future and superannuation.

What the students experienced through research exposure

The Gen Y Money project exposed the Design Centre students to a user-centered design method rarely practiced in Australian design and which challenge the assumed role and methods of designers. Conventional design produces a specific response to a client brief in the form of a design artefact, system or service. It rests on the understanding that only a few individuals possess designerly creativity and exercise this in isolation from end-users in a professional context. Design consultancies often list among their key capabilities the capacity to predict future needs and wants and claim to base the development of new products and services on needed innovations. In contributing to the research activity in the Gen Y Money project either as prospective end-users or in acting as design facilitators, the students experienced a contrasting model of informed group creativity.

In the late 1980s, the influential psychologist Csikszentmihalyi argued in his writing on systems theory that creativity was distributed across people, tools and environments (Sawyer and De Zutter, 2009). Creative products, he argued, are the result of a complex system containing the creative individual, a broad social con-

text and a collective body of knowledge and prior works. Recent research by Sawyer and De Zutter (2009) confirms that creative ideas are embedded in social groups and that creative products emerge from complex interactional processes, not the internal mental processes of specific individuals within a group and are rarely exercised by independent, so-called creatives. They use the term 'collaborative emergence' to describe situations where collaborating groups of individuals collectively and consciously generate a creative product, giving the example of a free jazz band. PD recognises such effects and their benefits.

The Design Centre students learned the value of PD in finding out things you could never know without engaging everyday people in the design process. On one level, the participants in the Gen Y Money project presented as passive, disconnected recipients of compulsory superannuation. The persona and scenario work provided a snapshot of a generation focused on their immediate social sphere. Yet, the participants' comments about the intangible nature of superannuation and their lack of knowledge about what their money is invested in showed them wanting superannuation products with strong local links that provide real benefits for the community. Their comments and design propositions revealed a yearning for local, personal, tangible and values-based qualities in superannuation. Participants in the Gen Y Money project had preeminence in idea generation, conceiving some key affective characteristics, features and delivery modalities for a future superannuation product, challenging students with the proposition that only designers can design.

The project will form a case study for a doctoral student in the Faculty of Design. The student worked closely with a team of communication design students from Design Centre to create the workshops scripts and accompanying design tools. The Design Centre students' contribution to the research was real and significant. They gained first-hand experience of a range of research and professional skills while helping to develop PD tools, documenting the results of the workshops and preparing a research report for the industry partner (see Figure 3). Where many design consultancies use highly traditional methods, the Gen Y Money project exposed students to a corporate client that is open to innovation and risk-taking, embracing a strategic form of design that seeks to effect fundamental change in products and systems.

Design meetings between the lead researchers on the project, the doctoral student and the Design Centre students discussed the many unresolved issues in PD. This included PD's tendency to be built on idealized, uncontested principles of democracy and social participation rather than evidence of usefulness and the challenge of preserving stakeholders' ideas during the

Fig. 3: Design tools developed by honours and masters students for the Gen Y Money project, December 2010. Copyright the authors.

design process. PD generates rich, qualitative data on different people's needs, perspectives and situations as well as their creative ideas, introducing much greater complexity into the design process, including the challenge of data analysis. This emergent knowledge showed the Design Centre students how evidence can drive design innovation and hopefully suggested the shortcoming of jumping straight into design with no knowledge of end-users. The students participated in the generation of new, practice-based knowledge delivered directly to a research client, disrupting the idea of research as something done for an essay or thesis and divorced from the world of work. The doctoral student provided the Design Centre students with an example of a designer who had chosen research as a career path. Two students from the honours class of 2010 subsequently applied for and won Australian Postgraduate Research Awards to study for a doctorate in the Faculty in 2011.

Conclusions

As societies have become increasingly knowledge-based, a Triple Helix model of university–industry–government relations has emerged, which expects universities to contribute to industrial innovation through knowledge and technology transfer (Etzkowitz and Leydesdorff 2000:29). The government view in Australia is that 'Research training is not the sole purview of academia, nor is academia the sole beneficiary of research training. Research is of value to society as a whole, be it in academia, government, or small and large businesses. (Standing Committee on Industry, Science and Innovation, 2008, p.vii).' In Australia, however, the alliance of academia and design has not resulted in significant research partnerships with industry as expected by government. Rather, the proliferation of design degrees suggests the effect of student pressure to provide qualifications in a popular vocational field (Becher & Trowler 1989). Honours programs are common in Australian design degrees, but the emergent nature of design research and the limited need for higher degrees for professional advancement means few design graduates currently follow a research pathway in their career.

The Gen Y Money case has sought to show how involving honours and coursework masters students in research projects enables a higher level of active, problem-based learning, the scope to challenge received

thinking in design making the connection between research and learning a potential source of design innovation. It suggests that an honours graduate with good research exposure and skills can contribute to the research and innovation efforts of industry and to the level of innovation in society as a whole. Students' exposure to applied research in practice is vital to the credibility and future development of design, especially since few designers write up their projects as critical cases in the aim of advancing the knowledge and scholarship of design as in other fields of practice, seemingly fearing giving away some competitive advantage.

Carolyn Barnes
Director of External Research Liaison,
Faculty of Design, Swinburne University
of Technology, Australia
cbarnes@swin.edu.au

Simone Taffe

Andrew Hateley

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Michael Taks and Karien Dommerholt

Enterprising Innovation: Academia, Government and Industry

A practical approach to open innovation, connecting education and enterprise

Background

'Innovation is the management of all the activities involved in the process of idea generation, technology development, manufacturing and marketing of a new (or improved) product or manufacturing process or equipment' (Trott, 2008). Innovation is the virtual engine of modern economy. In The Netherlands, regrettably, most innovation is mere incremental innovation. This means that in most cases variations of existing products and services are being developed, that have little impact on an enterprise's development, let alone the economic sector or the regional economy. On the other hand, radical innovations, such as digital photography, have a much bigger impact. However, radical innovation is rare.

According to the Dutch Scientific Board for Government Policy, a source of (radical) innovation lies in cooperation between people or companies that have different knowledge and resources. This especially counts for Small and Medium Enterprises (henceforth called SMES). The European Union (2003) gives the following definition for SMES; 'The category of micro, small and medium-sized enterprises is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding 50 million euro, and/or an annual balance sheet total not exceeding 43 million euro.' Research by Ulhaner and others (2007) confirms that both knowledge absorption and knowledge creation is important to the success of innovative efforts in small firms (10–49 employees). Their estimation results suggest that knowledge management acquisition or input strategies may be the most important aspect of the innovation process influencing the performance of small firms. Market research and the use of external networks for knowledge exchange are associated with higher sales turnover growth. In addition, they find a positive effect of cooperation with other firms for renewal, at least among the medium-sized firms (50–99 employees).

Kennispoort Zwolle, a regional network for exchange of knowledge around the city of Zwolle, has initiated the "Enterprising Innovation" program to facilitate innovative and possibly successful projects. Kennispoort ("Knowledge-Gate") is an initiative of the province of Overijssel, the Chamber of Commerce of Eastern Netherlands, the municipality of Zwolle and Windesheim University of Applied Science (henceforth called Windesheim). Windesheim is one of the largest Universities of Applied Sciences in the Netherlands with over 17.000 students. It offers Bachelor programs in 50 different disciplines. The Enterprising Innovation program is regionally supported by both the larger enterprises and SMES Small and Medium Enterprises. Kennispoort improves the development of company clusters and networks by organizing knowledge circles and innovation-meetings. Exchange of experience and knowledge, as well as generating ideas is the prime objective. The Enterprising Innovation program facilitates the development and marketing of such ideas.

Enterprising Innovation fits closely to the provincial innovation policy. The Dutch province of Overijssel wants to maintain and expand its employment. One way of achieving this is by bringing together innovation abilities, creative entrepreneurship and knowledge-intense industry. The province acknowledges that companies often cannot innovate by themselves. The solution is to have public authorities, research- and educational institutions and foremost regional businesses to join forces. The program called Economic Innovation actively enables this. The province participates in clusters and projects that add value. Also is searches for and initiates surprising connections between companies amongst each other, as well as companies and knowledge institutions. The Enterprising Innovation project embraces exactly these lines of action.

Setup

In the execution of the project several parties are involved. Each has its own responsibility. Firstly, Oost NV is responsible for acquisition of participating enterprises, as well as the general project management. Together with the Dutch Rabobank, Kennispoort and the municipalities involved, it organizes meetings for Enterprises
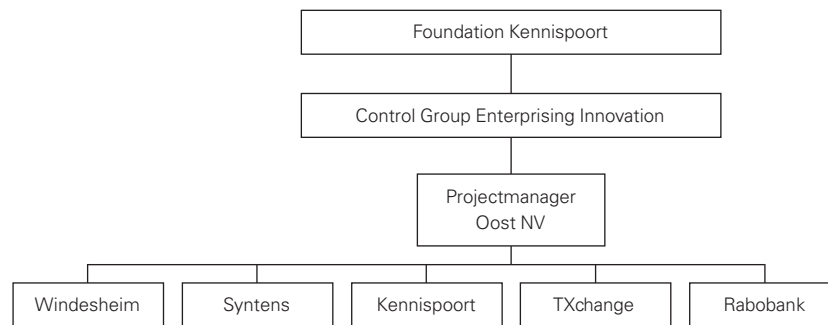
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Figure 1: organization of Enterprising Innovation Project

to get them interested in participation. These meetings take place on a half year basis. After an Enterprise's consent to participate, Oost nv interviews the responsible managers. Based on these interviews the enterprises are grouped to participate in the so-called acceleration-chamber of tx Change. This is a lab at the Twente University of Technology, equipped with state of the art tools for the support of brainstorms, visualization and simulation. Each acceleration-chamber consists of 15 entrepreneurs from mixed sectors and locations. The mix is on purpose to enhance interaction between people that have never met before the project. In turn that will increase the creativity and out of the box thinking. The result of the session at tx Change is a group of on average five entrepreneurs, that have gathered around a certain subject or theme (e.g. healthcare, security or environment).

Meanwhile at Windesheim, groups of Bachelor students are made. The students participate in an elective semester called Enterprising Innovation. It is a co-operation between the Schools of Engineering & Design, Management & Law and Business & Economics. The students involved each study at one of these schools and are mixed into groups of on average four students.

Together with the entrepreneurs they form Clusters, that will work on the creation of innovative products or services for one semester. During this semester the students will be coached by one of the Windesheim teachers. The whole cluster will be coached by a consultant from Syntens. This is a semi-governmental network with the purpose of stimulating innovation at Dutch Small and Medium Enterprises. The result of this five months of intense co-operation and interaction is one or two Mini New Business Cases. These mnbc's describe the innovation, as well as its technical, financial and commercial feasibility. The innovation delivered can be a product, a service or even a more efficient way of organization. Due to the multi-disciplinary character of both the student group and the group of entrepreneurs a flow and interchange of ideas, knowledge and

insights is created. This pushes the innovative force to a higher level, resulting in solutions that the participants could never have achieved alone. The structure of the project with its participants is shown in Figure 1.

Already during the process of research the project-coaches try to find links to possible subsidies for funding eventual innovation. Although the project Enterprising Innovation stops after half a year, when there is concrete Mini New Business Case or even a sort of prototype, Kennispoort still aims to support the participating entrepreneurs in finding the right subsidies and government funding to realize the product or service developed. Next to that Windesheim provides possibilities for further actual development of the innovation as a student project, internship or graduation project. Either way, the goal is to make sure that the project does not stop at the mere idea, but to make sure that the entrepreneurs will actually implement the innovation in the end.

Execution

Most smes that develop their own products or services, focus on the actual development and implementation of spontaneous, great ideas from management or staff. If you look at the stage-gate model for innovation (figure 2), you will find that these activities take place in the 3rd stage and beyond. Practice learns that the stages before stage 3 are the most challenging. That is where the actual innovation starts. That part is also the most difficult phase for most smes. Imagine management realizing that a new product needs to be developed to avoid future loss, but being clueless as to what kind of product this should be.

This is where the Enterprising Innovation project steps in: at the fuzzy front end. The whole set-up aims to help teams of enterprises form various backgrounds to innovate together. The idea is not just to create new ideas, but to create ideas that will actually generate turnover end consequently secure the future of the participating smes. The role of the student groups in this pro-
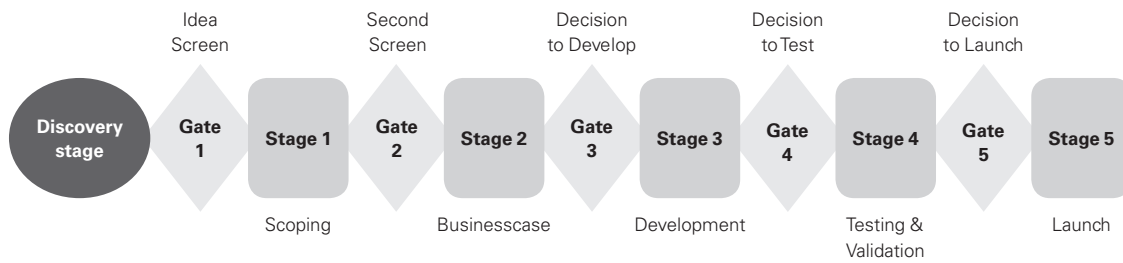
Figure 2: stage-gate model for innovation by Cooper, indicating product development phase (Van Wulfen, 2011)
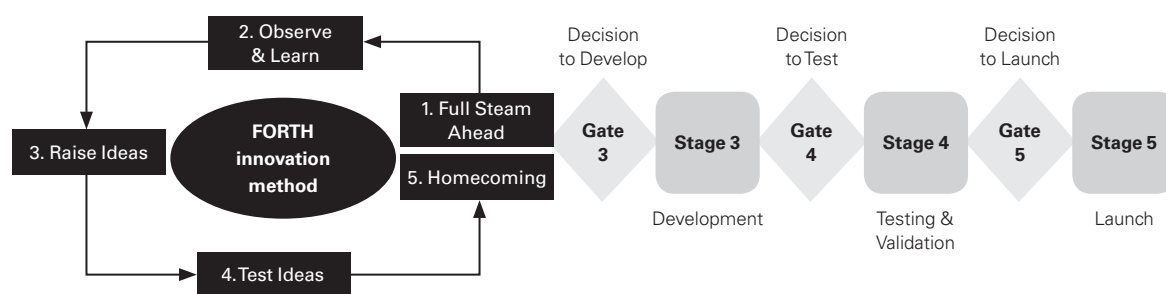

Figure 3: stage-gate model for innovation, indicating FORTH innovation method (Van Wulfen, 2011)

cess is very large and important. They do a substantial part of the actual work. Also they are responsible for guiding the process of innovation. As such, they provide fresh insights as well as a methodology that they learn during this project. This approach is both refreshing and instructive for the entrepreneurs.

Communication is a vital aspect of the process. Officially the entrepreneurs and student teams meet every 3 to 4 weeks to exchange ideas, opinions and to report progress. In practice the contacts are far more frequent than that. The students are encouraged to involve the entrepreneurs in the process, even in an operational sense. This way, the entrepreneurs' commitment is increased by far. In addition to that, documents are kept in a web-based storage, such as Dropbox, to provide continuous accessibility for all participants.

To support the students in the process, they get extra classes to deepen their knowledge in the areas of management, marketing and engineering & design. These classes run parallel to the phases in the process where the separate subjects are most needed. Besides this, the students organize masterclasses on subjects of interest to the entrepreneurs, related to innovation in general. The masterclasses are also a network gathering for all project participants

Methodology

To give structure to the process of innovation, the students work according to the FORTH innovation method. This methodology was developed by Gijs van Wulfen, a Dutch consultant for innovation. He developed his method over many years of experience in the already mentioned Fuzzy Front End. In his book "Creating Innovative Products and Services", which has recently become available in English as well, he describes a successful method for innovation. Figure 3 shows the FORTH innovation method as it is positioned in Cooper's stage-gate model. As can be seen, the method takes you through 5 phases, which in total take 20 weeks to complete. Since the FORTH innovation method was originally not meant for open innovation, i.e. innovation with multiple enterprises, our students take the general steps of the process. The result is that the book by Van Wulfen is used as a guide, but not all steps are strictly followed. A short description of the process, as our students go through it, will be described, with kind courtesy of Gijs van Wulfen.

In Van Wulfen's (2011) vision, innovation can be seen as a journey. The FORTH method is a journey in five stages:

- Full Steam Ahead
- Observe and Learn
- Raise Ideas

• Test Ideas
• Homecoming

The different phases of the process take you to different "Islands" and as such, innovation can be an exciting and enjoyable experience, like an adventure. Figure 4 shows a visualization of the FORTH journey. Each part of the journey takes a certain, limited amount of time. Limiting time is one of the big advantages in this methodology. By strictly keeping to a time schedule, Van Wulfen forces the innovating team to make decisions and thus avoid getting stuck in one phase endlessly (which is often the case in innovation processes)
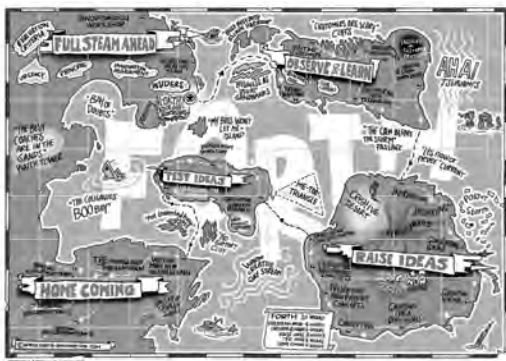

Figure 4: "map" of FORTH innovation method (Van Wulfen, 2011)

1. Full Steam Ahead

The first phase of the FORTH innovation method, called Full Steam Ahead, takes approximately 5 weeks. At this time four very important decisions are made:

• What is the innovation assignment?
• Who is the internal client?
• Who would make the ideal ideation team?
• Which opportunities are chosen to be explored?

As already explained, the project starts by making clusters of several entrepreneurs and groups of students. The latter are carefully formed. Two aspects are important: multidisciplinarity and optimal team composition. To get multidisciplinary teams of students, each team has at least one student from each participating School (Engineering & Design, Business & Economics, Management & Law). As for the team composition, the introduction of the semester is used to form each team with optimal use of each student's capacity and competences. This is based on several tests, such as Belbin.

The next step is to have students and entrepreneurs develop the Innovation Assignment. This is a statement of a few sentences, that clearly gives direction and focus to the rest of the innovation process.

Thirdly, with the help of pre-analysis and some creative techniques, the possible innovation opportunities for the ideation team are determined. Innovation op-

portunities can be seen as a direction or area that gives interesting starting points for creating possible innovation. This can be for example a trend, an emerging market or even a social development. This is done very practically by asking questions. Where are the greatest opportunities with regards to the innovation assignment? Which potential customer groups are we going to visit? Which customer groups, experts, organizations or companies will be a significant source of inspiration? How are we going to approach them? The answers to all these questions are the basis for the second phase of the FORTH innovation method.

2. Observe and learn

The essence of phase 2 is to start viewing things differently, to detach from existing thought patterns about the market, and to gain new and fresh impressions. The team members each explore a different innovation opportunity and start to discover the market and the target group. They link their progress to each other and to the extended team. During this stage a new and renewed learning process is developed in three ways:

• Which trends and technology can we take advantage of?
• Who is the customer and what frictions are they struggling with?
• Which innovation opportunities offer promising perspectives?

Both entrepreneurs and students enable themselves to get good insights into market opportunities, trends and developments that give possibilities for new products or services. Talking with experts and visiting inspiration sessions (seminars, exhibitions, etc.) enhance these insights.

The result of this phase is possible reduction of the number of innovation opportunities, as well as customer insight and a clear view on customer frictions. The latter will need to be solved by the innovative products or services that will be developed in the entire process. The whole phase of Observe and Learn takes a sizeable 6 weeks.

3. Raise Ideas

During this third phase, which takes 2 weeks, the main creativity in all of the FORTH innovation method takes place. The Raise Ideas phase consists of 2 main parts:

• Creating ideas in creativity sessions
• Developing viable ideas into product concepts

The creativity sessions is where the new product ideas are actually prepared are well prepared. Van Wulfen suggests several creativity techniques, from which the

students choose two or more. Both students and entrepreneurs, as well as possible outsiders, participate in the creativity sessions. This broadens the range of ideas through multiple insight.

From the numerous ideas that come out of these sessions, about 12 are chosen, based on the information and knowledge gained in the previous phase. These product concepts are then further developed during the concept development. The product concepts are described in a strictly defined format, making the concepts explicit and testable.

The acquired customer frictions, the involvement of outsiders and an effective creative process are all part of the third stage. It is the creative peak of the journey.

4. Test Ideas

How attractive are the new product concepts and how unique are they really? It is a very relevant question and that is why it is good to reflect on the developed concept. This 4th phase of the innovation method takes 3 weeks and its main goal is to select the product concepts that really stand a chance to become successful innovations. I general about 3 to 5 product concepts are taken to the next and last phase of the innovation process.

The Test Ideas phase can be divided into 2 parts. Firstly, the team performs qualitative research to check the concept's viability. The team will go back to the sources they have consulted in the Observe and Learn phase. This can include interviewing customers or organizing customer focus groups. The concepts can also be checked by experts. the team will answer the question if the product concepts solves the customer frictions, discovered in the second phase of the FORTH innovation method.

Secondly, part of the 3 weeks is used to improve the product concepts by adjusting negative aspects. The qualitative research will definitely give suggestions for improvement, apart from an indication of the viability of the concept. These suggestions can be incorporated in the concept. Also, the team might organize one or more improvement session. During these sessions the team will brainstorm on more possible improvements to the product concepts.

5. Homecoming

In the final stage of the FORTH innovation method, which takes the last 4 weeks of the whole project, the team will return "home" with tested product concepts, which can be presented to the participating entrepreneurs. Because the group of students and the cluster of entrepreneurs have worked together throughout the innovation process, the new product or service concepts will have support to be further developed.

During this phase the new product concepts are further developed by applying the criteria regarding turn-over, profit, feasibility and whether it fits into the organizational strategy. The product concepts are written down and presented as Mini New Business Cases: a clear, commercial, professional and financial base for new initiatives or new investments. Mini, because in this phase it is still only developed on the surface. New, to distinguish it is a business case regarding a new concept rather than, for example, an investment. The advantage of drafting mini new business cases is that the team becomes aware of the fact that not only creative aspects, but also commercial, professional and financial aspects contribute to the decision to include the new concepts in the innovation process. In addition, it increases the power of persuasion because the attractiveness of the concept is based on strategic, commercial, professional and financial indicators. The students will present 1 or 2 Mini New Business Cases to the entrepreneurs.

The Mini New Business Cases also give an indication of the effort needed to actually develop the product or service created during the whole process. It is the starting point for the actual development of the idea into a physical product or service. In fact you might say that the FORTH innovation method ends with a clear assignment for a product development team. For this purpose a new team will be formed. Van Wulfen stresses the importance of a well –organized transfer of knowledge, experience and possibly even participants to this next step in the chain of development.

Results

At this moment two semesters of the Enterprising Innovation project have passed and the third semester is running. During the first two semesters 9 clusters of entrepreneurs have participated, as well as 9 student teams. The results vary. Some resulting product concepts in the shape of Mini New Business Cases are:

- an interactive cable-television self-help applications system for elderly people
- an energy-scan for SMEs linked to a web-community for the exchange of experiences
- a bicycle parking system
- a business model for the training and work-placement of people that have autistic personality disorder

One project, not mentioned above, has resulted in a patent research, because the product concept was really innovative. Others have still not been taken to the next phase of development. The difficulty for the participating entrepreneurs is to pick up where the project ends and continue the development of the product or service created during the project. One of the solutions to do this, is to involve different groups of students from specialized courses to run further development of the concept

as a new project. Another is to have the project run by means of a graduation project or internship. In the end Windesheim and in fact the whole Enterprising Innovation Project has the objective to establish a continuity of innovation through long-term co-operation between the entrepreneurs and the educational institute.

Nonetheless, one can say that the outcome of all teams is refreshing, surprising and in its own way innovative. To illustrate this, a special cluster will be discussed. One cluster of entrepreneurs has put two different assignments to two different student teams. Both results were innovative, yet far apart.

Cluster Experience

The cluster of entrepreneurs consisted of three participants. The first is Kaldi, a franchisor, selling the experience of drinking good coffee and tea. The second is IVM, which provides training for first aid officials. The third entrepreneur is a franchisee of the Welkoop chain. Welkoop sells all kind of products for agricultural and gardening purposes.

All three entrepreneurs were struggling with the communication of experience, internally from management to employee or franchisee, externally from management to the customer. In other words, how can you make your customer experience your products or services at a higher level and how can you make your employees or franchisees provide this experience in the way you (management) have intended it.

Two groups of students were linked to this cluster. One would focus on the internal communication of experience, the other on the external communication. The resulting innovations are stunningly different, which is why these examples are shown here. The group that worked on the internal communication of experience came up with a very innovative communication model and script. The "external" group delivered an Augmented Reality concept to let customers experience the products and services of the entrepreneurs, rather than merely seeing and using them.

Cluster Experience Internally

Company management often has good ideas about the kind of image and experience the company should transfer to its customers. However, ever so often the employees or (as in the case of Kaldi) franchisees are not able to translate this experience in their direct communication with the client. Together with the entrepreneurs, the students took on the assignment to find a way to let management's ideas about image and experience flow through the employees and franchisees directly to the customer. The main problem was to get employees and franchisees involved and actively committed to the ideas. Instead of searching for a product to solve this friction, the students searched in a more organizational direction. They soon discovered that the problems

lies in communication skills rather than the message itself or the means by which it is communicated. The students stated that in order to create experience within an organization, one would have to change the way employees think. After intensive research and creative sessions they described a model for internal communication, based on the mantra "Tell me, I forget; Show me, I remember; Involve me, I understand" (TSI).

The basis for the model is understanding that there are different types of employees. They explained this with the so-called TSI-matrix, which is shown in figure 5.
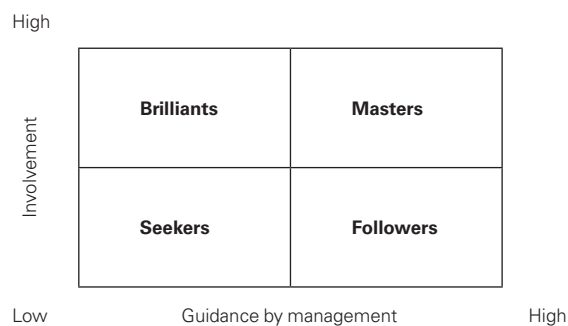
Figure 5: TSI-matrix

The four quadrants in the TSI-matrix represent four types of employee or franchisee. Each one has his own characteristics, habits and needs. To determine which type fits a certain employee, the students created a measurement tool, based on 10 characteristics.

The next step was the creation of an organizational typology, indicating what kind of attitude management should have, based on the types of employees from the TSI-matrix. This is shown in figure 6. The typology shows that each type of employee or franchisee requires a different type of communication from management.
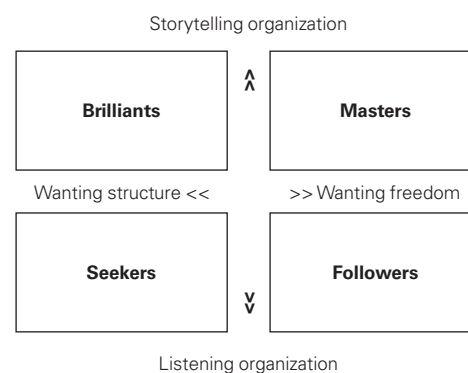
Figure 6: organizational typology, based on TSI-matrix

The first two steps of characterising the people in the organization and determining which kind of communication to practice are necessary prerequisites to be able to involve them in management's plans. In order to do this, status quo has to be determined, as well as

the intended direction and the way to get there. Finally, the students designed 5 involvement-strategies that enable management to transfer ideas, image and experience throughout the organization:

1. Shifting paradigm
2. Encouragement of participation
3. Transfer aspiration as a vision of the future
4. Telling the story
5. Generate focus and a sense of urgency

Feedback from human resource management specialists proved the model created during this project to be very innovative in its kind. For the entrepreneurs involved, the method of distinguishing different types of employees and franchisees was a regular eye-opener. At this moment IVM, one of the three companies involved in the project, is taking serious steps to implement the model. This will very likely become a Bachelor project for students in the School of Management & Law at Windesheim.

Cluster Experience Externally

All three companies involved in the project strive to not just sell a product or service. Kaldi wants to sell the experience of drinking special coffee or tea, rather than mere beverage. It wants customers to feel part of the Kaldi family and to be willing to show that. In a way, the same counts for Welkoop. This organization wants to give its customers the feeling of living outdoors and being close to nature. Finally, IVM would like to give its customers more than just a plain course in emergency aid. The company would like its customers to get more involved in the courses and experience them more realistically. All three entrepreneurs also wanted to get information from the customers about the way they experience the brand, products and services of their company.

The group of students faced the challenge of creating a way of interactively transferring experience directly from the companies to their customers. They started by doing research on what experience is and what is it does to customers. Intensive interviewing of customers was an important part of this research. An important result was the kind of information customers wanted to get the feeling of experiencing the company's products. In the case of Kaldi, it was more information on taste and preparation. In the case of Welkoop, customers merely wanted basic information and a way to find the products they wanted. Finally, in the case of IVM, customers wanted a more realistic way for the first aid training to be given.

Contrary to the previous group, these students looked for actual products and services to solve the customer friction they found. They came up with several Augmented Reality (AR) solutions. Because the three companies were so very different from each other, they created three tailor-made solutions, one for each entrepreneur. Each solution incorporates the possibility for customers to give the company feedback about the Augmented Reality application as well as the experience they have or would like to have.

For Welkoop they created an Augmented Reality guide through the Welkoop shops. By means of a smartphone, customers can find their way through the shop, getting relevant information on products (what they are or where to find them) as they go along.

In the case of Kaldi, the students suggested to put AR-codes on products, making it possible for customers to get real-time information, including visual material on production, consistency and preparation of the product checked. During the project, Kaldi was already preparing iPad applications for the Kaldi shops. The ideas of the students group would take this development a step further to individual customer smartphones.

Finally, the students created the most advanced AR-solution for IVM. They suggested AR-spectacles for course participants. These spectacles visualise the emergency situation to be trained as an augmented layer on top of the actual training reality. The implementation of this solution will still need a lot of development and is not likely to be taken up on short notice.

The solutions generated by the students are not extremely new or innovating. However, to the entrepreneurs involved, they were state of the art high tech innovations. The fact that they brought relatively new technology into the project created extra added value for the entrepreneurs. This way, one very important target of the Enterprising Innovation Project, being transfer of knowledge, was established. During the project, the students really got themselves well-informed about the technology that makes augmented reality possible. This resulted in an AR Christmas-card , sent to the entrepreneurs, as well as a fully operational AR-demo during the presentation of the Mini New Business Case at the end of the project.

Conclusions

After more than one year of running the Enterprising Innovation program, one can say that it is a successful project. Even though not all the ideas created have lead to implementation and actual increase of turn-over, the learning experience for both students and entrepreneurs has been tremendous. The students have been able to take part in the really difficult fuzzy front end of innovation, while working with actual companies that have actual problems to be solved. The entrepreneurs have gained experience in multidisciplinary methodical innovation. Also, in most cases they got access to new and interesting technologies and organizational issues, as well as a number of very surprising and unexpected solutions. Over a year of experience also resulted in some points of improvement for the project:

- The selection of companies and the grouping is an issue to be taken into account. Some of the clusters contained only two entrepreneurs, which is a small number for open innovation. The project would lack the benefit of interaction. On the other hand there was also a cluster of 7 entrepreneurs. This group size is far too big. Differences of opinion and interest can obstruct decision making and delay the process too much.
- The starting point of the project should not be a clear idea, that merely has to be developed. This was the case with some of the entrepreneurs that participated. In fact this would be the outcome of the open innovation process. The start of the project is far more open and vague than that. This issue is taken up in the acquisition of new participants for the project.
- The differences between the various clusters have risen questions about the applicability of the methodology used. In some projects, the coaches from Windesheim as well as the Syntens consultants have doubted if the FORTH Innovation Method is the most appropriate method for the specific cluster and the specific problems faced. For the coming projects, other methods of innovation may be considered besides FORTH. One idea is to provide the students with knowledge on three or four methods (FORTH included) and to have them choose the appropriate approach within their specific cluster.

Michael Taks

Karien Dommerholt

Presenter:
Lecturer, School of Engineering & Design,
Windesheim University of Applied Science
The Netherlands, acjm.taks@windesheim.nl

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Panel 5
Social Collaborative Projects

Apinya Limpaiboon

Social Collaborative Design: Creating Knowledge base in Sustainable Development

Review of Social Involvement in Design and Planning

Nowadays, Sustainable development is a critical issue, which most countries, including Thailand, are trying to conduct their growth towards, on their own context and agenda. To achieve the sustainable development, three integral issues which are environment, economic and social must be accessed and developed together in balance. Although social collaboration is one of the key successes in balancing the system, it is the most difficult task for any sustainable society to overcome. Social collaboration could be proceeded by different means during different development stages. The ultimate goal for sustainability is to include social collaboration in every possible step it takes.

The degree of social involvement, commitment and responsibility (participation degree), refer to eight ladders of participation in planning (Arnstein, 1969), which are, partnership, delegated power, citizen power, informing, consultation, placation, therapy and manipulation. However, the ladder of participation are ordered more upon the power of citizen in decision making, not upon collaborative degree from the most to the least collaborative. In *"Theory and practice of Transformational Collaboration"*, Himmelman (1996) had defined the word "Collaboration" as "exchanging information, altering activities, sharing resources, and enhancing the capacity of another for mutual benefit to achieve a common purpose". He further recommended that partner, rather than collaborator, is a better way to describe participants. However, it has been remarked that the full model of collaboration is very complex. This project defines collaboration (which means "working together" in its Latin root), as a strategically process with participants degree is set to be in the form of partnership (working
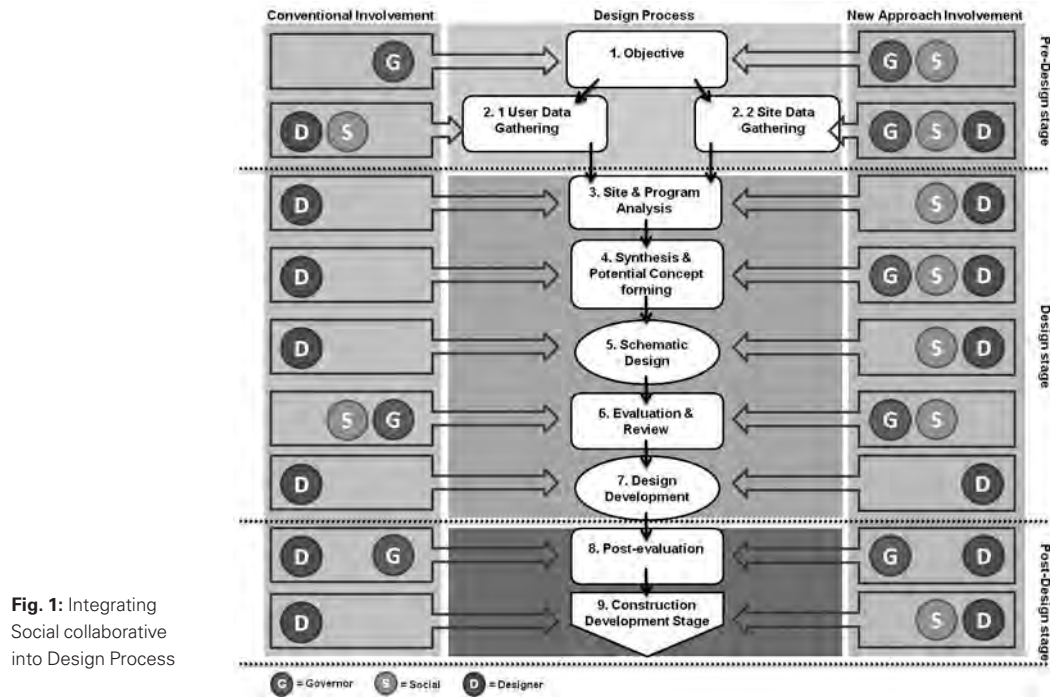
Fig. 1: Integrating Social collaborative into Design Process

side-by-side) and/or consultation (sharing, discussing ideas, information) in the collaborative process.

From basic workflow of design process (Fig.1: Integrating Social-collaborative into Design Process), there are 7 steps from objective setting, data gathering, analysis, concept forming, schematic design, evaluation, and design development. Step 1–2 can be called pre-design stage, step 3–7 called design stage, step 8–9 called post-design stage. In Thailand, there has been a continuous attempt to involve social factor in a process of design, but mostly on data gathering stage. Designers/planners use social interaction techniques, such as interview, observation, questionnaire, casual talking, and/or public meeting to involve communities in pre-design or pre-planning stage. Some projects with their nature relevant strongly with social context (such as urban planning project) might be forced to extend their social involvement to the design stage, but mostly only in the model of Public hearing and Public reviewers to get feedback from communities. In planning, since 1996, people participation in government project has been enforced by Administrative Procedure Act in some degrees. At present, direct participation is included in the pre-planning stage with the Public meeting/explanation, questionnaires, News announcement techniques, and in the planning stage with the Public hearings and Public review techniques (Pimonsatean, 2004). Still, the roles of stakeholders in practice of most projects are information provider, requirement setter and/or reviewer as they are directly affected by the design. This could be understood as "social as user and/or client" in the de-

sign process. This project further demonstrates a model of "social as design generator" which involve social collaboration in every stage of design process. Therefore, the complete cycle of sustainable process from decision making (planning), installation, renovation and maintenance is under the monitoring and responsibility of the communities.

The main objective of this project is to construct an understanding in design for students and teachers of MNY as a tool for initiating sustainable development of the school's physical development plan. Through Collaborative Design (Co-Design) approach, the school is expected not only to be able to utilize the existing valuable resources, but also properly compose new landuse to serve new requirements for upcoming future.

The Project Background

Mattayom Praratchatan Nayoa School (MNY), a private school located only 200 kilometres from Bangkok, was classified as an underdeveloped rural school. The school was established in 1997 to serve as a high school for under-privileged students in the rural area of Chachoengsao province under the financial support from HRH Mahajakri Sirindhorn. With a collaborative partnership of MNY, King Mongkut's University of Technology Thonburi (KMUTT), and National Center for Genetic Engineering and Biotechnology (BIOTEC), the school has developed an integrated resource development curriculum in science and technology and other subjects, following the directive to strengthen its educational quality using sufficient economy despite limitations. The school

has a total land area of 240 rais (94.8.acres), composing of existing academic buildings, mechanical shops, accommodations and green areas of forest, rice field and fish ponds. When the master plan development project started last year, the school was in a developing stage with a need for new buildings and other facilities to support its growth. The direction of growth was then taken into consideration with a concern of what and how it should be.

Since 2004, the school and community have practiced on the basis of Sufficient Economy (SE), which has been accepted as an appropriate medium towards sustainable development for Thais. Sufficiency Economy is a philosophy that stresses the middle path as an overriding principle for appropriate conduct by the populace at all levels[1] (NESDB, 2007). It has been bestowed by His Majesty the King Bhumibol as a guidance for Thais to balance their way of life. It represents the realistic idea of moderation ranges from the ground up. It also enlightens the wisdom and guideline for all Thai people from the toughest time of economy downturn through recovery. It does not deny the globalization or capitalism which driving world economy but respects interdependence among people and nature. Its basic concept stresses on the use of knowledge wisely due to circumstances and consideration. Its core values include integrity, diligence, harmlessness and sharing. Finally, its ultimate goal is seeking to achieve balance and sustainability. Sompit Moi Fusakul and Praoranuj Siridej (2010) have seen Sufficiency Economy Philosophy (SEP) as an alternative approach to sustainability, but remarked that "nevertheless, applying SEP approach in design sector is still relatively under developed". How-

ever, to develop its physical growth accordingly, the concept of SE, the essential elements to sustainability, as well as the school components must be reviewed in order to evaluate the potential growth properly.

Four basic requirements to achieve sustainability without poverty in developed community are:
- Improve and promote knowledge and understanding (knowledge Base)
- Improve marketing strategy and increase production and cash income (Economic base)
- Pursue concerned citizens to participate in any stage of development process (Community base)
- Support local and national policy by good governance (policy base)

The important of "knowledge and understanding (wisdom)" is not only mentioned in sustainability, but also in Sufficiency Economy Implementation as one in two key conditions of success (Siridej & Fusakul, 2010). It is also stated that Sufficiency Economy requires breath and thoroughness in planning, and carefulness in applying knowledge and in implementation of those plans.

The project, were the quest of MNY School to lay out its master plan for building-area expansion and landscape development. The sustainable development of the school as well as community had been discussed to see the possibility and to set the strategy to achieve. Regarding to the MNY School and community components towards sustainable development, we reviewed the relationship of three key integral issues –– environment and natural resources, policy and social aspects. A list of its strength, weakness and potential has brought into discussion. The result implies opportunities or constraints in Collaborative design (Co-Design).

Strength,
1. Participants have basic understanding in sufficient economy and sustainability.
2. Encouraging of participation of all level is the main policy to develop the school.
3. There are strong relationship and interdependency between school and community.

Weakness,
1. Stakeholders have less participation in level of decision making or suggestion due to culture and social status in Asian society.
2. Not every stakeholder is aware of the beneficial of preservation and reforestation, although the school policy is to preserving the forest area to 60% of its total area.
3. Decision making of development guideline comes from administrators; the lack of participation from every party might cause the main failure of sustainable development.

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1 Sufficiency Economy is a philosophy that stresses the middle path as an overriding principle for appropriate conduct by the populace at all levels. This applies to conduct starting from the level of the families, communities, as well as the level of nation in development and administration so as to modernize in line with the forces of globalization. "Sufficiency" means moderation, reasonableness, and the need of self-immunity for sufficient protection from impact arising from internal and external changes. To achieve this, an application of knowledge with due consideration and prudence is essential. In particular great care is needed in the utilization of theories and methodologies for planning and implementation in every step. At the same time, it is essential to strengthen the moral fibre of the nation, so that everyone, particularly public officials, academics, businessmen at all levels, adheres first and foremost to the principles of honesty and integrity. In addition, a way of life based on patience, perseverance, diligence, wisdom and prudence is indispensable to create balance and be able to cope appropriately with critical challenges arising from extensive and rapid socioeconomic, environmental, and cultural changes in the world.[5], Sufficiency Economy Implications and Applications by Sufficiency Economy Movement Sub-committee

Potential,

1. Even though the lack of academic knowledge and professional practice, school and community have high ability to initiate and implement many projects by their own.
2. Ratio of developed area is still low, preventing the conflict of land use, while vast area is still available for future expansion. However the appropriate zoning and site capacity for the next phase of development must be aware.

As the school has developed its education through collaborative partnership with various institutions in many subjects, we saw an opportunity to set up the strategy in designing the school's physical development plan through education, by the collaborative design (Co-Design) between KMUTT, MNY communities, educators and design professionals. This strategy will strengthen Knowledge Base and Community Base as it initiates community's sustainability in learning which leads to lifelong learning and self-dependence in long run. The model of Co-Design activity would allow all stakeholders, who are MNY administrative, students, teachers to be involved, and thus will build their understanding in design for sustainable development of their school.

Knowledge Aspects for the project,

1. Acquire board knowledge in sustainable development
2. Provide knowledge and analytical thinking in physical aspect and site capacity such as opportunities and constraints, pros and cons
3. Provide understanding in decision making process for stakeholders in community
4. Develop student's intellectual, creative and imaginative capacity according to landscape architectural education.

Objectives of the Collaborative Design (Co-Design)

- To provide opportunities for administrators, teachers and head of students to study, participate and practice in sustainable landscape design and spatial/program management which can be applied for other areas/cases
- To develop an understanding in essential elements of sustainable development appropriated to their own community contexts which are resources and environment, macro economics, and community's identity
- To promote the importance of appreciation and awareness in the value of environment and hometown to the participants
- To demonstrate landscape design education for prospect students on how to apply those knowledge to their hometown

- To provide opportunities for students to develop and understanding of the professional practice of architectural design based on sufficient economy theory and to be aware of the influence of 3 essential elements in sustainability development.
- To expand an ability of the students to engage/collaborate with 3 different parties which are local people as stakeholder, students in different field of study and expertise.
- To offer social contribution's opportunity for professionals
- To promote the importance and awareness of an involvement of social in design process

Model of setting Co-Design activity

According to the Public Participation Manual (Siroros, 2003), many different techniques are recommended to apply in three different patterns of participation: Informing, Hearing and, Discussing. The selected technique to initiate discussing and consulting pattern in Co-Design is Training Workshop.

The Co-Design activity of the project was set up through a basic circle model. It was a continuing sequence of stages in circular flow, starting from Review and Analysis of resources and contexts to set collaborative Learning/Working model. This model defined framework of activity as well as collaborative parties and their roles. Then, the activity stage, collaborative parties were learning by doing, they worked side-by-side to propose the ideas. The Outcome was production (result) that was produced in an activity stage. Then, both result and activity were marked the strength and weakness in Evaluation and Refine stage. Consequently, some production may need refinement by a more skillful professional. Finally, the Review and Analysis of the whole process were conducted, which was a starting stage for the next task.

The Co-Design knowledge base process is based on the idea of "Learning by Doing". It will be conducted through workshops with the style of "PLAN without plan", it means that outline of objectives, working process, and target groups is carefully defined and set, but there won't be rigid schedule or activities for workshop. Along the process, the activity is evaluated from times to times and the schedule or activities will be conducted accordingly by moderator (or consulting team). The knowledge contents will then be inserted into each stage by brief lecture, comments and conclusion of the activity they have done. So the working model is flexible enough for different group of participants and it will be designed according to their potential, commitment and contribution.
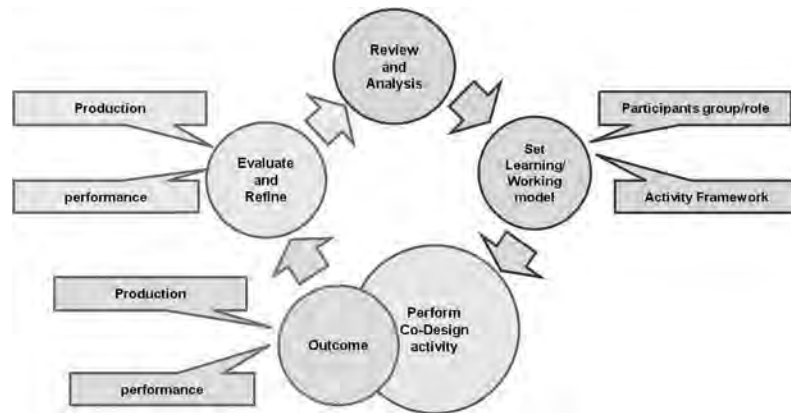
Fig. 2: Model of setting Co-Design activity

Creating Knowledge Base by Co-Design

For MNY School, we set 3 phases of workshop (WS1, WS2, and WS3) with an intention to involve social participation into every stage of the Design process. The theme of Co-Design workshops is called FUN-FIND-FOCUS to avoid using various Design technical terms in communicating with school community. MNY, KMUTT and BIO-TEC, first carefully discussed and set target groups of participants. During the activities, participants' capability, involvement and commitment were observed. After each phase, participants' performance was evaluated in order to plan the detailed schedule and components of the following phase.

WS1 "FUN": The purpose of first workshop was to give basic knowledge in Landscape Design to participants, so they would have some background before design phase in WS2 with Landscape architecture students (LA students). Consulting team was composed of 5 lecturers (experts) in planning, design, architecture, social study, resource management. They played various roles during the activities as lecturer, visitor, moderator, consult or conductor. Community participants are composed of 3 groups of stake holders, 25 MNY students in high school level who live in a village, 5 MNY teachers and school president.

The FUN activity started with brief lecture from KMUTT to MNY communities about definition in design and some basic information about site plan data and investigation techniques, such as scale, map, direction, plan etc, Then the knowledge and practice would be achieved through play + learn exercises such as site survey, brain storming, mind mapping, and informal discussing. Finally, they had produced a zoning map by their own sketch, together they named the zone from voting for most preferable name. It implied that they started to propose the concept and program for each zone.

WS2 "FIND": The second workshop, by working alongside with LA students, they will depict their vision on to paper. It was the demonstration of how to design sys-tematically from analysis to final production. Consulting team was composed of lecturers from 5 institutions in design with collaboration of 3 experts from Thai Association of Landscape Architects (TALA). They would be advisors and critiques during the analysis and design activities. Academic participants were 50 LA students from 5 institutions who would work alongside with MNY students to purpose the Landscape Master Plan. Community participants are composed of 25 MNY students, 5 MNY teachers and MNY president; most of them continued their tasks from WS1.

The FIND activity started from a brief background of the site and philosophy of the school by school president. MNY students presented about what had been done in last workshop (WS1), their dream school and the outcome production, which was the sketch zoning plan from their discussion. Then LA students showed the zoning map in 1:2000 and 1:500 scale which they had prepared by CADD from MNY sketch, so it was the first time MNY saw their work in technical drawing map. After that they were separated in 8 groups to work on design, starting from site analysis, site selection, conceptual design and proposed landscape development design of the area they picked. Each group were composed of MNY students, teacher and landscape students from 2 institutions or more. MNY president, lecturers and experts would give comments and critic their work in each stage. Each member in a group had to present the work and how they involved.

WS3 "FOCUS": The last workshop is planned to be detail design and installation stage. MNY communities will build the selected area from their design with the help of professionals and contractors. The purpose is to focus their knowledge in refining detailed design and construction, so they will be trained some skills in maintenance.

The FOCUS activity is now on process of setting private sector collaboration both in terms of funding and professional supporting.

Fig. 3: WS1 FUN Collaborative activities, **Fig. 4:** WS2 FIND Collaborative activities

Outcome and Discussion

WS 1 "FUN": FUN IN KNOWING, ADDRESSING, IMAGING

We have to ask which kind of knowledge is needed to address their identity, their values, and what could encourage them to think about their needs and their dreams and how they can achieve them. The other results we should have from WS1 are we should be able to estimate the participant's commitment, their learning potential and their abilities in design.

1) COMPONENTS

The components in WS1 were defined to assure that three issues of sustainability were involved. Preserved forest, agriculture field, and local way of living represented resources (environmental issue). Students and teachers represented user and community (social issue) and school president represented policy, philosophy, and financial resource (economic issue).

2) COLLABORATION ACTIVITIES

Participants had a chance to practice their observation and thought about their identity, their like and dislike through "FUN" activities as followed;

"*Meet your new friends*" introduce brief knowledge and definition of site design and master plan to them.

"*Show me your school and village*" let the students and teachers investigate and observe school environment in details and be able to explain to others.

"*Why I like here most*" is the practice of analysis and synthesis,

"*impossible dream?*" allowed the students to dream further from existing context and express through their mind-map,

"*Storm your brain*" is the brain storming session to practice opinion expression,

"*What we will name it*". Allowed them to create concept, and give zoning fit to site on to the map.

3) REVIEW AND DISCUSSION

In the WS1, the intention of social collaboration model between KMUTT and NMY community was more likely to be coaching system than partnership. The important thing was that they were encouraged to express their thought and speak out their opinion. The role of collaboration parties would take turn from teacher to learner and vice versa in different activates. The school had an opportunity to be a host, a tour guide who knows more than visitors. This would help to create sense of belonging and pride of local identity.

Compare to critical thinking of design process, WS1 is data gathering, site investigate; program forming, and conceptual design. In addition, we had to insert knowledge background about what was the purpose and definition of Site Design to the participants in between each activity.

The production outcome showed that even though the students were able to understand the site condition and able to propose land use zoning, their graphic communication was limited by lacking of drawing skill. Therefore this minor obstacle was assisted by LA student who reproduced their sketches to AUTOCAD later on.

WS2 "FIND": FIND PROBLEMS, NEEDS AND SOLUTIONS

We have to ask which kind of knowledge is needed to **put vision into drawing,** and how they can achieve it.

1) COMPONENTS

Again, the components' role in WS2 was defined to assure that three issues of sustainability were involved. Natural and agricultural land represented resources and value role in development (environmental issue). School students represented owners and design driven (social issue) in designing Master Plan. School president and teachers represented supporter in management and budget in investment and operating plan (economic issue).
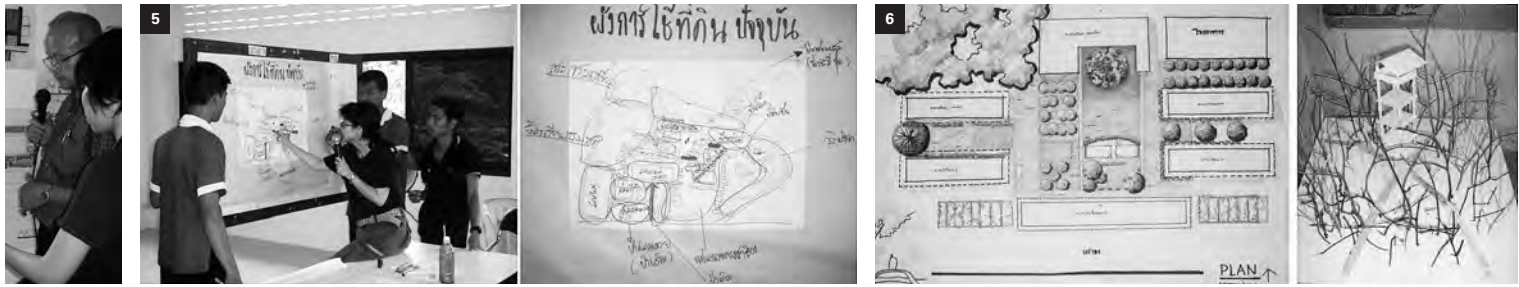
Fig. 5: WS1 Outcome, **Fig. 6:** WS2 Outcome

2) COLLABORATION ACTIVITIES

To demonstrate the working process in design and to exchange ideas + skill in team working (creative thinking) with stakeholders. The MNY community was lead step by step through the design process. In this stage, more technical terms in design and planning such as analysis, concept, Zoning map, harmony and contrast, landmark etc., were introduced to educate MNY participants in design. Participants had a chance to practice on group working, sharing ideas and exchanging knowledge through the "FIND" activities as followed;

"Find what are good and bad points" was the exercise of analysis and group discussion to identify problems and opportunities.

"What do we want to do/what we can do" was the practice of group discussion about site selection and concept

"Present your ideas" allowed participants from all levels to talk about their idea.

"Show me your design" allowed only students to propose their solutions while teachers and experts became critics.

3) REVIEW AND DISCUSSION

In WS2, we observed that there were knowledge and skill sharing between MNY students and LA students according to the changing of role they were responsible. For example MNY students taught LA students about plant ecology and water supply system produced by their own school and LA students taught MNY how to draw and use technical drawing tools in return. During the oral presentation and critic stage, they also shared their point of view and in their part.

Compare to critical thinking process, WS2 ranges from site and program analysis, conceptual design to proposed development plan. Moreover in WS2 the degree of involvement and commitment of student were encouraged as much as possible.

At the end of WS2, NMY students and participants would understand the whole design process regarding to their experience. Moreover the administrator had more confidence in students' opinion and potential which leaded to more involvement of decision making in the future development of the community.

In the WS2, the social collaboration model between KMUTT and NMY community was changed to be more partnership system to increase the degree of participation in design of NMY community.

Conclusion

From observation, we found out that it is possible to construct knowledge base in design for sustainable development for the community in some certain level. However the achievement of knowledge base is composed of 3 following aspects;

1. Awareness and respect in nature and culture of the participants.
2. Involvement of stakeholders who are in charge of policy setting, investment and management.
3. Collaboration and commitment of the community.

With this composition, the participants are expected to be self-dependence in the future by sustainability approach. The Ultimate goal of sustainable knowledge is to develop critical thinking ability of school community in order to tackle any problems in a future with or without assistance from expert.

However the interim evaluation of this phase cannot reflect the accomplishment of the whole project because of the last workshop (WS3: "Focus") has not been executed yet. Therefore, to assess the level of success in constructing sustainable knowledge, the post evaluation requires 2 evidences as achievement indicators which are;

1. Students and community are able to apply knowledge and experience from this project in other cases.
2. Students and community are able to pass over this knowledge to next generation.

The significant evidence in this project proves that the collaboration of different background of people is possible even in design. It would strengthen their sense of belonging and their pride of local wisdom. This would lead to sustainability society at the world.

Apinya, Limpaiboon
Lecturer, School of Architecture and Design,
King Mongkut's University of
Technology Thonburi, Thailand
apinyalimpaiboon@hotmail.com
apinya.lim@kmutt.ac.th

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Panel 6
Failure & Innovation

Mehmet Ali Altin

Maximizing experiences by limiting material variations: Furniture design

1. Introduction

In Fine Arts most of the educational departments are named with the material it uses and the education is tied to that material. For example, ceramics is remembered with its materials like potters clay, gypsum and glazing minerals; glass is remembered with glass and sculpture is remembered with various materials like stone, wood and metals. Painting is remembered with its materials as paints and canvas. This kind of tied relation with materials is not being observed only in the field of arts; it also can be seen in artisanal production. Most of the artisans deal with specific materials for their specific processes to form the material and fabricate to create a product. They all have the ability and experience to work with those materials. Artists and artisans work in the language of materials which only they could understand. The product is created from the beginning to the end in a process where design manages the production and the production manages design in a synchronous manner. Design ends where the production ends.

Design fields as architecture and interior design are different. The design and production processes are separated and asynchronous because of the size of the product, the diversity of the materials and diverse professions involved in both processes. Design can send data to production but usually production cannot support design in this way. Designers can not have the opportunity of material forming, detailing for the material and finding material specifications by experience and experimentation which of all is part of the production. Instead of these designers are motivated to use data from previously produced products, the details provided by ready-made component manufacturers. In this case designers are getting far from the valuable infor-

mation retrieved from the production process. This information also feeds the design process.

For these fields the process of education is nearly the same as above. Because of the problems due to size and availabilities, in project classes vocational learning is not involved in the process. The process is run on paper, scaled models or digital models on computer screens. Some of the architecture and interior design departments provide a simplified version of the applied process of production in vocational classes. In these classes sometimes a small part or a component of the big whole is produced as life size prototypes.

2. Problem

Furniture Design I and II classes in Anadolu University, Fine Arts Faculty, Interior Design Department, were being held in the same way as the project classes. The lessons were structured on a given subject like "chair design", "kids furniture" etc… Lessons were run on sketches on paper, scaled models or computer visualizations. At the end of the class students must have produced a life sized prototype and the concept must have been explained on drawings. The expectations from students during the class were a research of limitless materials and conception of the subject and via this information a usable prototype creation. During the class the conception phase was so much elaborated and material experiments and the production quality which must be in the focus of a vocational class were disregarded. Students were forced to produce their prototypes after the completion of conception phase which usually took ninety percent of the class time. After that they needed to go on production of prototypes. Prototyping phase was always a painful and unfinished process. Students were running from one workshop to other in a very limited time. The problems that occur during the production phase were not solved due to time limitations and usually the prototypes were visually and functionally in bad condition. The main causes of this problem were the time and effort spent in the project classes for conception and very limited time left after conception for workshop production, experiments and experiences. Another very important cause was the budget of the prototype. The school provides a workshop only for wood processes. Students must have provided their own material for the prototype. They usually need to go outside the school for other material workshops like plastics, metal or even wood for some parts that are not possible to be produced at school workshop. Most of these extra materials increase the budget. It was observed that a subject with unlimited material choice and the provided workshop possibilities do not fit on a good quality design that is demonstrated on a good quality prototype. Even if the material was limited to wood it was not providing a synchronized design-production relationship due to materials availability and

price problems. Students were not going in a material experimentation which will guide the production and also design. The designs were still on paper until the initiation of the prototype production.

But this situation is not the same in other departments of fine arts. In a limited material variation it is so common to experience unsuccessful material experiments, learning from failures and innovations of new techniques for solution of production problems. In the Ceramics Department, the limited variety of materials like potters clay, gypsum and glazing minerals are provided in an unlimited quantity. In the Glass department fluid and sheet glass are provided in unlimited quantity. These materials could be provided in unlimited quantity because they are suitable economically and they could be recycled. Ceramics clay can be used to create models and can be recycled to make molds and also even after drying the same material could be recycled to get in the process again until it is fired. Potters clay is the most cheap design material and the most suitable one to be recycled. Another cheap and recyclable material is glass. Glass could be recycled even after firing and can be used again and again. Very little amount of the glass is wasted in workshops.

3. Method

Furniture Design class in Interior Design Department is restructured in a point of view of learning from experiments and failures. In this new structure it was aimed to test a method which eliminated conception and puts a wider experience on material use and techniques of using materials in a limited material context.

The observation about material variety limitations and recyclable material facts from Ceramics and Glass department are examined to be transferred in furniture design class for providing a better experimentation environment of materials. Corrugated cardboard is selected to be used as the only material variety to be used in the class. Corrugated card board is mostly used in packaging industry because of its special features like light weight, durability, strength, recyclability and relatively low priced. Below are the facts that act a main role on the selection of cardboard for furniture design class:

- Material has a wide potential of transforming in 3 dimensional forms which comes from its features. These potentials are also provided with light weight and high strength.
- Material features are suitable for hand crafting,
- The techniques and equipment to form wood in the department's wood workshop are also suitable for cardboard.
- The material is used nearly everywhere and it is discarded by lots of shops and supermarkets. Students can find a plenty of this material in a close proximity.

Below are asked to students during the class which took 14 + 3 weeks.

- First two weeks, students must research material features. This research must be focused on features of the material related to forming; techniques in order to create furniture out of a packaging material and produced examples.
- Students are free to choose the subject. The only limitation is that students must choose a subject suitable to the material and its production techniques.
- Students must work on scaled physical models and they are obliged to show only these models while they need a critic from the instructor. Drawings will not be accepted other than the ones used for production itself.
- Students will use the facilities provided by department's wood workshop, they may not get help from other workshops or staff of them.
- Students must demonstrate the process of their work with a life sized working prototype and a report explaining the process. Drawings and conceptual visualization will not be accepted.

The process is documented during the class by observations on student's activities, photographs and at the end of the class by the prototype, a survey and the report which shows the insider view of students.

4. Progress

Students are asked to experiment material features and its ability to have a form. They were asked to use the waste packaging material which can be found from shops and supermarkets free of charge. This course took 2 weeks. Students presented their research on free scale models in a hands-on approach. In these researches students were free of any subject and they did not have any goal.

In these research weeks after refinement of many experiments, they could find 3 ways to form corrugated card boar in order to make furniture forms. These ways include cutting the material in various ways and joining together. They also found out the extra materials which will be needed during the production phase. Below are the 3 ways:

- Stacking vertically or horizontally,
- Slot fitting,
- Folding and joining.

After the research phase students are asked to find a furniture design subject suitable with the corrugated cardboard material. Most of the students had problems in this stage. Finding the suitable subject was difficult for them there were lots of unsuitable attempts and there were attempts of conceptualization. Most of the

students tried to explain their ideas on paper instead of physical models. Most of the students wanted to follow the same course as they do in their interior design project classes. They tried to start with a concept and wanted to design something following that concept. Because of the prohibition of conceptualization it was difficult for them to adapt to this new approach and there was a big delay in progress during this period about 1 to 4 weeks depending on person. After long discussions about the selection of a subject for most of the students the subject was chosen in two directions "a unit for sitting on" and "a unit for storage". After this phase students are asked to produce 1/5 scaled models. The production has to be done with the facilities of wood workshop. After the approval of their designs students had time for production of the prototype depending on the person it was about 4 weeks to 8 weeks.

Students had problems to obtain corrugated cardboard in large quantities and big size. The problem is solved by a local cardboard factory. Large amounts of material in big sizes and diverse thickness is provided and sponsored by the producer. Students also had the opportunity to have a trip to the production facility to see the production line and get information about the material. After this phase the quantity of material was nearly unlimited. The process got faster and students started to experiment with out of the fear of budget and available sizes. After 14 + 3 weeks 11 of 15 students could end the course with a valuable product. And 8 of those had the opportunity to take place on the exhibition depending on the quality of works. 2 students left the course without a prototype.

5. Conclusion

Can limiting material variations and unlimiting material quantity have a positive effect to have a synchronized process between design and production in furniture design education? The research question is examined in 2010–11 Furniture Design I class. The prototypes and observations during the class were useful to understand the process but "What was happening on the student's side?" was also important. In order to understand this student reports which were explaining the process was useful. Students were also asked to take a survey in order to put their own remarks to the end of the course.

In the conclusion, one of the works will be explained from the given student reports in order to make the outcomes clear, a review of the whole reports will be shown and the results of the survey will be shown.

5.1. Zeynep's rocking log

Zeynep was one of the most hardworking students in the class. Her work has been selected due to her reports quality and suitability of her work for the process demonstration.

Zeynep did not choose the provided material stock. She decided to work with rolled corrugated cardboard which is very flexible in one dimension and rigid in the other. This situation caused problems to her. Sometimes she could not find enough materials to buy and sometimes it was difficult to carry them to the class.

Zeynep wanted to roll the cardboard on its own surface and make it rigid. It would have been seen like a solid and heavy log but in fact because of the porous structure of the material it will be light weight. Zeynep did not lose much time for conceptualization like other students. She decided to design a bench to take part in public spaces. She started progress with 1/5 scaled physical models.

Zeynep had the most difficulty during the course on transferring design from 1/5 scaled physical model to life sized prototype due to changing materials to be used and needed extra effort. It made her to change the design to fit to production. For example she could not find flexible corrugated cardboard wider than 150 cm which made her design to be changed from a sitting unit for two people to one person. Another fact affecting the design was budget, she has used stationary type glue for her scaled model but it is relatively expensive. It was not suitable for a life sized prototype so she tried other alternatives like natural wood glue. She tried to roll the cardboard straight and for this she has spent a big amount of material. While she was rolling the 10 meters long cardboard in a relatively narrow space she had to improve lots of practical ideas for production. When she finished rolling and gluing the material after it was dried she sit on it and discovered that it was rocking. The idea was changed to a rocking sitting unit. She decided to emphasize it on a tree log shape which is cut diagonally in each end. Another difficult aspect was that students had to work in the wood workshop with its facilities and limitations. Zeynep was so much limited with the height of the provided band-saws. She needed to refine her design also for this reason.

When Zeynep had finished her prototype it was 17 weeks from the start of the project. Her design was so much changed from her first decision on 1/5 scaled models.

5.2 The Survey and results

12 Students took the survey which makes 80 % of the class population. Questions in the survey are prepared to be answered mostly from two options "Yes" or "No". There are also commentary questions which cannot be valued in percentages and there are also questions to get a value in numbers. Below questions and percentage of selected options can be found, value input and commentary questions will not be shown as their results are out of the scope of the survey.

1. How was corrugated cardboard as a material to be handcrafted? Was it easy to use?
   100% answered "yes".
2. How did limited material variation affect your design? Was it helpful for your design?
   83.3% answered "yes", 8.3% answered "no" 8.3%, had no comment.
3. How did limitless material quantity affect your design? Was it good?
   75% answered "yes", 16.6% answered "no", and 8.3% had no comment.
4. Did limitless materials allowed you to experiment material?
   66% answered "yes", 34% answered "no".
5. Did materials hand crafting potential affect your experiments in a positive way?
   91.6% answered "yes", 8.3% answered "no".
6. Did the freedom of subject selection have a negative effect in the course?
   33.3% answered "yes", 58.3% answered "no", and 8.3 % had no comment.
7. Was it difficult to transfer design from 1/5 scaled model to life sized prototype?
   91.6% answered "yes", 8.3% answered "no".
8. Are there any differences between the initial idea and the prototype?
   91.6% answered "yes", 8.3% answered "no".
9. Did the end-product satisfy you?
   66.6% answered "yes", 25% answered "no", and 8.3% had no comment.
10. Do you think the things that you experienced while working with corrugated cardboard could be useful with other materials also?
    83.3 % answered "yes", 16.6% answered "no".
11. Do you think the credit and the hardness of the lesson fit? Does the credit need to be higher?
    91.6% answered "yes", 8.3% answered "no".

5.3 Final review and future work

In the search of a way to maximize experimentation for furniture design class in the context of existing potentials, minimizing material variations and maximizing material quantity was observed in 2010 Furniture Design Class. The findings are classified in subjective observations and objective survey results. It is possible to make interpretation combining these classes.

Selection of corrugated cardboard was found very useful by students in order to experiment by themselves, 100% of the class population found it easy to handcraft which also relatively affected their easy experimentation. It was also observed from end reports and their work during the course. Students could use tools like, cutters and scissors to cut; they have used normal pencils to draw on paper based material. They did not have limitations of transportation to carry the big sized but

low weighed cardboards. It was easy for them to work with the material.

Most of the students found, having unlimited materials provide more experimentations. Because of the delay in providing the material in big amounts some of the students could not have the possibility to experiment in design phase but most of the students could experiment material in the production phase. Having limitless materials was very useful also for the students who designed bigger in size. They worked without the fear of material shortage.

Limiting material variations was also found useful by students for their design. They did not need to research lots of materials in a limited time. They also could experience one material with its all features and aspects.

Freedom of subject selection was a problem in design phase. During the design phase it was the most time consuming aspect. Before the construction of the class it was thought that limiting every aspect could create an ordinary look in products. Therefore it was set free. Some of the students found it good even it was difficult to choose one subject. They liked it because at the end everyone had a distinct design. Also another finding was even the subject was set free it was limited to two subjects at the end. This approach was useful for students to understand that every subject does not suit to every material. But it was better if the subjects were limited to two or three to have more time in material experiments.

Most of the students found it difficult to transfer design from 1/5 scaled models to life sized prototypes. There were lots of changes refinements and restarts during this phase. It was the most effective phase of the class, they had to improve new methods and try new supporting materials like glues, nuts and bolts etc. It also affected the end product and the end product was totally different than the initial idea in some cases.

Most of the students commented that they think they can use the knowledge they had during the experiments with cardboard with other materials. Some features and production techniques could be transferred wood a plates and sheet metal.

The lessons were to be finished in 14 weeks but it took more 3 weeks until the examinations week. Time was an important aspect to finish an unknown product. Even with this limited time it was enough to have 8 good quality prototypes, 4 unsuccessful and 3 unfinished ones. Some of the students needed extra time to finish their prototype at the workshop it was provided for them out of the working hours of those facilities. Most of the students commented the hardness of the class was higher that it's credit and total time in weekly program. The lesson was designed to fit to a non-vocational type of learning therefore the time reserved for this type of class

was short. Because of the difficulties in reconstruction of the fixed program, class was constructed on the existing base. It was also useful to calculate the extra time needed for this kind of learning.

The budget needed for extra materials was another aspect of the class. Depending on the student and the work the money spent for the prototype was between 0 to 250 TL. The maximum 100 TL is the approximate amount usually spent for printouts which are explaining the concept. For the prior examples of the same class the money spent for multi-material prototypes was usually between 200 to 1000TL. At the end of the class there was no printout budget so some students paid very little money only for the reports A4 sized printouts. For the prototypes the extra budget was used for glues, nuts and bolts, cutter knives and big sized printouts which are used to transfer the scaled computer data prototypes.

This approach took so much effort from the lecturer and students. It was a very good period of full experimentation and experience with material. This approach does not focus on using the mentioned material but the way it must be when designing an object. It focuses on design for production and as a feedback production to design.

Mehmet Ali Altin
Lecturer in Anadolu University Fine Arts Faculty,
Interior design Department, Turkey
malialtin@gmail.com

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Bengisu Kelesoglu and Ipek Torun

On the Obscure Realm: Experimentation Through the Inexperienced Techniques

"A Study Focused on Finding New and Creative Solutions by Restrictions"

Introduction

"Mistakes are the portals of discovery" – James Joyce

Design, like everything else rapidly grows obsolete in today's consumption society. While technology, appears to be providing unlimited/numerous options, coming up with innovative and avand garde solutions are getting gradually harder with software presets and cliché's. In design education, the purpose is to, particularly, encourage students to seek for new solutions rather than teaching existing ones.

Thence, in two independent courses, with projects having parallel perspectives, by limiting the most adequate techniques, materials and methods that the students are experienced in; they are motivated to do the unapplied and untried.

As Teal Triggs (2004) points out to that "… communication is the result of meaning understood through the conventional use of words and where meaning attains form through letters" on typography and suggests "… developments in the new typography offers educators an opportunity to review traditional pedagogical approaches… Consideration may be given to developing programs that may choose to focus on the research and development process in realizing a solution, rather than on the final product itself." (p.170–171)

Applying the same attitude to both Typography and Packaging Design classes, the students are directed to focus on the process not the result itself. With this motivation the target point is to expose the recoveries gained from the experiences at the process rather than overcoming the obstacles.

As Paul Rand (1991) states that "Without play, there would be no Picasso. Without play, there is no experimentation. Experimentation is the quest for answers."

Problem

Typography course is given to the second year students in Bahcesehir University, Communication Design Department and is the only must typography course in 4 years of study. Due to extensive curriculum of the communication design departments, and beacuse the program contains theory and practice courses on print, time-based and interactive media integrated, this course is the most specialized one that students are to learn the knowledge of typography and apply the experience, considering that typography is one of the fundamentals of visual design.

The course necessitates an intensive syllabus containing the basic knowledge of typography along with the typographic design applications. In more traditional or more concentrated programs where the drawing skills and training are also take part in, such as graphic design programs, there are more courses that focus on typography and the typefaces are introduced to students mostly by exercises of drawing pre-designed typefaces by hand. By this method, the students study the anatomy of typefaces, letters and experience to qualify the different structures according to the design needs. Unfortunately in communication design programs, such methods are not applicable.

One of the main problems we faced in this course within 4 years of experince in teaching typography, the students are accustomed to computer usage and their familiarity with typefaces are based on default computer fonts. This accustomization, creates an unconvenient setting for genuine and distinctive project producing process, by not experiencing alternative usage of typefaces as well as typography choice, regardless of the resonance of typography and by using the typefaces that they already know of without studying the formal and semantic values. For a designer candidate, the tendency to produce existing designs while mastering, interferes being aware of his/her potential by experimenting and this disstresses the learning process.

In this typography course, the project that to be mentioned, is replacing the method of drawing the typefaces, with creating letterforms with actual materials and experiencing the forms of letters while making them. The students are aimed to be kept away from the computer typeface realm to a universe of typefaces that are waiting

to be created with any material. The boundaries caused by that computer typography are intended to cross over with the help of untouched fields of actual objects.

As an author of many publications on both design and typography; Philip Meggs (2001) states; "...technology alone can not fully explain the creative freedom of contemporary graphic design" and adds that "Many designers are fabricating words as solid diminutional objects, capable of being constructed from substances ranging from plexiglas to cake icing or discarded pieces of wire or metal, anything that can make an image becomes a potential tool for the designer seeking to imbue words with expressive form." (p. 219)

Also considering that the handmade typography has a lot of potential and due to the method, each design is unique and can easily be related to the context.

The second project to be examined in this study is the Packaging Design course held in Anadolu University, Faculty of Fine Arts, Graphic design Department. The purpose of this course is to improve design solutions in 3 dimensional surfaces.

The expectation from students, who had improved two dimensional design skills up to third year of study, is to explore the third dimension while being able to solve design problems for the product and the customer to develop creative and fresh alternatives at the same time.

The Packaging course, that is for two semesters as a must course, not only focuses on the originality of the form but also concentrates on the functionality and the communication aspects of what is on its surface.

Within overall projects, the first mock-ups coming from students are usually copies of a kind that they are familiar on stores.

In the seek for more innovative solutions, this is to be considered normal, but the instructor is required to guide the students to the distincitive though fuctional. Otherwise, the same design will be produced with different faces, and the similar products will be over-designed.

Another point is that the applied art and design schools should encourage students to the most creative solutions regardless of the financial stress that the market causes, in the educational process. The trial and error method should be experienced in this process, for students to use this experiences in professional design making.

Method

Typography course is given fourteen weeks in a semester which is didactical and practical as well. Four main projects and some class works that has to be done during the course, at the allocated time take place at this course.

The course is realized with 1 or 1.5 hour long class work experiences right after the topics discussed at the lecture part. However the essential part which intends to transfer the knowledge and the experiences gained from that course are the projects.

The first project is an illustration project which the pictorial practices are experienced. In general sense, the project is based on stylistic features of a typeface, aimed to give the definition of typeface and legibility is not considered. The second project is forming an experimental typeface that has to be produced with some materials with the isolation of computer fonts which they get used to reach easily. And the third project is a type specimen project so the students are able to improve their experiences in terms of communication design after these two projects. Final project can differ from time to time so that it is given by observing the students situation, interests and approaches during the semester.

In this study, the focusing point is the second project with the subject of forming a typeface by using different materials. The aim of the project is to experience forming a relationship between the visuality and the concept since they are supposed to write conceptual words with these materials whether they can be ready made or hand made. On the other hand it is important to analyze the anatomy of typefaces while giving effort on creating letters with ready made materials.

Using computer is forbidden at this project to give the opportunity of creating more unique and more original results. By this way, they stay far away from the medium that they used to and try to form three dimensional letters and photograph the designs finally. The point is not to avoid using technology to enhance learning, but to limit the areas that are explored to make space for the unexplored.

Different materials with different sizes naturally enable to bring the letters with different weights. In this method, the students experience the mechanical or robotic effect of a text which is created with very hard material while experimenting humanoid or emotional feeling of organic and soft materials with the aim of providing consistency in stylistic features of a typeface.

From the perspective of whole process, the project is to choose a concept, to decide the right kind of material, to write or compose the word which forms the concept, with ready or hand made material within a composition and layout related with the concept and to photograph the result.

Students are supposed to come to class with various alternatives done with different materials right after deciding the concept. This experiments will be evaluated in terms of typographic features with the participation of class. Both students and lecturer will present some suggestions about the chosen material and the experiments done on behalf of typographic composition and concept-visual matching. The participation of whole class is important on sharing different approaches and the creativity in each work.

Packaging design course is performed with talking, discussing and experimenting of presenting project face to face and to whole class. In general the aim of the course is to provide and put the unique and creative solutions of each project into life with functionality. The students have to care about the three main functions of packaging design carrying, protecting and presenting the product.

At the project which will be presented within this study, students are supposed to work with analyzing and identifying the relationship between form and the material with some restrictions in terms of material variation and method. The requirement of the project is to design a form or system which will carry and protect an egg but at the same time this system has to be original and the egg must be shown from outside of the package. With this obligation the students will be able to go beyond the boundaries of designing a closed cube that we used to see at the markets everyday. Another restriction is providing the ability of opening and closing the package by just using 300 gr. paper without using any kind of glue or adhesive substance. With all these limitations students are forced to think different and creative as well as knowing the features of their only material "paper".

Protecting the egg from any hit with an original form is also exposing the functionality of the package. With the lack of any adhesive substance, students will soon discover that any interlacing or locking system have the power to protect the product when compared with the glued packages. It is observed that, students tend to use these systems instead of glued ones at the subsequent projects with this experience and knowledge gained from the project. If decreasing in the amount of work and increasing in the protectiveness of package is thought, this experiments will direct the students at their professional life.

Progress

The Typography Project

For the project, the students are asked to define a comment, a word, a concept or their own point of view on something by using typography. The method of this definition/expression will be letters created by real-life-objects, actual materials from environment that will either support or create an irony on the meaning of the word.

At start they are asked to choose a word/concept and think about the first thing that comes to their mind when they think about it. They are advised to consider metaphors. Is it a piece of cake? Or a mountain high? They are expected to express using a metaphor or express directly.

They are asked to use photography to visualize their ideas. But they were not allowed to use computer based typeface. They needed to find organic materials to form letters or ready- made things that can be percieved as letters for solutions and photograph them to create their composition.

Also students are advised to check out Stefan Sagmeister's "Things I Have Learned in My Life So Far" for inspitration. It is a project by Sagmeister, startes from a diary of his, transformed into a book by himself, many installations, posters and a website that anyone's contribution is welcomed. There are plenty of examples of organic, non-computer-based typography.

When the project is introduced to the students, the students started to think about concepts they want to work on and these concepts were discussed at class. For the following class, the students are asked to make a research on the concepts. The very basic research consisted of googling the concept and checking the images related with that word. Even though this research method is not scientific, it helped students to find out the most common and cliche examples of the concept all together, at first. Later the students made detailed research within both printed and online sources.

The example works and the conceps by the students are; Afra: Free, Ayca: Chance, Efe: Unaccapted, Efe Kuray: Take Me Away, Kerem: Magnetize

After the decision of concepts was made with the students, for the next meeting of class, thay are asked to bring try outs. They started working and experimenting on actual materials.

Alternative solutions were discussed for the material exercises that are not able to be finalized in techical or artistic terms and developed projects were discussed on the next meeting.

Afra, first came up with the concept of "addiction", but her solution became too cliche, using the injection needles as the stems of letters. Then we agrees to process through a more conceptual one and she came up with "let your wings fly". The feathers had more potential than the needles because of the variety of their shapes, but the visual soltion she suggested was to build a wing model with the typography, place it on her back and shoot the photography on a roof. Unfortunately the model was not a success so she switched to the idea of a freedom which will be represented by a bird. After a few more shoots, she changed her word to a much more basic way to say "free".

Ayça, decided to use the playing cards for defining the word "chance". The original cards were not sufficient by means of typography and had legibility problems. So we decided that she might cheat a little bit and design her own cards, to add to the original deck.

Efe at first, picked the word "pain" to exress, but the solution he found was not typographically flexible and then he decided that he was willing to do something on design, so he came up with the idea of expressing his disapproval of the comic sans typeface. After his first

research he was focusing on the word "cencored" as a referance, used the word "unaccepted", to point out that the typeface is not something worth cencoring.

He designed a stamp with the typography of "unaccepted" and to make it look more official he used a letterhead with the signature of comic sans. He tried several compositions and shoots to gain readability.

Efe Kuray, wanted to create typography with particles. His first attempt was to use the sand in an aquarium to express the word "silence". The sand was not staying still as the filters work in the tank. So he used stones instead. Even though the lonely fish and the idea of being underwater helped to emphasize the word "silence", the angle of the camera and the composition was unsatisfactory, as well as the potential to a small amount of rocks for forming even letters. So he decided to use another material, flour, to point out to drug usage. Because the wanted the particles to be visible, he worked on smaller lettering. To make the letters consistent by hand at that size was quite challenging for him, so he did several tryouts. At the end he was able to create letters from flour that are even in size and proportions.

Kerem used metal dust and magnets to create the word "mangetica" He used helvetica as a basis for the magnets and tried several compositions. The studied on the contrast of dusts, the distorted shape that the dusts on the letters create with a well balanced typeface such as helvetica.

On the last meeting, the students who accamplished pairing off the material and the concept proceeded to finding the right compositional frames and layouts from the photos taken discussing on the photographic values and the mis-en-scene.

The Packaging Design Project

After the introduction to the project the students are are expected to do research, find succesful and unsuccesful examples from stores, books and internet, and to discuss the reasons of their evaluation with their classmates. After their research another stage of the project is to do a concept board on the ideas. The concept stage that will ensure the originality of the project and vitalize the form is highly important. At this stage the students are asked to find keywords for "egg" and its connotations with sub concepts. Typically the first ideas are quite similar, and consists of form solutions like basket and henhouse which will recall the egg. Even the students tend to keep the three main functions of a package which are carrying, preserving and presenting, on the background but they are reminded to find solutions to this three main issues frequently during class. Not only questioning the originality of an idea, but the fuctionality that the object has to be studied. Presenting the egg basket in exactly same way with paper, will not progress further than a paper basket but from the idea of a basket form with a new system designing of the

package must be supported. For a designer, every object exists can be an inspiration but executing the same object from a different material sometimes can not transcend mimicry. In this case, clearifying the distinction and guiding the student on this awareness will provide experimentation to the project.

The students search for the solution for transfering the concept that has been choosen to a three dimensional form by making multiple mock-ups on the following week. The following limitations put the students under a strain, so parallel to the critiques, they worked two more weeks on the mock-ups.

- The only material to be used was 300gr paper
- No glue was allowed
- The eggs was to be seen from the package.

The first mock-ups mainly was either to preserve or to carry the egg. The preservation is tried to be achieved by putting the egg in a structure that is three or four times larger than the egg itself or putting it in a cube thinking that the cube will be safer and stronger. At this point it is important to underline that the protection can be achieved without paper waxtage. The first goal is to keep the egg away from the ground and keeping it as high as possible when the package is dropped to the floor. They are to explore that folding, doubling and vertical meshed surfaces are able to preserve the egg. They are learning the strenght of paper and that glueing does not necessarily make the structure stronger with the help of these constraints.

Another restriction which is showing the egg from a perspective become a part of the project. Is it possible to show the egg from outside of the package while try to protect it? Students have to learn to accomplish this criteria with using or sometimes creating some empty spaces. By this way a graphic design principle "Less is More" is emphasized. The systems are tested with throwing the packages from a table while coming to conclusion. The students are also supposed to open and close their packages again and again. Student are restricted in terms of materials used and with this restriction they are forced to know the paper better.

Conclusion

In both courses, what is observed when compared to other projects, is that students tend to have following concerns at the beginning of the projects;

- The constraints in a project seems like an obstacle in finding ideas,
- With constraints when the area of study is limited, it seem like the projects will come up similar
- Being not familiar with the materials seems frightening

After the discussions, within the projects, students were able to see that the constraints did not effectted them as they were concerned. On the contrary, they noticed that it displayed a new level of creativity on the design problems to be solved.

Spesifically, the students who studied the typography process had an understanding of the letterforms. While doing designs using computer types, they tend to break the baselines, arrange the space evenly, they tried to break the rules of computer type without noticing the rules. Also they tend to use layer styling which leads them to overdesign. In a limited selection of typefaces, they tend to use as much typefaces as they can to create variety. But limiting the computer type, made students concentrate on the forms of the letters to keep consistemcy. Just as the opposite they tried to keep the letters as simple as possible in which they tried to solve readability issues. They picked a visual center and arranged everything else according to that and both as compositionally and typographically, this helped the perceptional focusing. In the projects done after this one, the awareness of these points were observed.

For packaging design students, who are familiar with 2 dimentional design problem solving, the 3 dimensionality was a new land to discover. They had the opportunity to experience the paper as a medium, which is an everyday material that they were not aware of the potentials. They discovered that what they see in stores preferably might not be the best solution. They learned that the strenght of the paper is not necessarily depended on the amount of glue or extra materials. Thinking and processing more on the material, made them aware that they can reduce the labor, minimize the amount of the material used and create more original solutions at the same time.

The relation with two projects may seem a few at the beginning but the outcomes and the process was similar. This we belive was one of the most helpful projects in discovering the medium and processing with learning. Even though the final of each spesific work by each student might not be stunning but exercising made them find out methods and ways of creativity in the progress. Also, two projects were found the most exciting and enjoyable ones by the students. The emotinal connection that the students had while developing the projects made them have the necessary dispositions cognitive and sensually for learning.

Bengisu Kelesoglu

Ipek Torun
Instructor, Communication Design Department,
Bahcesehir University, Turkey
ipek.torun@bahcesehir.edu.tr

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Panel 8
New materials, recycling & waste

Martin Beeh

Integrative Design Thinking©, Toxicity and Sustainability

How integrative design thinking© can tackle complex product design challenges

1. Design in context

1.1. Concept, form, materials

Design work, industrial design work in particular, is today defined in three majors steps: ideation and concept work, definition of function and form, translation into a material and industrial reality. The process is a flow, defined in best practice and combines the intuitive and the rational. Design process today, at its best, is integrated into marketing and product development planning.

1.2. User-Focus

A deep understanding of the users' needs by applying Design Research and Consumer Insight is today's major driver for relevant innovation which reaches the end user. Latest technological developments, particularly for consumer goods and electronics, have proven that technical innovation alone can not bring valid solutions to consumers' needs. Stretching a brand identity, exploring the depth and width of target groups helps marketing strategists to plan and deliver product innovation that has a lasting added value, both for the end user and the company.

1.3. Technology

Technology is everywhere and can be used in many ways. As mentioned in section 1.2. technology standing alone is yet a vain endeavor when it is not linked with meeting relevant consumer needs, identified and connected by brand and design strategy. The electronics and IT industry moves on in supersonic speed yet real progress is rarely felt: what is best today is outdated a few months later. Technology in design context needs to be taken as a catalyst for turning concepts into real-life solutions that are, again, based on design research

and consumer insight. Technology gets meaning and can become "sustainable" when all critical project factors are taking into account. The author will talk about strategies to encompass complex demands and knowledge levels into a walkable process solution.

1.4. Process

Process is a guideline, a check-list and an ever-evolving tool to communicate project intent. It defines ways of delivering it and makes it the "cement" of a work of a many united for one goal: project and product excellence. A process never stands still, evolves with practice and learning loops, fostered by constant feedback and improvement. Designing a process has become one of the key roles that project leaders of various disciplines today have to play. Process, know-how and a commitment to deliver the best possible solution put a project on the highway to success.

1.5. Economy

Economy drives design, defines start, project scope and outcome. Design work is not much entwined with economic key performance factors and sometime seems to go against them. Costs may raise to deliver a design solution that the market is possibly not ready to pay. Latest design practice is challenging traditional product evaluation and seeks for new criteria, "hard" and "soft" to judge innovative projects, combining intuitive and rational parameters.

2. From Design Thinking to Integrative Design Thinking©

2.1. .Design Thinking Definition

Tim Brown, CEO of IDEO defines design thinking as "a discipline that uses the designers sensitivity and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity"[1]

Design Thinking, as defined by bringing design methods, as described in 1.1, into bigger project contexts for e.g. business challenges. It consists of the following stages:

- Definition (of project scope and parameters)
- Research (Consumer Insight)
- Ideation (brainstorming and workshops)
- Prototyping (testing possible solutions)
- Implementing (of product or service, or business idea)
- Learn (and funnel the project with new insights)

A few thoughts on Design Thinking and a tribute to Roger Martin, Dean of the Rotman School of Business (Toronto, Canada):

"The most successful businesses in the years to come will balance analytical mastery and intuitive originality in a dynamic interplay that I call *design thinking*", says Roger Martin in his book "The design of business". Roger Martin further describes the design thinker: "And rather than being confined to the knowing without reasoning of intuitive thinking, the design thinker uses an explicit form of reason and logic and a process that, while less certain and clear than analytical thinking, has promise for producing advances with greater consistency and replicability than pure intuition." (The Design of Business, 2010. Page 26).

Roger Martin underlines that design thinking methods combine the best of "two worlds", the rational and the intuitive. The present article describes, how the practice of design thinking can further evolve and tackle challenges outside the design, product development or business context, reaching even more complex areas as sustainability and chemistry.

Design thinking describes a mindset that needs to be fostered and nourished, that of "abductive thinking" instead of the prevailing deductive or inductive reasoning. Roger Martin calls abductive thinking as "the essential core capacity for design thinkers". (s.a., Page 27)

Equally important, as Roger Martin says: " In addition to mastering tools for analyzing the past and using that analysis to predict the future, the design thinker develops the capacity for observation, for seeing features that others may miss. The design thinker is "a first class noticer" (s.a., Page 30).

Methods of business analysis like Six Sigma have long been applauded and excessively applied, no doubt for good reasons and excellent result, but they have not shown great effect on relevant innovation, product or other. Roger Martin says: "Six Sigma and TQM (*Total Quality Management*, note of the author) systems drive out waster from the business as currently configured, but they will not innovate (new business designs)." (s.a., Page 42).

Roger Martin further describes what Charles Sanders Pierce (1839–1914, an influential American philosopher working on the theory of pragmatism, founder of modern semiotics and a keen researcher on the origin of new ideas) stated "New ideas arose when a thinker observed data (…) that didn't fit with the existing model or model. (…) The true first step of reasoning, he concluded, was not observation but wondering. Pierce named his form of reasoning *abductive logic*.(…) Whether they realize it or not, designers live in Peirce's world of abduction. They actively look for new data points, challenge accepted explanations, and infer possible new worlds."

Roger Martin describes (s.a., Page 165) design thinking as " the application of integrative thinking to the task of resolving the conflict between reliability and validi-

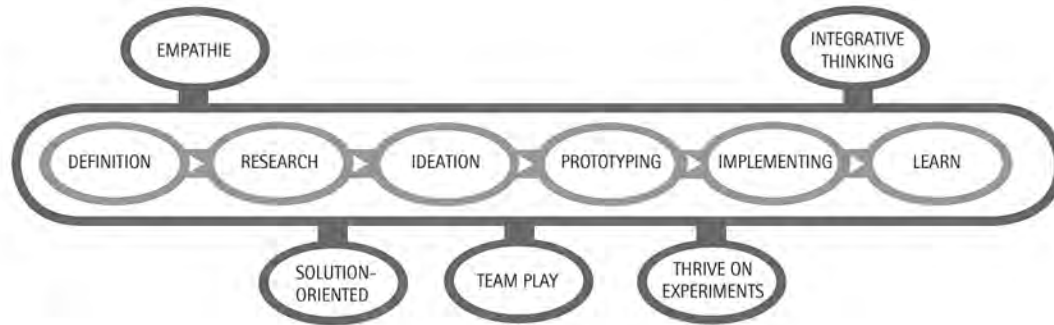**Table 1:** Design Thinking | graphic design by beeh_innovation. 2011©

Table 2: Design Thinking mindset | graphic design by beeh_innovation. 2011©

ty, between exploitation and exploration, and between analytical thinking and intuitive thinking. Both ways of thinking require a balance of mastery and originality."

2.2 Design Thinking mindset

Roger Martin describes the necessary mindset in the following fashion (the Design of Business, page 160): "The key tools of design thinkers are *observation*, *imagination* and *configuration*."

In order to identify and describe problems, to develop possible problem solutions the author recommends the three key tools identified by Roger Martin as well as the expertise in the respective fields in science, business and technology that help to give knowledge and best-practice substance to an appropriate, viable and effective process.

OBSERVATION:
Roger Martin describes it as (s.a., Page 161): "… deep, careful, open-minded observation. Since design thinkers are looking for new insights that will enable them to push knowledge forward, they must be able to see things that others don't (…). This requires careful watching and listening in a way that is responsive to the subject (…)."

IMAGINATION:
Roger Martin says (Page 162): " Design thinkers programmatically hone imagination into a powerful tool, one comprised of an interference and testing loop."

Abductive reasoning, as described above, is according to Roger Martin "underutilized and underdeveloped in the business domain in favor of deductive and inductive logic."

"(…) interference-testing loop is so important. Here the design thinker tests the breakthrough inference by producing a prototype and observing whether it operates as desired or expected." There is yet high risk of failure, but the more that is being tested and thoroughly analyzed, the more the outcome gains validity and relevance.

CONFIGURATION:
Says Roger Martin (Page 163): configuration (…)- translating the idea into an activity system that will produce the desired business outcome. This is essentially the design of business that will bring the abductively created insight into fruition. Without that, all the observation and imagination will have no meaningful payoff".

What Roger Martin describes for the "design of business" is equally relevant for challenges in the broader context of in science, technology and other fields of growing uncertainty. See chapter 2.4. (Integrative Design Thinking).

EMPATHY:
Being able to think as others think, humbly listening to consumers, users, all sorts of stake holders helps creative professionals of all disciplines to constantly update what they know about relevant needs of their target group. These target groups are not only consumers any longer, it is everyone who is directly or indirectly involved in a process. Says Roger Martin (s.o. Page 169): "The only way to design a compelling solution is to re-
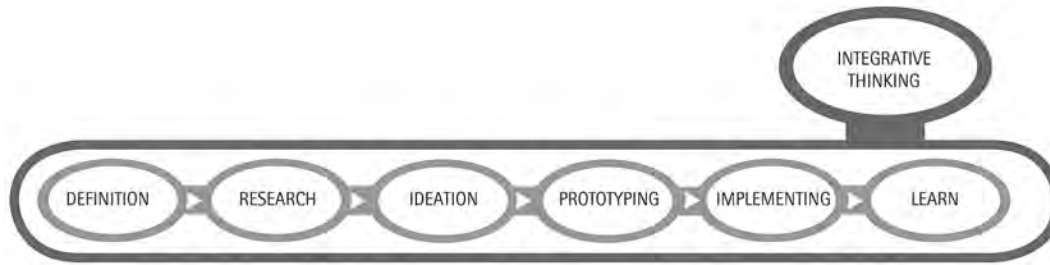
Table 3: Integrative Thinking | graphic design by beeh_innovation. 2011©

ally understand the user". The more one trains the capacity to listen and discover that little "grain" that is uttered, he holds the seed to let new ideas spread for problems not yet mass-communicated or even discovered by "forecast-professionals". Empathy also helps to make group works as a truly learning experience (see team-play).

SOLUTION ORIENTED:

Instead of focusing on the many – good – reasons, why one think will *not* work, Design thinkers will learn form difficulties, set up different risk levels of solutions and tries them out during the course of the project. Most inventions were successful by combining learnings from previous failures. Ask historians in technology how many trials Thomas Alva Edison used to run before the (now outdated) light bulb did (accidently) happen to perform. It may be a comfort to many, that an identified solution, even if not "perfect" is better than waiting for the "next big thing". Testing, prototyping, as described in the design thinking proceed is a proven accelerator of turning ideas into relevant solutions.

TEAM PLAY:

Experts, even renowned scientists, business gurus or design "superstars" have always worked in teams. How could Michelangelo draft, design and paint the Sixtinian Chapel (Rome) alone? Good teams consist of people with various backgrounds, different characters, origins and "agendas". Once the rules are set and the roles defined, the team can start working.

As challenges in design and areas of much broader complexity can never be solved by a single person, team structures, team competences and team performances have sharply increased. Imagine how many thousands of skilled and passionate experts are needed to design the ISS-space station or an Airbus A 380? Problems that come and face us, as how to turn industrial production, traffic or architecture around and make it environmentally sound, can only be "managed by the talent of the many".

THRIVE ON EXPERIMENTS:

A well planed experiment with the accumulated knowledge of a project team allows quick learning and valid feedback for further developments. A plan is just as good as its actual validity. Instead of time-loosing perfected planning, project hypothesis and possible first solutions are speed-tested with reduced cost, admittedly less quantitative validity but speed and quick learning cycles improve and verify project content. NB. Most great inventors have done many experiments. Most of the relevant inventions were not "planned" but fruit of coincidences or synergies that were not planned. Technical history is full of proof. Remains important the eye and the brain that discovers the outcome of an experiment as useful and good for mankind.

INTEGRATIVE THINKING:

It is the "art" of working, planning and thriving with the relative knowledge we have. In order to set up a project, define its scope, target and possible framework, a maximum of qualitative knowledge needs to be brought together. As opposed to "integrated", which states a given fact, "integrative" is describing the quality of an activity that does not end. As context, target and knowhow is moving fast and increasing in complexity, project managers and project members must search for the relevant input to "integrate". Integrative thinking adapts quickly to new situations and handles complex situations.

Based on Roger Martin's statement (s.a.) it is open-mindedness, a will to welcome surprising, uneasy answers as essential as well as combining the world of the rational and that of the intuitive, in new, ever-changing pattern. Design professionals, scientists and educators have to face the fact that their acquired knowledge is relative, possibly outdated or needs radical restart. Recent events in technology (as the Fukushima disaster) or in society (the democratic movement in the Middle East) show that not much is in fact – predictable. Aligning what we know, our expertise and our intuition (equals experience) with an open thought and action process will help us to identify, describe and tackle challenges ahead.
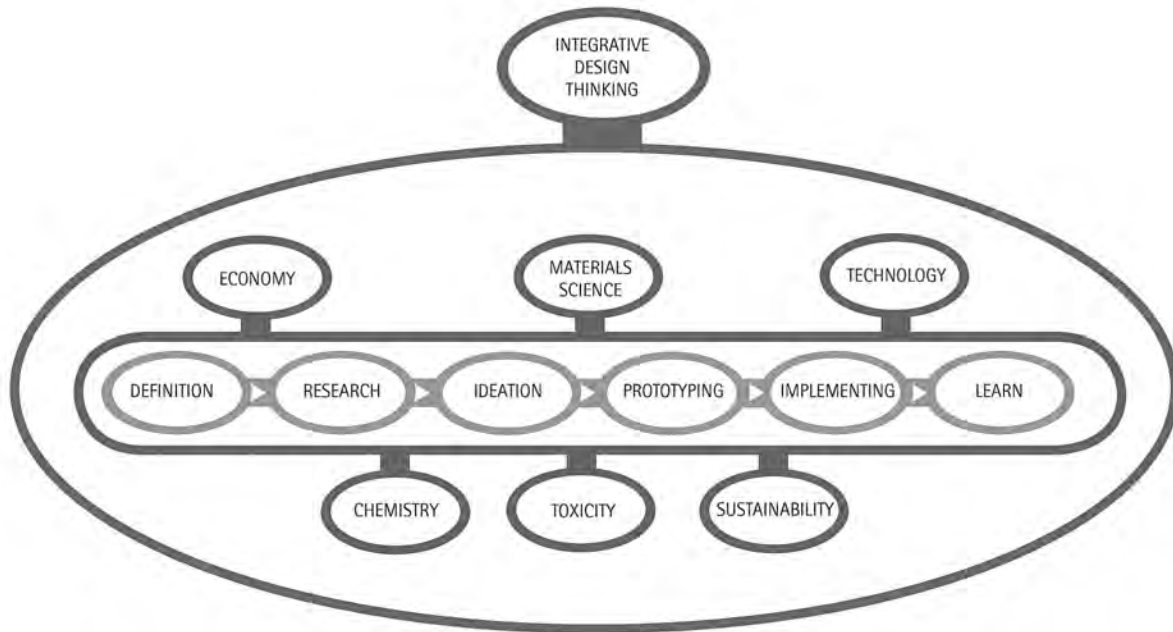
Table 4: Integrative Design Thinking© I graphic design by beeh_innovation. 2011©

2.3. Design Thinking practice has its limits

It is in practice in many business fields, most in interface development, IT, service and finance as well as for consumer goods. It is an excellent tool to combine intuitive and rational methods to cope with complex challenges. Multidisciplinary teams thrive with it. It is yet not carrying any further content than creating consumer insight (based on proved methods in ethnography) and the established rules of project management combined with specific knowledge related to the given task.

2.4. Crafting a new practice:
Integrative Design Thinking

Design Thinking as defined in 2.3. needs further "pollination" with content that can bring solutions to challenges we face in design education and design practice. Apart from Consumer Insight that is already established in the conventional definition of Design Thinking, Integrative Design Thinking is an ongoing, "organic" process that integrates knowledge areas as sustainability, chemistry, materials science and technology. Economic thinking is also integral part of the "content" list.

WHAT IS *INTEGRATIVE DESIGN THINKING©*?
Design thinking talks about left-brain, right brain methods to develop new business opportunities. Integrative Design Thinking is a further development of design thinking, defined by the author. It is design thinking

extended to new fields in science, technology and even society. It embraces expertise of the various disciplines, being an organic, nature-inspired process, that meanders and develops from stage to stage and from project to project, yet supervised by process review, milestones and evaluations. It is the antipode of a predefined, analytic-only, typical "left-brainer" (thus limited) process. Integrative Design Thinking© is apt to tackle "wicked problems" which the industrial society faces in a growing number, as sustainable product development and other fields.

INTEGRATIVE DESIGN THINKING© HELPS
SOLVING "WICKED PROBLEMS":
To be able to understand and develop measures to solve "wicked problems" integrative design thinking can light the path. So called "wicked problems", causing headaches to many and a particular challenge to be motivated from are defined as the problems beyond the "hard problems. Jennifer Riel in an article in Roger Martin's book "Designing business" defines them as "merely harder or more complex than hard problems. (…) Analytical thinking alone does isn't going to generate an answer to a wicked problem. (s.a., Page 95). Jennifer Riel further explains that the definition of "wicked problems" goes back to mathematician Horst Rittel in the 1960s. Riel adds: " Rittel's notion of wicked problems was detailed by C. West Churchman in an 1968 issue of *Management Science* (*long before the term design thinking*

was first described, note of the author). Churchman described wicked problems as "a class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing." (C. West Churchman, "Wicked Problems" Management Science, vol. 14, no. 4 (Decembre 1967). Knowing, how wicked problems are defined, there is much sense in considering sustainable product issues and the process definition and execution of a sustainable product development as a typical "wicked problem". Chapter 3.1 and 3.5 will talk more about a suitable design strategies.

Jennifer Riel mentions Bill Buxton's statement, principal researcher of Microsoft: "Designers thrive on problem *setting*, at least as problem *solving*". Riel sees design thinking strategies as a truly needed and "sustainable" problem setting and problem solving tool (see B. Buxton): In a world rife with wicked problems, the end of oil, the battle for talent, confounding mysteries of all kinds – the companies that succeed will be those that make a valued place for design thinkers, for those people who thrive on setting and solving wicked problems, throughout their organizations." The author will explain its impact on design profession and design education in chapter 3.5.

3. Integrating key factors into Integrative Design Thinking©:

3.1. Sustainability

Bringing together design and environmental issues is not that new, at least in design theory. Victor Papanek (1927 to 1998) describes in *Design for the real world* (1976) that design thinking can foster social and environmental responsability. Buckminster Fuller (1895 to 1983, known by his biomorph architecture and geodesic domes), Ralph Caplan (*By design*), Papanek stand as early disciples of integrating a broader spectrum of social and economic challenges into design *thinking* and design *making*.

Not many designers today can pro-actively and with deep knowledge apply sustainable design and product development factors. Only few engineers, sustainable process "wizards" and chemists know how to cope with the sustainable aspects of product development. We are not even speaking of a mere idea on "sustainable business" …

Designers need to come up to date in sustainable matters. Sustainability "labs" as the "Sustainable Summer School" (www.designwalks.org) show the way. In-house projects in companies and best-practice guidelines from design consultancies light the path. Yet only a few hesitating "test runs" have been taken.

Natural systems and biomimicry have million years long experience in making species adapt and develop for survival without harming future descendants. William McDonough and Michael Braungart (founder of EPEA) say in their book "The next industrial revolution" (German issue, free translation, Page 38 to 39): "Natural systems function and thrive through complexity. In contrast to standard solutions of the industrial revolution and the appraised uniformity of globalization nature fosters endless variety. (…) Designers can learn from this surprising biological diversity creating new niche for a multitude of design problems." Even if McDonough and Braungart stay vague describing the transferable potential of nature's principles into the tangible work of industrial designers, it is up to design and architecture professionals to understand the skills and methods of "mother nature".

William McDonough and Michael Braungart have, if not "invented" (nature has), yet largely and successfully communicated to an interested international public the cradle to cradle principles, defining product development and consumption processes in "the biological cycle" (waste is "food") and the "technical cycle" (energy-intense or harmful substances stay in a closed loop, perfectly hermetic).

According to McDonough and Braungart there is "room for more" if we change our way of "designing things" (German issue, free translation, Page 38 to 39):" If industry applies the efficiency of natural systems by manufacturing (new) things, it can create a healthy affluence and enable unlimited and useful industrial systems, that start with a positive synergy effect in following economic, ecological and social objectives."

The two promoters of the cradle to cradle-concept (German issue, free translation, Page 22 to 23): "Sustainability is basically too modest (…) as it focuses more on tolerable effects than on what could be positive terms for the development of profitability, ecology and the

Table 5: Herman Miller's Mirra chair, a cradle to cradle product. Photo: Herman Miller Inc.

social aspects of life. Sustainability creates neither innovation nor quality design, it rather limits creativity while being centred on efficiency (only)."

William McDonough and Michael Braungart discover early in 1995 that integrating various disciplines is the only way to develop solutions for environmental challenges " (German issue, free translation, Page 32): "We soon discovered that we need to work with partners and find other experts. For our integrative approach (in German: übergreifender Ansatz) we brought together knowledge from areas such as chemical research, architecture, urbanism as much as from (*product development*, adds the author) and industrial design."

3.2. Chemical science

Michael Braungart says (s.a., free translation, Page 27): "The study of chemistry rather factors out solutions and environmental questions until today, science at university is more interested in the structural research of problems than in strategies of change. Scientists are usually paid for examining problems but not for finding solutions."

Nonetheless, the science of the elements and their combination holds the key to many aspects of sustainability. It is no coincidence that some of the leading figures of sustainable product development, as Michael Braungart, are chemists. Given the methods of Integrative Design Thinking© and the number of "wicked problems" in the field of sustainability, "left-brainer" chemists should be encouraged to work more with "right-brainer" designers, combined with experts that qualify to the mindset map (see Chapter 2.2). Chemists, biologists, sociologists and designers are today's the key professions to advance relevant solutions for sustainability issues, in an integrative style.

3.3. Toxicity

A subject that is most feared and not a very heart-warming one! Little is known, even from product development engineers (even less from industrial designers) on the toxicity of substances that are used in production or that are permanently integrated into one's products. Apart from EU-listing on banned substances, little is known about the complex relationship between chemical substances, their effect on environment and the human being. Who has heard of the EU-List of the SVHC (Substances of very high concern)? Toxicity is today a "legal" problem, too little known in design education and design practice.

Michael Braungart (s.a., free translation, Page 29, 30) describes toxicity as an every-day phenomen that industry and the consuming public is not willing to realize in its every-day importance. There are psychological reasons, why people do not want to live in a "permanent status of intoxication" but fact is that many sub-

stances that "surround us" are harming health of may even contain toxic substances. Little is actually done to limit or fight toxicity except national or EU-legislation. Parliaments are today's most effective advocates to fight toxicity but a citizen should be skeptical and responsible enough to learn more about the issue. Knowledge about toxicity less glamorous than a "green luxury-LOHA-Lifestyle" but nonetheless holds the key to turn around many harmful effects.

William McDonough and Michael Braungart (Cradle to Cradle, 2002., free translation, Page 145, 146) talk about the example of developing a shower gel for a European consumer goods company, a gel that does not "clean" men's hair, but also river beds and fish stock (drastically described, yet true) from any grease, sweat and scall (human) scales (fish) to a lethal tidiness.

Professionals in product development and design, as well as in marketing and retail are supposed to get up to date with current discussions on toxicity. If they do not, their "next big thing" can be abolished form the market by containing substances that are not supposed to be in or that are not EU-listed (yet) and harmful. Typical example is the discovery of toxic substances in plastic toys for children. If you don't ask the supplier about harmful substances he will do little or nothing to inform you. Knowledge about typical toxic substances per product categories can help prevent damage from people and – indirectly – millions € losses in legal dispute and compensation.

3.4. User motivation and behavior

Sustainability is not only a matter of a lifecycle analysis, carbon footprint-measuring or related "physical" parameters to measure the impact of a product on the environment. Design has a major role in defining the user experience, thus the way the user interacts with a product or service. Behavior has a major impact on the ecological footprint. Car-owning or car-sharing makes quite a difference, everyone will agree.

The Manifesto of the 1st Sustainable Sumer School states (1st sustainable summer school", 2009 booklet of the processes and outcomes of the workshop) the challenges for today's designers (Page 5):

"DEMATERIALIZE create attractive lifestyles that consume fewer resources.
RETHINK existing systems and develop new ones.
CHANGE the cultural attitude – be aware of patterns.
LET your individual choices reshape markets and influence politicians.
SHARE your stuff.
MAKE IT cool to be green.
DEVELOP Media partnerships to raise public awareness.
CHERISH cultural diversity, for it is a precious resource.
CONSIDER people's health.

UNDERSTAND the "real price" of products ad services. The use of nature also has its price. "

It is evident that most changes for a "greener" world lie in reducing the impact of industrial production, mobility, consumption patterns and the prevailing values of a society. As sustainable design is a complex issue, the understanding of the interaction and the effect of one's activity, be it in a business context or as a citizen, is a starting point.

With practice, knowledge sharing, and the *design thinking mind-set factors* mentioned in chapter 2.2 a design student and a design professional can gradually gain confidence and know-how, allies and platforms to walk the path of sustainable design of which there will be no valid alternative in the future, nor from an economic nor from an ecological or social perspective. Continuous training, practice and quick learning is essential to become a "sustainable design champion". The good news is that there is no "restricted entry".

3.5. Applying Integrated Design Thinking© in the context of sustainability and toxicity

As William McDonough and Michael Braungart (s.a., free translation, Page 35,36) state that nature systems (*Natursysteme*, note of the author) can help development in many areas of human activity: "Systems can be created that are built after the intelligence, richness and efficiency of nature, e.g. energy currents and their natural resources."

Brigitte Wolf, professor of design management at Bergische Universität Wuppertal, summarizes in "1st sustainable summer school" (2009 booklet of the processes and outcomes of the workshop) the challenges for today's designers (Page 22): "Sustainable design does not mean merely saving ten percent in materials here or reducing

energy consumption by five percent there. Nor does it mean simply substituting one material by another material with better recycling qualities. A "green" surface is not enough. (…) Sustainable design therefore must focus on the complexity of the system as a whole and consider all of the material and energy cycles that are moved in order to maintain industrial production. One must consider the interaction between these varying influential factors. Environmentally friendly products and services are already economically successful, but shaping the future in a sustainable fashion poses designers both a great challenge and an ever greater opportunity."

Craig M. Vogel in his article *Notes on the evolution of design thinking: A work in progress* in *Design Thinking* makes a call for adapting design education models to a broader spectrum: "(…) we need a new educational model in the spirit of the Bauhaus, a model that emphasizes equally both education and research." Vogel further states: "Although interest in the practice of design grows, research, graduate, and doctoral programs in design fields must grow with it to pull even with the more established branches of engineering, applied science, and business."

Design education can define and develop *green think tanks* where design projects are initiated, developed and evaluated after a comprehensive set of tools, measuring and describing the effect of a design solution on environment, society and economy.

Bruce Sterling in the introduction of *Worldchanging* (edited by Alex Steffen, Page 13) jubilates:

They (*online visionaries and contributors of the book*, note of the author) are finding, exchanging, assembling, and discussing information – with one another and with their huge ad growing global audience. By their nature, they are continuous process, rootless yet blooming, a kind of rolling, seed-spewing electronic tumbletweed.
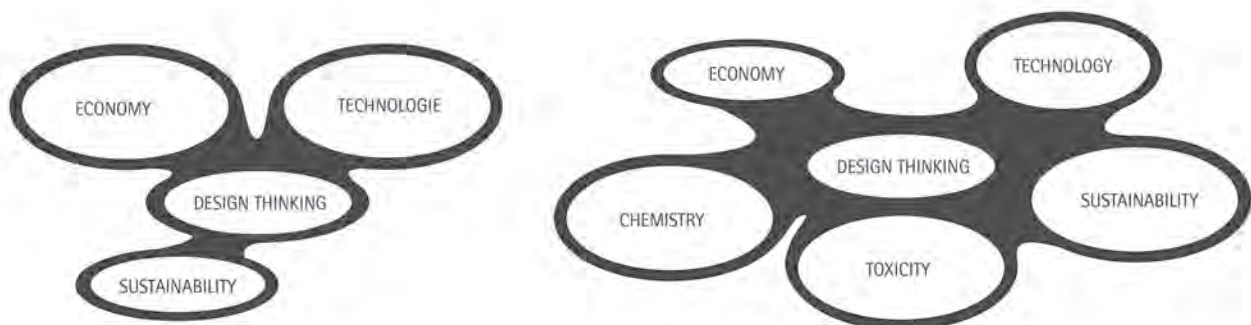

Table 6: three models of how Integrative Design Thinking© adapts and transforms relative to project challenge and focus: | graphic design by beeh_innovation, 2011 ©

They are forecasters of tomorrow's culture. They confidently predict that the tools, models, and ideas for building a bright green future are already here. The pieces are scattered around us, awaiting a slow-gathering combustion of insight, the flash of a cultural gestalt."

Alex Steffen, the editor of *Worldchanging* is full of optimism and sees bright green futures ahead:

(Page 23) "We're learning with every passing day that changing the world is a growth opportunity. Vast fortunes will be made by those companies that invest in clean energy and new technologies. Huge savings (and a better quality of living) will be realized by those cities that grow smart and that green their infrastructures. Green may not follow gold, but there is gold in green; there are fortunes in fairness:"

The present article, the talk and the panel participation at the Cumulus conference aim to add Integrative Design Thinking© "to the movement", as an ongoing, adaptive and effective process for creating sustainable solutions, integrating the best possible motivations and competences in man.

3.6. About the CUMULUS Paris conference workshop

In the workshop, the author will show how Integrative Design Thinking© can be applied to challenges in a sustainable design process for a possible product development scenario. It will be discussed what needs to be taking into consideration when applying the approach in the context of design education as well as how design practitioners can benefit.

Martin Beeh
Lecturer and project co-ordinator
Folkwang-University of the Arts,
Essen, Germany
martin@beeh-innovation.com

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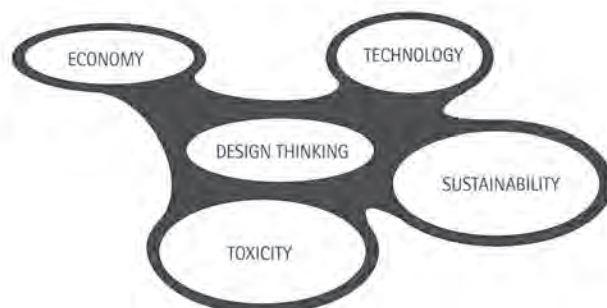
Armin Reller and Peter D. Stebbing

Responsible Materials Governance

1. Introduction

In this paper we will first examine some of the reasons why we should acquire a fuller understanding of our use of resources and the effects of their use. We will then propose curricular responses to the problems so that with a deeper understanding of materials and resources students can take appropriate action in the future. We anticipate and hope that in the future with such knowledge that their responses would range from not only the appropriate selection of a resource in a professional context but extend to a socially responsible action of protest and "whistle-blowing" when such resources are used at the cost of society and the environment.

2. The Problem

The exhaustion of our resources is one of the top challenges now facing humanity alongside overpopulation, climate change, and the security of food, water and energy. As the western cultural consumer society begins to recognize its un-sustainability it is either avoiding or struggling to accept the extent to which it must rapidly change. It is as though the consumer mindset of past decades and our democratic social structures have blinded our ability to identify viable alternatives despite the consequences of scientists´ warnings.

Politicians and economists have confirmed their inability to implement the changes necessary to ensure our continued well-being. As the Observer confirmed in an editorial "*If we continue to pollute the planet at our current rate, terrible consequences will follow. The evidence is there. But our leaders cannot find the will to do anything about it. No wonder the scientists are frustrated. At a meeting in Copenhagen last week, leading researchers called explicitly for more government action…*" (Editorial, Observer, 2009) In extreme cases the Bush administration which attempted to corrupt science and deliberately set out to falsely represent the effects of climate change on health etc (Schor, 2008). Deadly economic growth remains the political aim now just as before the recent financial crash despite the fact that not just oil has peaked but as Richard Heinberg (2007) describes we are now facing a series of peaks in our resources where growing demand exceeds supplies. It seems that in our world of finite resources consumerism and continual growth is all that we can imagine. If we cannot leave this path and without being dramatic we must face the fact that we are doomed – something which we are not allowed to mention.

Our strategic use of resources is therefore essential, not only because they are finite but also because they are causing a suite of other problems. Therefore, in order to motivate strategic action and management of our finite resources we review here some of the evidence what western style consumerism costs.

Subsequently, we propose curricular initiatives since we believe that top down political leadership is insufficient at best or corrupt at worst and that educational bottom-up driven initiatives have greater opportunity to bring about informed change.

Some of the costs of our unsustainable consumerism

It is not possible in a short paper to list all the costs of our irresponsible resource use but we cite some of the most prominent and tragic costs including…

1. the exhaustion of irreplaceable resources.
2. hunger as biofuel-crops replace food crops.
3. conflict, massed rapes and migrating refugees.
4. the death of other cultures.
5. the destruction of biodiversity.
6. the poisoning of the environment.

2.1 The exhaustion of irreplaceable resources.

In April 2010, the Guardian Weekly reported that…

"*The US military has warned that surplus oil production capacity could disappear within two years and there could be serious shortages by 2015 with a significant economic and political impact.*

The energy crisis, outlined in a Joint Operating Environment report from the US Joint Forces Command, comes as the cost of crude oil is predicted to soon top $100 a barrel.

"*By 2012, surplus oil production capacity could entirely disappear, and as early as 2015 the shortfall in output could reach nearly 10m barrels per day," says the report, which has a foreword by a senior commander, General James N. Mattis.*

It adds: "While it is difficult to predict precisely what economic, political and strategic effects such a shortfall might produce, it surely would reduce the prospects for growth in both the developing and developed worlds. Such an economic slowdown would exacerbate tensions, push fragile and failing states further down the path toward collapse, and perhaps have serious economic impact on both China and India."

The warning is the latest in a series from around the world that has turned peak oil – the moment when demand exceeds supply – from a distant threat to a more immediate risk." (Macalister, T., & Webb, T., 2010)

Sir David King, a previous chief scientific adviser to the British Government from 2000–2007, has written (18.6.2010) that *"The International Energy Authority (IEA) predicts that over the next 20 years there will be a steady increase in demand for liquid fuels, most of which will come from China and India. It also predicts that the supply of oil from fields that are now in production will plummet over the same time frame…*

The bottom line is that demand for liquid fuels is virtually certain to outstrip production by a considerable margin over the next two decades, regardless of how much oil remains in the ground.

…as the world emerges from the current economic downturn, all the evidence is that oil prices will take a substantial hike. Our analysis predicts that prices will soon be considerably more than $100 a barrel, peaking at around $130 by 2015. This in itself is likely to stall the global economic recovery following the financial debt crisis."

In July, 2010, the Guardian reported that European Commission published a report in June which listed 14 metals which are critical to Europe's economy through innovative technology. For example the Fraunhofer Institute estimates that by 2030 we will need three times more indium for flat screens. The basic problem is not always to meet demands but rather some suppliers are in a dominant position; for example China supplies the world with 95% of rare earth minerals and has recently been cutting back in order to develop its own technology industries. Indeed, China is now a leading nation in greening its own energy supply since certain key minerals are essential for solar panels.

Our real problem is not so much that oil has peaked but that coal and a range of other basic resources such as freshwater and rare earths will also peak during this century. This has most serious consequences since we will have to cope with a synergy of shortages of basic resources (Heinberg, 2007). Many continue to believe that mankind's ingenuity and technology will save us from our future problems, however, this is simply unrealistic because we will not have the minerals and resources to be so creative with! Obviously, and without being dramatic, this will test civilization to the extreme as by the end of 2011 we will number 7 billion inhabitants.

2.2 Biofuel-crops replace food crops already bringing hunger to millions

"Biofuels have forced global food prices up by 75% – far more than previously estimated – according to a confidential World Bank report obtained by the Guardian.

The damning unpublished assessment is based on the most detailed analysis of the crisis so far, carried out by an internationally respected economist at the global financial body.

The figure emphatically contradicts the US government's claims that plant derived fuels contribute less than 3% to food price rises…

Senior development sources believe the report, completed in April, has not been published to avoid embarrassing President George Bush…

"Political leaders seem intent on suppressing and ignoring the strong evidence that biofuels are a major factor in recent food prices," said Robert Bailey, policy adviser at Oxfam. "It is imperative that we have the full picture. While politicians concentrate on keeping the industry lobbies happy, people in poor countries cannot afford enough to eat."

Rising food prices have pushed 100 million people worldwide below the poverty line, the World Bank estimates, and have sparked riots from Bangladesh to Egypt…

…Instead, it [the report] argues that the EU and US drive for biofuels has had by far the biggest impasct on food supply and prices.

Since April, all petrol and diesel in Britain has had to include 2.5% from biofuels. The EU has been considering raising that target to 10% by 2020, but is faced with mounting evidence that such a move would push food prices higher.

"Without the increase in biofuels, global wheat and maize stocks would not have declined appreciably and price increases due to other factors would have been moderate," says the report.

The basket of food prices examined in the study rose by 140% between 2002 and this February [2008]. The report estimates that higher energy and fertiliser prices accounted for an increase of only 15%, while biofuels have been responsible for a 75% jump over that period." (Chakrabortty, A., 2008)

2.3 Consumerism profiting from conflict, violence and massed rapes

"An ugly paradox of the 21st century is that some of our elegant symbols of modernity – smartphones, laptops and digital cameras – are built from minerals that seem to be fueling mass slaughter and rape in Congo. With throngs waiting in lines in the last few days to buy the latest iPhone, I'm thinking: What if we could harness that desperation for new technologies to the desperate need to curb the killing in Central Africa?

I've never reported on a war more barbaric than Congo's, and it haunts me. In Congo, I've seen women who have been mutilated, children who have been forced to eat their parents' flesh, girls who have been subjected to rapes that destroyed their insides. Warlords finance their predations in part through the sale of mineral ore containing tantalum, tungsten, tin and gold. For example, tantalum from Congo is used to make electrical capacitors that go into phones, computers and gaming devices.

Electronics manufacturers have tried to hush all this up. They want you to look at a gadget and think "sleek," not "blood." " (Kristof, N.D., 2010)

2.4 Consumer driven cultural genocides (and biodiversity losses)

"Across the globe, as mining and oil firms race for dwindling resources, indigenous peoples are battling to defend their lands – often paying the ultimate price."

Indigenous groups say that large-scale mining is the most damaging. When new laws opened the Philippines up to international mining 10 years ago, companies flooded in and wreaked havoc in indigenous communities, says MP Clare Short."

ARIZONA: The Navajo nation is fighting uranium mining through the US courts. Radiation levels are 450 times normal levels. Other uranium mines are opposed by indigenous groups in Australia, India, Canada, Niger and Botswana.

BOTSWANA: The Bushman of the Kalahari desert have been progressively pushed out of their traditional lands by the state to make way for mining.

BRAZIL, PARAGUAY, PERU Five "un-contacted" tribes living deep in the forests of Peru, Brazil and Paraguay are at risk of extinction as oil companies, colonists and loggers invade their territories, says Survival International.

CANADA The giant oil tar fields in Alberta are some of the most polluting in the world, and will stretch over thousands of square kilometers. They are the centre of a legal battle between oil companies and the Beaver Lake Cree nation and other indigenous groups.

COLOMBIA Oil companies are moving into the western Amazon and prospecting indigenous land. Tribes are caught in the crossfire of a civil war between the state and guerillas.

CONGO Pygmy groups in the rainforest are threatened by logging and mining companies.

GUATEMALA Thousands of indigenous people have been forced to move to make way fir giant dams and other developments. Indigenous leaders are regularly faced with threats of assassination by the authorities. Death squads have re-emerged.

INDONESIA Palm oil companies in Sumatra have been expanding into the forests and grabbing land from indigenous communities. This, says OXFAM, is leading to conflict and more poverty.

KENYA The indigenous Ogiek people who have lived for centuries in the Mau forest are being forced out to make way for logging, paper and tea companies.

NIGERIA The oil producing Niger Delta which accounts for 4% of all the world's oil, is now heavily militarized as ethnic militia groups resort to kidnapping and violence in response to generations of abject poverty.

PHILIPPINES Tribal lands are being militarized and repression of indigenous groups is increasing as giant coal, gold and copper mines destroy traditional water sources and fields.

WEST PAPUA Companies have dug around $100bn of copper and gold from West Papua in 40 years, but while the Indonesian government has richly benefited, local tribes have been dispossessed of land and livelihoods." (Vidal, J., 2009)

2.5 The extraction of oil causing the destruction of biodiversity.

Kelly Swing (2011) recently reported that Ecuador's President Correa offered *"…to sell the world a guarantee that oil would not be extracted from the Ishpingo-Tambococha-Tiputini (ITT) block, a 1,200 square kilometer portion of Yasuni on the country's eastern border with Peru. The $3.6-billion price is about half of what Ecuador could expect to make from roughly 850 million barrels of crude oil reckoned to be there. In exchange, Correa said that the area would be legally set aside, and become off-limits to extraction in perpetuity. In Ecuador, the plan is optimistically referred to as Plan A."*

So far the fund contains $100,000 and Swing sees little chance of the $3.6-billion price to preserve a diversity hot spot being raised. Why? Probably because there is no guarantee that can be made without the risk of it being renegued on in the future. As Swing observes *"Realistically, no conservation plan can demand that any sovereign nation be permanently deprived of rights to develop and profit from its own natural resources."*

If Plan B is undertaken which is ready to be in: to extract the oil; then if history repeats itself the result will be catastrophic. Meanwhile, The *Independent* (Adams,

2011) has reported that the US giant oil corporation Chevron has been fined by a court in Ecuador $8.6bn for an environmental disaster that has been called 'the Amazon's Chernobyl'. In addition it has been fined $0.9bn reparations to the victims of oil pollution that fouled a swathe of Amazon rainforest.

Is there any chance that oil companies can be made to extract oil in an environmentally responsible manner? Probably not, since this would raise the price of petrol at the pump to motorists and reduce the dividends paid to shareholders. The oil companies inability to either care for the environment or the peoples living adjacent to oil extraction has always been negligent: witness the Niger Delta, Canadian tar sands extraction and the Athabasca River, BP and Gulf of Mexico, Trafigura and the Ivory Coast, etc. etc.

2.6 Consumer electronics causes health problems & poisoning of the environment in Africa

"*Thousands of discarded computers from western Europe and the US arrive in the ports of west Africa every day, ending in massive toxic dumps where children burn and pull them apart to extract metals for cash.*

*The dumping of electronic rubbish, or e-waste, is in direct contravention of international legislation and is causing serious health problems in the shanty towns…"
(Wray, R., 2008)*

"*Burning plastic cables to get to the valuable copper inside gives off smoke that can cause chest and lung problems. Some chemicals released into the environment are carcinogenic. Crude break-up of electrical items can cause heavy metals such as lead and mercury to leach into the soil, and then into the water table: there they are taken up by plants, ingested by animals, and eventually accumulate at the top of the food chain, in humans." (Tickle, L., 2010)*

"*Britain is throwing away more than one million tonnes of electronic "e-waste" such as broken computer monitors and discarded mobile phones every year, and new government figures show that more than ever is going abroad.*

Last year, 23,000 tons of IT and electronic equipment was shipped out illegally, mostly to China, west Africa, Pakistan and India." (Vidal, J., 2004)

These costs demonstrate the hubris the consumer to consume and of companies acting on behalf of the consumer who doubtless would immediately protest were what we have described above happening next door–however, in a distant land, a different place…but who

cares? Clearly, we must design innovative resource-responsible-infrastructures and governments must rigorously guarantee their implementation for ensuring that products are returned, recycled and the resources reused. That is the challenge.

3. The utmost necessity for an academic response: new curricular components

We must profoundly change the way that we use resources but more importantly think about them. We must start to recognize that a substance, whatever it is, never belongs to us but rather we borrow it. (Just as Prince Seattle, the Indian Chief wrote about his land which was to be purchased from his tribe by the US Government) Implicit within this idea is that we must use our resources ethically. Substances have a biography and they have relationships. One of us (A.R.) has been developing a program for students to understand a resource's biography and history, including its extraction, processing, use etc. Meanwhile, (P.D.S) has developed a concept called schesiology concerned with the recognition of all the relationships and consequences concerned with a process or object.

3.1 The Designer as an Agent for Change

What can be done? The solutions must come from the grass roots- the bottom up. Designers are responsible for many of the decisions affecting how resources are used. Design educators should recognize their potential to play a key role in adaptation. Until now most design curricula have been concerned only with informing students which materials are suitable for a specific product or component. Design for disassembly is not even a topic of discussion on most design courses and recycling is still not a criterion for the assessment of a design as form, function and use.

4. Innovating the curriculum with new knowledge

In order to use materials ethically we need to teach not only what they are but about them, in other words resources have biographical histories. What are they?

4.1. The Biography of resources and materials

In the past three, four decades an enormous increase of the diversity of functional materials, in particular of functional metals can be observed. Who would know that in a cell phone or in a laptop some 30 to 50 different metals are functionalized. In addition they are the chemical constituents of chemical compounds such as alloys, ceramics, etc. and therefore of hundreds of different functional materials exhibiting specific physical and chemical properties. Therefore, the said electronic devices are most complicated conglomerates of hundreds of interacting functional materials. And eve-
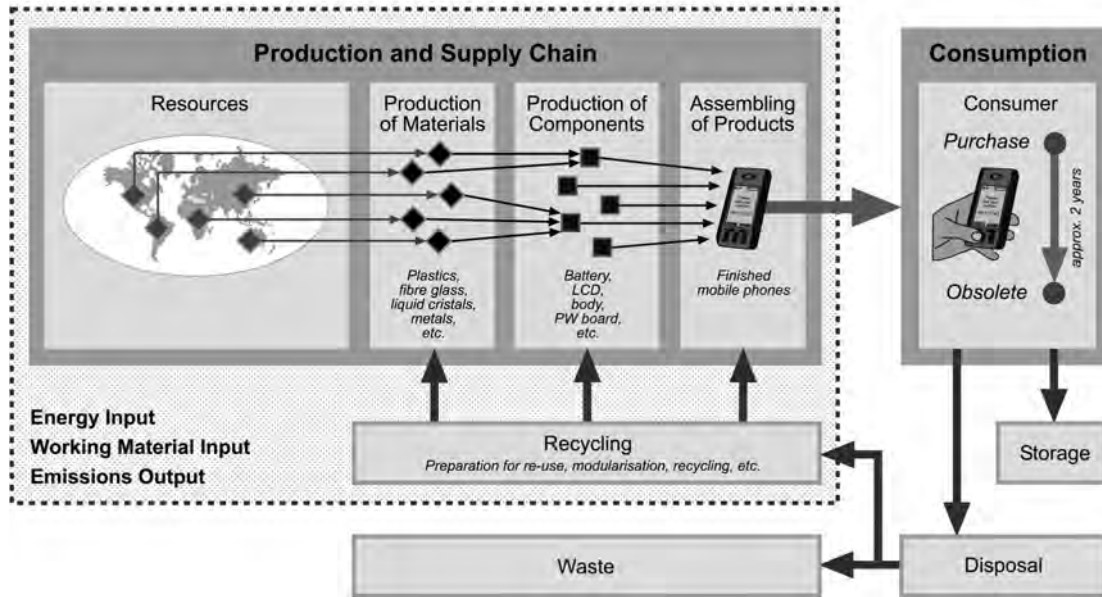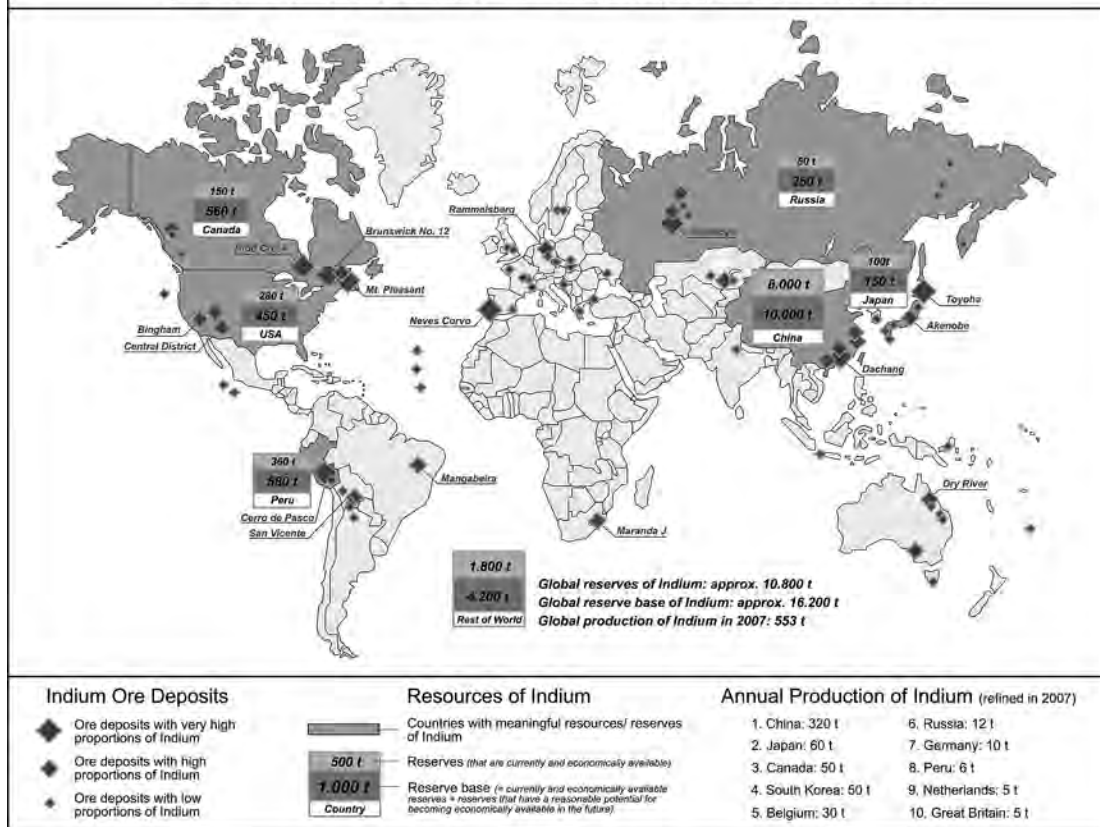
Figure 1 (above) The life cycle of a cell phone
Figure 2 (below) The global distribution of indium deposits

ry in-built material, every metal tells a story, has a kind of individual biography (Reller a. et al, 2009). Since the resources, i.e. the mines of mineral resources and therefore of ores and metals are spread out all over the globe the characterization of the supply chains from the min to the product is most often not transparent (see figure 1).

In many cases it is not known under which working place conditions, health situation and social structures, but also ecological standards resources are mined and refined. Obviously the product designer composing and functionalizing appropriate materials should be aware of the fact that designing means planning physically and energetically real stuff and material biographies. The knowledge of the availability or scarcity of resources, i.e. the mines (see figure 2), a map of the deposits for Indium, an essential metal in LCDs), the spatial and temporal trajectories of functional materials, products and devices along the supply and production chains, but also along the after-use phase is an indispensable prerequisite for improving resource efficiency and over-all sustainability.

The successful realization of the potential of optimal re-use, re-manufacturing, re-cycling as well as downcycling procedure depends crucially on the architecture of the materials in a product or a device. Assembly and disassembly processes have to be foreseen and designed in a manner allowing the best possible recuperation of materials. This demand, however, is compromised by the fact that the diversity of differentially functionalized, interacting materials is increasing exponentially. Micro- and nanotechnology render the technological possibilities for re-gaining the valuable fractions more and more difficult. Therefore, the identification and validation of the most important constituents is decisive for the reduction of pending dissipation. As example the coating of textile fibers, i.e. socks or underwear with silver nano-particles may be mentioned. As a bactericide silver diminishes the evolution of miasma. By the washing process of silver-coated cloths one part of the silver goes lost and is dissipated in the biosphere via the water cycle. Owing to the obvious bio-activity of silver this application certainly is disputable, especially by considering the production (21,000 metric tons per year) and the competing applications of this valuable metal.

These considerations lead to the consequence that the efficient and sustainable use of resources demands for transparency of thee whole supply chains, the knowledge of the trajectories during the use of products and devices, and last but not least their traceability in the after-use phase, i.e. the re-integration into ecologically benign or economically responsible loops of materials. The validation of resources, processes and technologies can be achieved by the criticality concept. This concept is based on a set of criteria which indicate possible risks for specific supply and product chains. Among the most important quantitative and qualitative criteria are:

- Geological availability or scarcity of mineral resources/metals
- Geo-political restrictions, conflict and warfare potential
- Economic competitiveness
- Resource efficiency
- Recyclability
- Potential dissipation
- Ecological impacts
- Social standards, working place standards, health standards
- Cultural and intercultural issues (acceptance of products, devices, technologies)
- Intra- and inter-generative issues

Any validation should be applied in the early stage of a product, i.e. in the R, D & D (research, design & development) phase.

All in all this extended catalogue of criteria for the validation of the criticality of resources, functional materials, products, devices and technologies seems to be too demanding. In practice however, the identification of the most critical factors and criteria is decisive and useful.

Biographies of resources and materials should not end but rather undergo a sequential reintegration into cycles schematically represented in figure xx. Finally these biographies of resources and materials have to be considered in a broader framework of contexts, i.e. in terms of different living standards and lifestyles.

4.2 The Schesiology of resources and materials

Schesiology is the study of relationships (*schese* is derived from the Greek and means relationship and *logos* meaning reason) and their consequences. Therefore if we were to consider a mineral we might discover that its extraction required large quantities and of water. Over a long period the extensive use of the water has consequences elsewhere such as lowering the water table which in turn could affect the ground resulting in it becoming salty so that local farmers could loose their livelihood. Schesiological thinking therefore results in crossing traditional knowledge boundaries resulting in an interdisciplinary awareness. It is close to systems thinking and networks, but not quite as it might be perceived as a path through different systems or networks. These contexts should be part of the curricula of product designers, because during the planning of products the optimally efficient and maximally sustainable supply chains and life cycle strategies are effectuated.

5. Conclusion: Design for the strategic and ethical use of our resources

We hope that with such new approaches it becomes clear how we can begin to introduce students to an ethical perception and moral responsibility of our material world. All the resources we use to create security, and entertainment in our lives belong to nobody for perpetuity. Rather we are the temporary borrowers of resources and materials which must be returned, i.e. re-integrated for the use of those who come after. The author, Ian McKewan, wrote "*Climate change is difficult because it's not in our nature to perform favours for people that aren't born yet.*" McKewan's words apply just as strongly to our use of resources too.

Armin Reller
Resource Strategy, University of Augsburg,
Universitätsstraße 1a, D-86159 Augsburg
armin.reller@physik.uni-augsberg.de

Peter D. Stebbing
Basic Design, Hochschule für Gestaltung,
D-73529 Schwäbisch-Gmünd
stebbing@hfg-gmuend.de

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Panel 9
Designing for Life/ Designing for Humanity

Joo Yeon Lee and Chang Ho-ik

The Varying Design Value Spectrum in Product Design
Based on Theories of Human Needs

1. Introduction

1.1. Background and Purpose

All humans have needs that need to be satisfied at all times, and these needs vary accordingly to the circumstances of the environment and lifestyle of the individual. Human needs continued to increase and started to search for new needs, as the standards of human lives became free from the literal requirements for human survival. The same can be said for the designs of products, where consumers used to need products with only the basic function, but more and more they are motivated to want products that have more than just the basic function, but something more which can be seen as the 'design value' of the product. It is important for designers when designing a product, to know what kind of consumers they are dealing with and must fathom their needs in order to gain a successfully designed outcome.

This study investigates the theories on Human Needs as a foundation of this praxis in order to determine the design values at different stages of needs and create a template. By applying a product to be designed, to this template, a spectrum of values appropriate for the certain product will be created, and this Value Spectrum can be used as an elementary guide in the design planning process.

This design value template will provide new sources for designers to think in many different aspects, and to instill the meaning of value to the product relevant to the human needs.

1.2. Method and Scope

Firstly, a literature review on the different theories on Human Needs is preceded, but this study refers mainly to four Human Needs theories. The first is an updated version of Maslow's Hierarchy of Needs which is based on one of the first theories introduced as a basis for un-
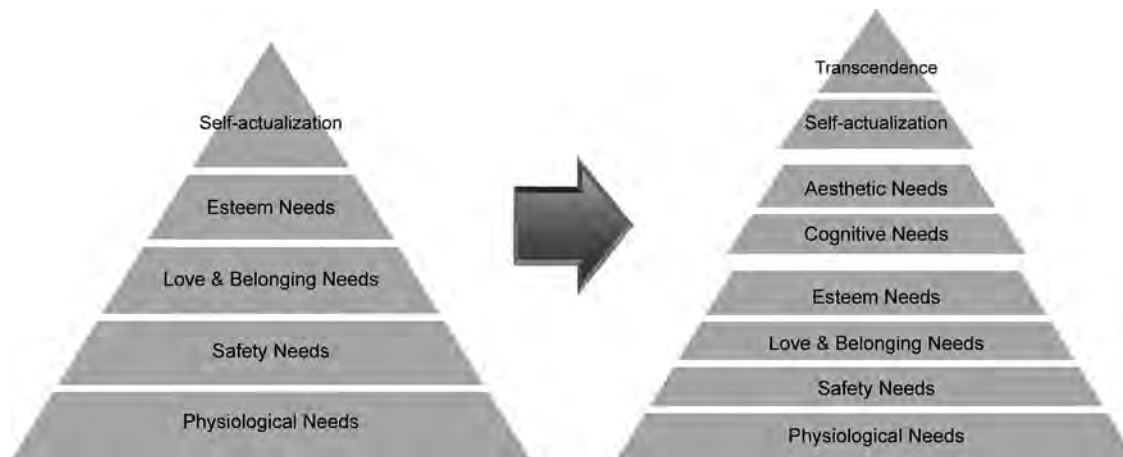
Fig. 1: Maslow's Hierarchy of Needs

derstanding consumers' motives for action. The second theory is the erg (Existence, Relatedness and Growth) Theory proposed by Clayton Alderfer, and the third theory, William James's theory, both expands from Maslow theory. The last theory referred to, is the Fundamental Human Needs which comes from the Human Scale Development produced by Manfred Max-Neef and his colleagues. Through the synthesis and evaluation of these four theories, the design values appropriate for each stages were extracted which completed the template.

A case study was then performed, applying the product to the template, to further explain how it can effectively operated for designers. The item for case study was selected from six references; Edward De Bono's Eureka – The illustrated history of Inventions from the Wheel to the Computer, Korea G-Mark, Japan Good Design, German Universal Design Competition, Red Dot Design Awards, and if Design Awards.

Through the execution of the case study, the transitions in the varying design value spectrum within the different categories were illustrated and compared, and further possible research topics were discussed for future references.

2. Theory on Human Needs

2.1. Maslow's Hierarchy of Needs
This is a theory in psychology proposed by Abraham Maslow in 1943 focusing on the growth of human needs according to the expanding range of people's lives. It was first illustrated in his book Motivation and Personality in 1954, in a five level pyramid as shown below. But in 1998, Maslow and Lowery differentiated the hierarchy of needs by specifying 2 more levels prior to the self-actualization level[1], and an additional level beyond

the original hierarchy[2] as shown in Fig. 1. Maslow refers to the first four layers of the pyramid as "d-needs (deficiency needs)" and suggests that the most basic level of needs must be met before the individual will develop a desire for the upper levels of needs.[3]

But it seems important to note that Maslow's viewpoint can be seen in a relatively subjective or objective perspective and not all people live by these values.

A physiological need is the most basic need and can is related to the concept of homeostasis, the essential needs and lacks in the body. Homeostasis refers to the body's automatic effort to maintain a constant, normal state of blood stream. An actual need in the body refers to appetites, preferential choices among foods. But Maslow mentions it is impossible and useless to make any list of fundamental physiological needs in the first place because it can come to almost any number depending on the degree of specificity of description.[4]

When the physiological needs are relatively well satisfied, safety needs emerges. Safety needs are security, stability, dependency, protection, freedom from fear, anxiety, chaos, need for structure, order, law, limits, strength in the protector, and so on. A broader aspect of the attempt to seek safety and stability in the world are seen in the very common preference for familiar rather than unfamiliar things.[5]

The belongingness and love needs also known as social needs involve emotionally based relationship such as family, friendship, and intimacy, where individuals can love and be loved by others.

The esteem needs where people desire for a stable,

1   Maslow, A., & Lowery, R. (1998). Towards a psychology of being (3rd ed.). Wiley & Sons, New York

2   Maslow, A. (1971). The Farther Reaches of Human Nature. The Viking Press, New York.

3   http://en.wikipedia.org

4   Maslow, A. H. (1987). Motivation and Personality (3rd ed.). (pp 15–16). Harper and Row, New York

5   Maslow, A. H. (1987). Motivation and Personality (3rd ed.). (pp 18–19). Harper and Row, New York

firmly based, high evaluation of themselves, for self-respect or self-esteem, and for the esteem from others. These needs therefore can be classified into 2 versions. First is the desire for strength, achievement, adequacy, mastery and competence, confidence, independence and freedom. Second is the desire for reputation or prestige (defining it as respect or esteem from other people), status, fame, dominance, recognition, attention, importance, dignity, or appreciation.[6]

The cognitive need is a need to satisfy curiosity, and have the urge to learn more and know more, hence understand and to explore.

The aesthetic need is the need to satisfy beauty, sensuous shock, delight, rightness, or perfection.[7]

The self-actualization need was a term coined by Kurt Goldstein in 1939, in his book The Organism. This need refers to people's desire for self-fulfillment, namely, the tendency for them to become actualized in what they are potentially. At this level individual differences are the greatest and in order to reach a clear understanding of this need, one must first not only achieve the previous needs, but master these needs.

The transcendent need is to connect to something beyond the ego or to help others find self-fulfillment and realize their potential.

2.2. ERG Theory
The ERG theory was introduced by psychologist Clayton Paul Alderfer in 1969, which further expanded on Maslow's Hierarchy of Needs by distinguishing three categories of human needs that influence worker's behavior. Alderfer categorized the lower levels (Physiological and Safety) into Existence, and Love and Esteem into the Relatedness category. The Growth Category contained the self-actualization needs.[8]

But unlike Maslow's theory, the ERG theory allows for different levels of needs to be pursued simultaneously.

2.3. James W. Theory
Psychologist William James (1892/1962) also hypothesized the human needs in three levels; bodily (physiological, safety), social (belongingness, esteem), and spiritual.

Bodily self seeking is all the ordinary useful reflex actions and movements of alimentation and defence are acts of bodily self preservation. This seeks not only the development of the bodily Me, but that of the material Me.

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6   Maslow, A. H. (1987). Motivation and Personality (3rd ed.). (pp 21). Harper and Row, New York

7   Maslow, A. H. (1987). Motivation and Personality (3rd ed.). (pp 43). Harper and Row, New York

8   Alderfer, C. P. (1972). Existence, Relatedness, and Growth; Human Needs in Organizational Settings. Free Press, New York

Social self-seeking is carried on directly through our amativeness and friendliness, our desire to please and attract, notice and admiration, and indirectly through whichever of the material self-seeking impulses prove serviceable as means to social ends. Spiritual self-seeking includes every impulse towards psychic progress, whether intellectual, moral, or spiritual in the narrow sense.[9]

2.4. Fundamental Human Needs
Fundamental Human Needs matrix was created by Manfred Max-Neef and his colleagues Elizalde and Hopenhayn in 1991 and made their book: Human Scale Development: Conception, application and further reflections. In this theory, Human needs are understood as a system and that all human needs are interrelated and interactive. With the sole exception of the need of subsistence, to remain alive, no hierarchies exist within the system. On the contrary, simultaneities, complementarities and trade-offs are characteristics of the process of needs satisfaction. In reflecting on the nine fundamental needs proposed in the book, common sense, along with some socio-cultural sensitivity, surely points to the fact that the needs for Subsistence, Protection, Affection, Understanding, Participation, Creation and Leisure have existed since the origins of homo habilis and the appearance of homo sapiens. At a later stage of evolution, the need for Identity and Freedom appeared.

They organized the human needs by combining 2 axes; the demonstration of interaction on the x-axis as existential (Being, Having, Doing and Interacting), and the y-axis as axiological (Subsistence, Protection, Affection, Understanding, Participation, Creation, Leisure, Identity and Freedom) as shown in Table 1.

2.5. Synthesis of Human Needs
The four exemplary theories investigated above have been integrated together to see the comparisons between them. From studying these theories, the following were the noticeable findings.

Based on Maslow's theory, the other theories represented similar needs that developed from the main priority to survive, then to wanting a sense of belonging and social relationships, and then to wanting a sense of self.

ERG theory simplifies Maslow's hierarchy into three levels, effectively expressing the status of one self.

The theory by James W. can be most naturally translated as the influence in product design to Humans; product design provided physical supplement(material value) for the human needs, then gained social supplement(value to society)from products, followed by spiritual supplement.

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9   James, W. (1892/1962). Psychology: Briefer course. Collier, New York. (pp.165–167)

Needs according to existential categories

Needs according to axiological categories	Being	Having	Doing	Interacting
Subsistence	Physical health, mental health, equilibrium, sense of humor, adaptability	Food, shelter, work	Feed, procreate, rest, work	Living environment, social setting
Protection	Care, adaptability, autonomy, equilibrium, solidarity	Insurance systems, savings, social security, health systems, rights, family, work	Co-operate, prevent, plan, take care of, cure, help	Living space, social environment, dwelling
Affection	Self-esteem, solidarity, respect, tolerance, generosity, receptiveness, passion, determination, sensuality, sense of humor	Friendships, family, partnerships, relationships with nature	Make love, caress, express emotions, share, take care of, cultivate, appreciate	Privacy, intimacy, home, spaces of togetherness
Understanding	Critical conscience, receptiveness, curiosity, astonishment, discipline, intuition, rationality	Literature, teachers, method, educational policies, communication policies	Investigate, study, experiment, educate, analyze, meditate	Settings of formative interaction, schools, universities, academies, groups, communities, family
Participation	Adaptability, receptiveness, solidarity, willingness, determination, dedication, respect, passion, sense of humor	Rights, responsibilities, duties, privileges, work	Become affiliated, co-operate, propose, share, dissent, obey, interact, agree on, express opinions	Settings of participative interaction, parties, associations, churches, communities, neighborhoods, family
Leisure	Curiosity, receptiveness, imagination, recklessness, sense of humor, tranquility, sensuality	Games, spectacles, clubs, parties, peace of mind	Day-dream, recall old times, give way to fantasies, remember , relax, have fun, play	Privacy, intimacy, spaces of closeness, free time, surroundings, landscapes
Creation	Passion, determination, intuition, imagination, boldness, rationality, autonomy, inventiveness, curiosity	Abilities, skills, method, work	Work, invent, build, design, compose, interpret	Productive and feedback settings, workshops, cultural groups, audiences, spaces for expression, temporal freedom
Identity	Sense of belonging, consistency, differentiation, self-esteem, assertiveness	Symbols, language, religions, habits, customs, reference groups, sexuality, values, norms, historical memory, work	Commit oneself, integrate oneself, confront, decide on, get to know oneself, recognize oneself, actualize oneself, grow	Social rhythms, everyday settings, settings which one belongs to, maturation stages
Freedom	Autonomy, self-esteem, determination, passion, assertiveness, open-mindedness, boldness, rebelliousness, tolerance	Equal rights	Dissent, choose, be different from, run risk develop awareness, commit oneself, disobey	Temporal/spatial plasticity

Table 1: Fundamental Human Needs matrix. Max-Neef, M., Elizalde, A., and Hopenhayn, M. (1991). Human Scale Development: Conception, application and further reflections. (pp.32)

Theory	Maslow	ERG	James	Max-Neef
	Physiological	Existence	Material	Subsistence
	Safety			Protection
	Love/Belonging	Relatedness	Social	Affection
	Esteem			Understanding
Levels	Cognition			Participation
	Aesthetic	Growth	Spiritual	Leisure
				Creation
	Self-actualization			Identity
	Transcendent			Freedom

Table 2: Synthesis of Human Needs

The theory by Max-Neef and others can be seen as the relationship between the human and product design. It shows the growing significance of product design and in the relationship between product design and humans and their lifestyle.

But as mentioned previously and worth emphasizing, is that apart from Maslow's theory, the others do not have a hierarchy within themselves and proves there is no certain order and humans can develop the need for higher needs regardless of whether the lower needs are reasonably satisfied.

2.6. Designing for Human Needs
In the process of designing a certain product, it is essential for designers to acknowledge the needs of the people for whom it is for which is the reason the previous chapter synthesized the exemplary Human Needs theories. Through this synthesis it was evident that each level of human needs sought different needs which also apply to the products needed. Even when designing the same item, the values vary according to the human needs in different levels, while a primarily focused value exists in the item itself. The outcome of this is referred to as the 'Design Value Spectrum', which is beneficial to the design planning stage.

3. Significance of Value in products

3.1. Definition of Value
Value is a property of objects, including physical objects as well as abstract objects, representing their degree of importance. It can be distinguished in 2 different concepts; philosophic value and economic value. But because everyone's viewpoint on value develops differently according to their environment, no specific value can be said to be more valuable. For example, when looking at an item, philosophic value can be regarded as more important where a priceless product is passed onto the next generation, or as an environmentalist, thinks the sustainable value is more important. Economic value can be regarded more important where a product is worth the value of its price, or in some cases, aesthetic value might be most important.

Therefore, the design values of any item are numerous, creating a spectrum of design values which can be used to explore the hidden needs of humans and to find the possibilities to create new design values for products.

3.2. Design Value
Design Values in this study are extracted in reference to the Being, Having, Doing, and Interacting in Max-Neef's theory which is construed as the most adaptable to the relation between human and products.

The design values in the subsistence level are based on the basic essential functionality of the product representing the pure purpose of its existence which counts for all products, for example, the essential value of a cup is for containing liquid to drink, and a car is to get to another place. No matter how wide the value spectrum expands for the item, all products cover the subsistence level, even an artwork require the main purpose to pleasure the eyes.

The design values in the protection level focus on products dealing with safety issues, such as emergency equipments which need to operate reliably and accurately, and products for infants which need to be hygienic and safe for infants to be around, and kitchen appliances which need to be accessible and usable. The products focusing mainly on this level may expand over other sub-levels but not necessarily all levels.

The design values in the affection level focus on products which form meaningful attachment by stimulating

Human Needs	Design Value	Design Category	Products
Subsistence	Basic essential function	Most products in general	Products necessary for food, clothing and shelter. (Lighting, cup, refrigerator, telephone, pen, heater, vacuum cleaner, bike, car, etc)
Protection	Reliable, security, usability, Life supporting, accessibility	Life supporting design, Design for Infants	Products that provide safety. (Medical device, baby car seat, food processor, fire extinguisher, etc)
Affection	Attached design, meaningful, curing, humorous, design related to nature,	Humorous design, Nature related design	Products related to living things such as pets and plants, which provides affection, memories, and humor. (Hug salt & pepper shaker, Alessi corkscrew, etc)
Understanding	Human-centered, intuitive, simplification	Medical design, Human-interaction design	Products that delivers and provides information and knowledge. (Computer, Electronic Dictionary, remote control, Smart phone, etc)
Participation	Sustainable, universal design, design considering society, disabled, third world, minority	Public design, Universal design, Social design, Design for disabled, Design for the third world	Products providing consideration to the society and environment. ($100 laptop, life straw, hippo roller, wheelchair, public bathrooms, bench, public transport, Moscardion Sporks, etc)
Leisure	Entertaining, well-being, play, relaxing	Game, music, hobby, sports	Products that provide entertainment and leisure. (Gaming device, Lego, audio, mp3 player, musical instruments, etc)
Creation	Creativity, unique, individual	DIY, reform design, one-off product, handcraft	Products that provide individuals to express creativity. (Art, DIY furniture, pottery, self-designed products, etc)
Identity	Personal aesthetic value, self reflection, customized design, symbolic design	Collection, limited edition	Products which express self-individuality. (Personal valuables, car, headphone, mobile phone, china collection, paintings, home ornaments, etc)
Freedom	Free from needs, problem solver	Continuously developing products in function, aesthetics and targets.	Products that provide for new needs that arises.

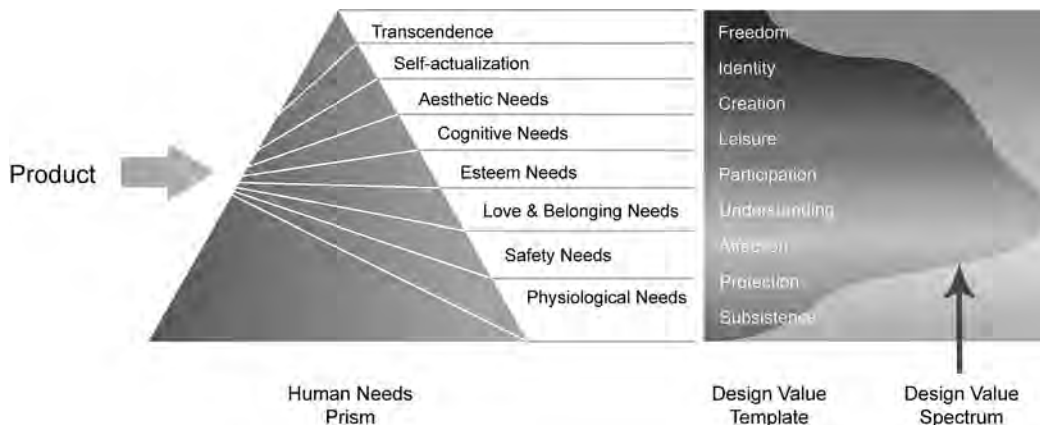**Table 3:** Design Value Template

Fig. 2: Design Value Spectrum Model

the user's memory or nostalgia. It also includes products supporting the psychological being, whether in humorous form, or concepts related to nature.

The design values in the understanding level focus on products where intuitive human interaction is important, especially in the areas involving high technology such as smart phone, and digital devices, as well as medical equipments where the understanding and accurate operation and is vital.

The design values in the participation level focus on products pursuing the social issues as well as the environmental issues.

Social issues involve considerate design for the society such as the disabled, elderly, third world, to help these people to be more dependent, mobile, and mostly comfortable. And environmental issues is being able to recycle or to reuse for another purpose, consider the materials being used to be earth friendly, and also energy saving.

The design values in the leisure level focus on products that are used for playing and enjoying, such as sports equipments, games, toys, and musical instruments, etc. Products involved in this level pursue relaxing factors which can be free stress.

The design values in the creation level focus on products that can be created in its own way by the user, through DIY (Do-It-Yourself) products, or reforming a current design into something new, especially making a one-off product that is individual.

The design values in the identity level focus on products that represent and reflect the user's identity. This level somewhat overlaps with the design values mentioned in the creation level, but it may be to show others more than for self satisfaction, and to display personal aesthetic qualities to others. These products include collection, or limited edition items, that have values in itself, or can it can be a symbolic item which has an inherent meaning to show self identity.

Finally in the freedom level, is to be free from all values. Design values do not exist in this level because all is satisfied and nothing more is needed. But as time passes, other needs will be needed again and so the cycle will evolve continuously. This level also includes the belief that Buddhist, Bop-Jung asserted on 'non-possession', which is being free from all materialistic possessions

As mentioned above, the design values are listed according to the 9 human needs level, along with appropriate product categories and examples of products. Table 3 shows the completed 'Design Value Template', which can be used to build the Design Value Spectrum introduced in the next chapter, 4.

4. Introducing the Design Value Spectrum

4.1. Significance

By using the completed Design Value Template explained in the previously chapter, it will provide designers with a general guide as to what design values may be required for the specific product they are planning on designing. This general guide of design values created for every product builds a Spectrum of design values, which can be used as a valuable design resource, referred to as an essential part of the design planning process.

4.2. The Design Value model

The model shown in Figure 2 indicates how the Design Value Spectrum is extracted. The Product to be designed is processed through the Human Needs Prism consisting of eight levels of The Fundamental Human Needs, which then radiates the scope of the Design Value Template. Within the range of the Template, the different levels of design values are measured by a dispersion which creates a Design Value Spectrum for a Product. Over many measures of different Products, many spectrums will be created for valuable purposes.

5. Case Study

5.1. Product Selection Criteria

Prior to executing case studies using the design value template, product categorizations were compared and listed in order to find the most exemplary product category. A common product category was made in reference to Edward De Bono's Eureka-The illustrated history of Inventions from the Wheel to the Computer, Korea G-Mark, Japan Good Design, German Universal Design Competition, Red Dot Design Awards, and IF Design Awards. The common product categories were Transportation, Communication and Living Goods out of which the refrigerator from the Living Goods category was considered the most appropriate to apply as a case study.

The refrigerator was predicted to be a product which possessed design values that distributed most evenly throughout the design values spectrum, hence creating an exemplary case study. It is an item used by almost everyone and has a diverse multi-functional usability in the domestic, commercial, outdoor areas, etc, and does not rely entirely on the technological factors.

5.2. Evaluation on Refrigerators

5.2.1. SUBSISTENCE

Refrigeration method was invented by Jacob Perkins in 1834, who described in his British Patent Specification of the vapor compression cycle in which cooling was produced by the evaporation of volatile fluid, while

constantly condensing such volatile fluids and bringing them again into operation without waste.

But it was not until 1862 in the International Exhibition the first refrigerators were marketed, inspired by James Harrison to bring Australian meat to Britain[10]. It was also enabled surplus produce to be stored against times of famine. Figure 3.1 shows the image of a general refrigerator used in homes to store food. All refrigerators, whether they are portable, used commercially, or are energy efficient, or expensive, have the same basic purpose which is to protect food or other materials that is needed to live on.

5.2.2. PROTECTION

Protection of the food was an area that almost all refrigerators focused on as it is related with the subsistence factor. The commercial refrigerators shown in Figure 3.2 was seen as an appropriate example because its purpose is to preserve the temperature of certain foods while on display, in order to protect them from spoilage and to keep them fresh and cool for consumers.

Another significant example would be the creation of the rubber door seals used on doors which was acted upon The Refrigerator Safety Act in 1956 to prevent children hiding inside and being locked in because of the previous latch that could not be opened from the inside.

5.2.3. AFFECTION

Mini refrigerators shown in Figure 3.3 are produced to store products that people would like to store separately from the other foods such as special drinks such as alcohol, cosmetics, milk next to the espresso machine, etc. It is flexible to many personal purposes and is handy to connect to power at the same time carry around to use as a mini icebox.

5.2.4. UNDERSTANDING

Clinical refrigerators as shown in Figure 3.4 are used to store human organs, blood, and other chemicals for surgical operations and experiments. It is essential for these refrigerator functions to be intuitive to operate and safe to use. The only appearance that is important is the safety of the materials used and the control areas which needs direct notification when it is not operating properly.

5.2.5. PARTICIPATION

Oz by Electrolux Zanussi shown in Figure 3.5 was produced in 1998, the first fridge to break away from the conventional cube form made of metal, Oz uses Bayer-grade polyurethane which is flame-retardant and can have open cell and crushable foams to closed-cell

rigid forms[11]. It uses the same materials for the thermal insulation, the polyurethane injected foam[12] which makes recycling much simpler.

Another example focused on participation factors would be the energy saving refrigerators and the ones with transparent doors placed in homes and commercial areas where you can see inside without having to open the doors. Also there the home bar system which is a small opening in the front door to approach frequently used foods such as milk, water, etc. The placement of the small opening is placed so that children can access it comfortably. Also the opening saves unnecessary energy waste through cold air leaking from the fridge compartment.

5.2.6. LEISURE

This cooler as shown in Figure 3.6, is a cordless cooler used outdoors at a picnic or a party to keep the drinks chilled in ice while providing a cocktail table on the surface. There are many refrigerators focusing on the leisure purpose such as portable iceboxes, mini fridges, and car fridges.

5.2.7. CREATION

A modular refrigerator shown in Figure 3.7 is a concept designed for the Electrolux Design Lab competition 2008 by a student named Stefan Buchberger. Designed for people sharing a flat, the concept allows you to use the fridge the way you wish without having to deal with others and are able to keep your food separate from others so it is safe.

5.2.8. IDENTITY

The luxury fashion brand Gorenje produced a limited edition refrigerator shown in Figure 3.8 crystallized with Swarovski. Gorenje has tried to make it rather unique with only 10 planned to be sold. It has attracted consumers who have the desire to show off their products as part of their identity, both personally and socially. It will have new touch control screen mounted at eye-level on the fridge door which will show settings, warnings and serve as a built-in radio, recipe book and voice memo recorder-player.

5.2.9. FREEDOM

There are no refrigerators that can free anyone from all the needs that human have. There are always constant needs to satisfy. But compared to the general refrigerators placed in homes, human needs have advanced refrigerators to be produced according to the commercial locations, and needs have developed portable refriger-

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10 De Bono. E. (1974). Eureka, How and When the Greatest Inventions were made. Thames and Hudson, London.

11 Lefteri. C. (2001). Plastics. Materials for Inspirational Design. RotoVision, UK.

12 http://www.bpf.co.uk/plastipedia/plastics_history/default.aspx

ators, and refrigerators in various sizes and purposes such as clinical, cosmetic, etc.

6. Creating the Design Value Spectrum

6. 1. Outcome of Design Value Spectrum

The images shown above were each processed to extract a Design Value Spectrum to show how the process is used. Each product was evaluated relatively according to equal measurement, with each spectrum displayed in an enneagon shape to clearly show the priority of the design values and the comparisons of the different products shown in Figure 4.

6.1.1. GENERAL REFRIGERATORS

General refrigerators showed strong design values towards subsistence and protection, and participation. Subsistence and protection is an essential design value for all refrigerators as mentioned previously. Participation was also considered an important design value because it is used daily by everyone around which means the human factor for disabled, children, and elderly need to be thought through.

Affection, leisure, and creation seemed the least important design values in the general refrigerators. But nonetheless to some people, it is considered a significant possession that will reflect their identity.

6.1.2. COMMERCIAL REFRIGERATORS

Other than the essential design values of subsistence and protection, commercial refrigerators showed strong design values towards understanding and participation because the commercial refrigerators rely on technology and is important to be energy efficient, easy to operate and use rather than having an attractive external appearance which will have counter result and distract the attention with the products displayed inside.

In this case, the affection, leisure, creation, and identity were low on significance. Freedom values were considered slightly higher for the freedom it provided to purchase cold, fresh products instantly in stored and other various places.

6.1.3. MINI REFRIGERATORS

Mini refrigerators were used in less fatal environments which lowered the subsistence value slightly compared to the previous two products. It is one of the most personally used refrigerators which is why it has high affection design values and also quite high on identity, leisure and creation compared to the understanding and participation design values.

6.1.4. CLINICAL REFRIGERATORS

Refrigerators for healthcare and medical purposes rated highly in understanding and participation design values as well as the essential subsistence and protec-

tion design values. The safety in protecting the products stored in these refrigerators were considered to be crucial while the identity, creation, leisure hardly showed any significant design value. Freedom was rated higher for its development to save people's lives and the medical research.

6.1.5. FOAM REFRIGERATORS

Foam Refrigerator was first produced in the late 1990s as an environmentally friendly manufacturing approach. For this reason it was rated highly for the participation design values and with its organic surfaces unlike the most refrigerators we see, the affection design value was also taken as significant and because of its appearance, the identity design value seemed to have the same significance.

6.1.6. OUTDOOR REFRIGERATORS

This leisure oriented refrigerator emphasized the leisure and identity design values followed by creation, freedom and affection design values. Subsistence, understanding and participation seemed not so significance because this product did not rely on the technical side as much as the others such as the clinical or commercial refrigerators. The identity of the product seems important because it is for social gathering and the product needs to have a pleasing appearance.

6.1.7. MODULAR REFRIGERATORS

The creation design value was considered most valuable for this modular refrigerator as the usage can be created personally by each user which gives identity and affection design values equally important. And the participation design value is also high for its function for many people to use it together to their own taste. It also has high values for subsistence and protection because it functions as a normal fridge.

6.1.8. LIMITED EDITION REFRIGERATORS

This refrigerator is mainly for display, for the satisfaction of the owner which can involve showing others. This is the reason why the identity design value was seen as most significant for its limited edition model. The expensive price consists of the brand name value and also the expensive materials used rather than the technology is the reason why the subsistence and protection design values were rated lower than the affection design values.

7. Conclusion

It is clear that the human needs towards products have diversified and personified, from initially needing the essential function-oriented products, people now are requiring products with values in the psychological aspect. Therefore, this study was proceeded to find a way to help define the design values for the different prod-
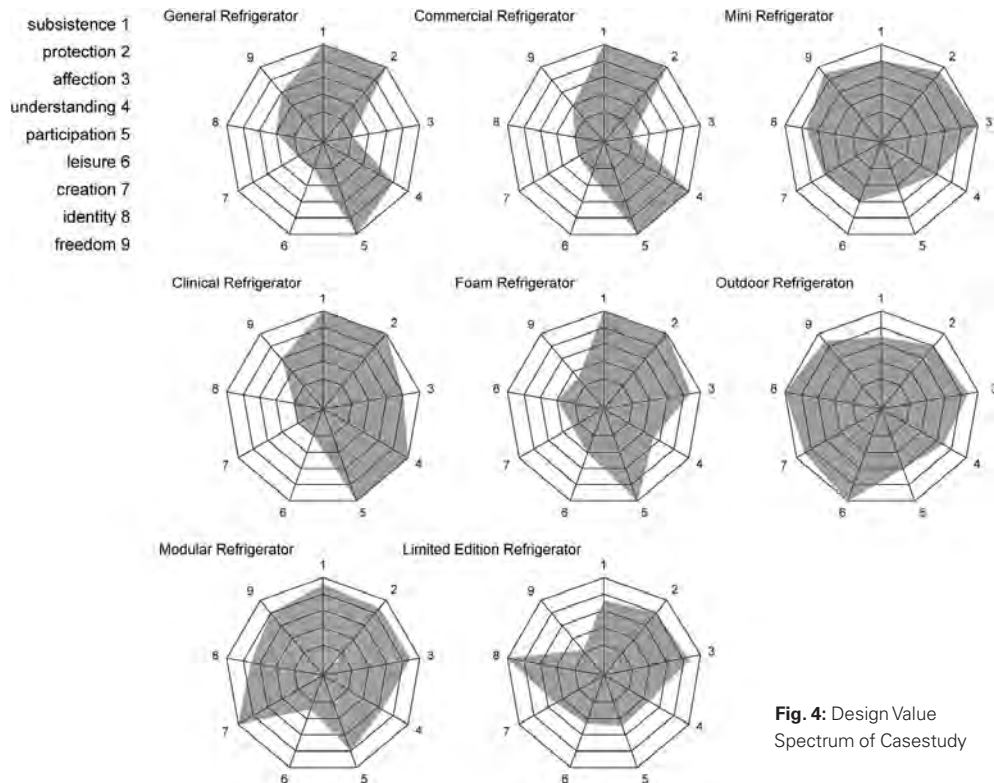
Fig. 4: Design Value Spectrum of Casestudy

ucts according to the human needs to guide designers in the designing process.

The procedure executed in order to define the specific design values for different products was developed into three steps.

Firstly, the level of human needs was explored throughout the various human needs theories out of which The Fundamental Human Needs theory seemed most relevant and was applied to organize the human needs into 8 levels to create the Human Needs Prism.

Secondly, the design values were measured for each human need levels with reference to the definitions in the Being, Having, Doing, Interacting matrix.

This measurement of the Design Values created the Design Value Template which is the tool the product to be designed is processed through in order to create the Design Value Spectrum.

Finally, a Design Value Spectrum is formed to indicate the dispersion of the design values for the product to be designed.

The proposed model through this study creates design values spectrums, and the results of multiple Design Value Spectrums gathered over time, will become a valuable resource for designers not only in the design planning stage, but also the spectrum can be useful for finding new markets for the products which the design value spectrum have not yet reached, and can be used as a tool for positioning similar products compare and distinguish the various design values.

Joo Yeon Lee
Chang Ho-ik
Doctoral Researcher,
Industrial Design,
Seoul National University, Korea
tldesign03@hotmail.com

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Ajanta Sen and Pravi Poovaiah

Innovation as a matter of 'cultural losses' in a globalised world

the need for a framework for pres-
ervation – the case of India

(I) Introduction – the narrowing of the
contours of innovation and an emerging
need for an alternative perspective:

From its broad intent as the " successful application of
knowledge or techniques in new ways or for new pur-
poses" (Bellon & Whittington, 1996), innovation today
has shrunk to the idea of an opportunity or lever to push
the profit line, narrowing down its playing ground to en-
tities that can pulsate as price-bearing commodity in
the marketplace.

The excitement of expecting something unexpect-
ed or different especially because it adds great value
is only secondary to whether this 'value addition' is ac-
companied by its monetization into profits. The litany
of books on the subject will attest to this.

In one of them, 'The Game Changer' (Charan and Laf-
ley, 2008), its authors (one, an erstwhile faculty at Har-
vard Business School, the other, the head of P&G) talk
about being able to create the "right initial conditions,
viz., people, purpose, environment." Which means, rec-
ognizing that "people are creative by nature (and) it is
part of being human". Organizing around such an ob-
viously known condition should have been a given. But,
there is something in the outlook for innovation in a big
ticket, techno-centric industry that makes this simple
matter an extraordinary revelation, and gets specifically
earmarked to be taken up as a "challenge".

The authors cite as an example of inspiration the
"edgy and bohemian neighborhood" that goes by the
name Over-the-Rhine, located in Cincinnati, and its even
edgier converted brewery on Clay Street, which "looks
like a combination of think tank and playground" – not
quite the standard P&G atmospherics, they admit.

Here, at Clay Street, while whiteboards and comput-
ers share space with crayons and chalkboards, with "peo-
ple sitting around telling stories" and providing the per-
fect grist for out-of-the-box thinking, all this inspira-

tion continues to remain strictly about a unique "ap-
proach" for P&G to connect with its customers.

However, Procter and Gamble's (P&G's) repertoire
of FMCG's, with their not very significant connect with
people's lives and everyday difficulties, can make all
this talk about innovation somewhat of an overkill.

The larger point here is as follows: because innova-
tion thus defined by a marketplace paradigm may or
may not resonate with the larger good of the larger num-
bers – a good subtext for social engineering – or even
benefit those outside of a P&G-driven FMCG ecosystem,
who is to implement innovations that are, for instance,
deeply beneficial to:

A. those on the margins of society's mainstream: (such
as farmers faced with drought in Africa or in India
may have no use for Napster, no matter how novel or
popular this contraption for music may be with the
urban youth); or,
B. those with special needs (such as children afflicted
with cerebral palsy, who could benefit from a special-
ized product that helps them with their otherwise in-
coherent communications over even routine every
day affairs, frustratingly difficult)

The fact is that product efforts to fill these critical needs-
gaps are often thwarted with P&G-styled high entry bar-
riers of competition into markets already heavily biased
in favor of 'mainstream needs gaps' (consumer prod-
ucts). With the odds stacked up high against solutions
that may be little known but are highly innovative and
contextual by nature, and profoundly beneficial to the
kind of users mentioned earlier. For design, this is a
holy grail – design for a purpose; design for all.

This raises the question: *can there be an alternative
perspective that will expand this shrinking space* to ac-
commodate all the different faces of innovation, know-
ing the role played by innovation and its intermediation,
viz., design, in furthering the quality of life, while at a
higher level shaping the face of civilization itself? And
be able to include innovations that may not have the
potential to be part of the profitability ecosystem but
are, nonetheless, of great value to society. And, by keep-
ing them underground, one is indirectly threatening
to exclude their 'audiences'/potential users in need of
these innovations but not in a position to afford new
ideas and products at 'commodified' prices.

Further, as innovation continues to gain currency
within the industry to become a rallying point around

this singular idea of "organizing a business to exploit new opportunities profitably," there remains yet another subtext to this issue of exclusion. And that is the presumably seminal position assigned to *technology* by an overtly innovation-for-profit industry – a slant that completely undermines an earlier premise that used to maintain that: "innovation is for all businesses whether using high technology or not" (Bellon and Whittington, 1996)

It would then appear that most innovations thus defined today, (i) apart from being located within the market economies, are (ii) specifically designed around the use of technology – to be differentiated from innovations that are approached through but not necessarily defined by their technologies, especially if these were low-grade, highly localized and immersive technologies originating from outside the market economies.

It stands to logic, therefore, that this narrowed down outlook for innovation that centers around technology and the markets can hardly accommodate innovations from far flung cultures that still remain outside the pale of marketization for all kinds of reasons, or innovations for special interest groups not always blessed by the laws of average that favor profit-making target group consumers required for building marketplace innovations.

The search for an alternative perspective, while squarely challenging the notion that those with a technological edge are the ones really innovating, needs imperatively to be premised on the concern that innovations outside technologies and profit-making will thus continue to evade our attention, and could hence beg an emerging need to broaden and redefine the real locus/intent for undertaking innovation as an activity. The question, therefore, is: *why has innovation, when not 'defined' by technology, moved away from our radar? And how do we bring this back into our line of vision?*

(II) The modern inflection point
for innovation – globalization:

Since times immemorial, innovation has originated and functioned in spaces or among various constituencies, whether aided or unaided by market mechanisms. The reason why the issue has only now come to head and even gained momentum is that, regions defined by different market-paradigms and hitherto separated from each other by physical distances/geography as well as by economic ideologies, have started to overlap through the networking technologies, resulting sometimes in a convergence of shared ideas about economic systems through either adaptations or assimilation of each other's ideologies and interests, or sometimes in complete mergers of disparate economic areas

The new inflection point for this, of course, is globalization, a highly contested idea in itself, as Steger (2003) maintains, and "defined as the intensification of worldwide social relations which link distant localities in such

a way that local happenings are shaped by events occurring many miles away and vice versa" (Giddens, 1990)

It is in the 1990's that one had occasioned a shift of the markets (called mature markets) from the West faced with a demand saturation from its consumers, to the new emerging markets endowed with large internal captive demands. Located largely in the East and the South these were held together in a loose geo-political collective now termed the BRICS nations: Brasil, Russia, India, China and South Africa, but also including Indonesia, Sri Lanka and some relatively smaller countries.

This overlap between the market-types had obviously seen the primary agents of the mature markets, viz., the MNC's (multinational corporations) and their smaller versions of industrial outfits initially 'ship' out their established innovations from their parent locales to the adopted ones. And then, being witness to many of these transported innovations failing to take local roots, had since begun to invest in setting up 'innovation centers' in their host countries to build localized solutions rather than ship in pre-made innovations, often devoid of contexts. Examples of companies that have set up shop in India with local innovation intent are Yahoo, IBM, HP, Google, MicroSoft Research (MSR) and Whirlpool among others.

It soon became evident that the emerging/new markets were clearly defined by rules beyond those of profitability, consumerism or the ease of spending with plastic money. The net result: recognizing the need for new rules of engagement.

So, what does this setting up of 'localized' branches of innovation augur for the times ahead? Is it enough to be franchises of one's offshore parent companies? Or, is there a transformative vision required to make these localized 'innovation centers' work? Making the need for building organizations from scratch that are able to capture the local spirit of innovation very critical. *And, could this require new rules of engagement with the adopted countries? If so, then what should that emerging frame of reference for innovation be?*

Before undertaking these questions, it is important to acknowledge recognition by votaries of globalization, of the range and diversity of the character of innovation itself. Tom Peters (20..) from Harvard Business School and Tom Kelley (2007) from IDEO allude to innovation's variegated nature, respectively, as the 'circle of innovation' and the 'ten hats of innovation'.

More pertinent to the subject of this paper is the manner in which Geoffrey Moore (2005) has identified the unfolding of innovation types according to their theatres of play. Accordingly, there can be different kinds of innovations depending on whether they are located in (i) growth markets, (ii) mature markets, or (iii) the declining markets. Moore's classification of innovations according to markets is important because it suggests that markets do not exist in a vacuum. Apart from their

more obvious association with their respective econo-my-types (indicating stages of economic progress: developed, developing, underdeveloped, etc.,), markets are concomitant with a larger set of dynamics – often overlooked – viz., that they are located within certain types of societies. And societes essentially encrypt the way people behave and evolve.

It could be a reminder that innovation is perhaps less labored and more easily achieved when it is not divorced from one's way of life, and when innovation becomes a part of one's cultural matrix.

This interplay between economy and society, and implicit within it the role of cultural mindsets in understanding business – a factor for long ignored by businesses – came to a head early on in this decade. The realization (pointed earlier) that markets, up until, now had pretty much worked as independent entities and remained contained within their respective geographies and were now increasingly getting interconnected through globalization brought in new ways of thinking.

One of them was Thomas Friedman's 'The World is Flat' (2006) and its advocacy of a flattened world through the idea that information technology as a driver could leverage complementarities of interests (such as, shortage of skilled labor in an industrialized environment being compensated with availability of the same in less industrialized-developing economies without having to move too much around physically – a mechanism of exchange called arbitraging).

While arbitrage of labor, commodities and currencies facilitated a seamless flow of business factors across the national boundaries, it also had the effect of flattening out cultures through a convergence of business interests across economies and geographies and an unfortunate *mainstreaming of cultures* termed by American sociologist George Ritzer (1993) as, the MacDonaldization of the world – "the imposition of uniform standards that eclipse human creativity and dehumanize social relations". And naturally decried among others by Robert Redford, that intrepid activist speaking out on behalf of those on the margins – including for the vanishing forests and whales in California – to be "just ever more costly, more formulaic, more cluttered with special effects." (Peters, 1997/ The Circle of Innovation) As part of the world of the motion pictures, Redford's reference to special effects cannot be lost on the reader.

It is significant that by at least one account, "globalization would refer to a multidimensional set of social processes that create, multiply, stretch, and intensify worldwide social interdependencies and exchanges while at the same time fostering in people a growing awareness of deepening connections between the local and the distant."(Steger, 2003).

So, whichever way one chose to see this, implicit in intense mainstreaming had always remained the sug-gestion of the interplay between markets and their respective societies, with one of the most important fallouts of this interplay being the accrual of *'cultural losses'* and bringing us back to our search for an alternative perspective with our original question: why have innovations from outside of the markets gone off our radar?

(III) Differential perspectives on innovation driven by differing 'worldviews' as a function of the evolutionary contexts of societies – a historical narrative:

To get answers, we may need to look at innovation retrospectively against the backdrop of society's evolutionary context.

A good starting point would be the recent dawning upon the West in its forays into the emerging markets, that, while broadly speaking their approaches to innovations, as indeed to many other aspects of their lives, is mediated through technology. By contrast, the activities and outlook of their host countries seemed deeply mediated by cultural factors.

Does this mean that the mature markets remained the sole locations of technology while the host countries (the emerging markets) became the sole repositories of culture? While, on the face of it, each of these locations may seem to have been the arbiters of one or the other, viz., of technology or of culture respectively. The truth lies in the way societies had evolved since their earliest times. And through it, had wrought the crystallization of their respective *worldviews* – literally the way in which each society chose to view the world around it. How did societies come up with distinct worldviews?

As it happens, all societies, without exception, have evolved through an interplay of a set of factors termed as modes of production – where resources (made up of both natural and human capital) interacting with technology helped society function. In the process, each society carved out its specific relations between its resources, technology and production modes in a complex amalgam that is termed production relations. It meant that, societies by virtue of social organizations evolved culture, and by virtue of their enabling tools of trade, evolved technology.

Along the way, while some societies forged ahead by viewing their growth through the prism of technology, particularly the Western societies in the 18th century onwards, shaped by their Age of Enlightenment, the progress of the sciences, and the arrival of the Industrial Revolution. Others moved ahead by viewing progress as being a function of the preservation of the complex nature of social organization and man's relations with nature.

The original universal nature of technology and culture thus got mediated through the historical behaviors of societies, whereby

I. in one, Man became central to a society's identity and Nature made subservient to Man. With a deep belief in technology's capability to subdue and control Nature, most activities became technologically determined. In time, mechanical properties as an outcome of technology became preponderant to the articulation of society's needs - with machines representing speed, built structures representing size, print and transportation advancements representing mobility.

And overall, the conquest of lands and people through this force of technology seminal to its identity, helped bring in further resources and commodities from far flung places to aid their already stocked up materials mechanically manufactured internally. This sense of making with machines as well as transporting more and different ones from distant locations became part of its culture's manifestations;

II. in other societies, where Nature remained at the center of its identity, society mediated its existence by deferring itself to what was reasonably within the limits of Man's own capabilities, with some help from technology but without any attempt to let technology become an overriding factor.

Man carved out an identity by viewing progress as a function of the factors of social organization such as language and culture, with everything else – tools of technology included – becoming secondary to this larger human purpose of existence. Thus defined by cultural factors that included interactions with everything around him/her, including or especially Nature, the tools of articulation showed up as being human-driven manifestations – the arts, the crafts, the vernacularly built spaces – all with local resources, animal and water-driven modes of transportations, local sources of energy, with a considerable imprint of Nature on man, or at least man working with Nature, and building the mechanisms required to mitigate as smoothly as possible, Nature's calamities from time to time – all in all, an attitude that remained deeply underscored by a sense of acceptance of the violent cycles of Nature.

Consequently, the human protocols thus developed have had to be complex enough to decipher and intuit the workings of Nature, thus enabling society to help preserve the many cultural and physical facets of its life, as reflected in its visual, oral and performance cultures such as in the arts, the crafts, its communications, the mythologies and its storytelling, respectively.

The end result across a human civilization spanning 11,000 years has seen the evolution of broadly two types of societies adhering to two distinct worldviews:

1. the culturally-mediated societies/Society-type I (s1c), and

2. the technologically-mediated societies/Society-type (s2t)

While historians from India in a line of Marxist tradition (Thapar, Kosambi and others), or those based abroad with a development outlook (Bhikhu Parikh, Amartya Sen and others) have attempted to portray the nature of such societies as being humanistic but not just human-centric, s1c type societies are often misunderstood as being regressive and living in the past. The fact remains, however, that India, for instance, continues to be home to some of the earliest living indigenous cultures of the world in coexistence with its IT and other industrial landscapes of today. And which should speak volumes of the complexity of the nature of such parallel existences, and the mindsets required to deal with these parallel worlds of realities.

In such a situation, it becomes important for cultural historians to recognize that globalization, whether we like it or not, is today "at the heart of our runaway world, (and) it means that in many respects we now share a common fate" (Giddens in Nandy ed., 2010)

Equally, it becomes incumbent upon hyperglobalizers – those who advocate a world to be undifferentiated in cultural terms and for whom 'cultural losses' as an idea remains immaterial or redundant – to attempt counting the 'cultural losses' that accrue to society when technology seeks to sublimate man-made efforts, and production modes have developed under different worldviews, and innovation transplanted from the outside without heed to a society's particular worldview can only fail to take local roots.

To understand how differential attitudes to technology has a direct bearing on the way we innovate, we will now address this through a real world situation: the idea of seeds as a potent and universal symbol of the continuity of civilizations terms of of two new sets of emerging but connected realities:

I. (i) the asymmetries set in by a techno-centric worldview; and

II. the 'cultural losses' accrued to society when ideas and technologies have been of an exogenous nature that have leeched on account of their failure to grow local roots.

(IV) The new realities for innovation (1) – culture's ascendancy while addressing the asymmetries of a techno-centric world:

The need to find a different way to re-organize the idea of innovation arises from our desire to address this asymmetry, located in two sets of biases:

I. firstly, in a technocentric worldview that makes innovation and technology synonymous, leaving little room for an objective understanding of what tech-

nology realistically can achieve for innovation, and equally, what it can do to destruct cultural mores and "traditional meanings" (Manfred Stegar, 2003) in its wake, without leaving behind any documented trail of this destruction, blighted as they get, by the passage of time; and

2. secondly, the mistaken notion that those who are technologically blessed do not need culture, and by that derivation, culture isn't that crucial to innovation.

The altered perspective under which we seek to understand innovation here will demonstrate that every society – 'advanced' or not – possesses technology, but not all technology translates into innovations, nor is that a necessary precondition for the flowering of an innovation mindset.

Equally, every society by virtue of having social organization will demonstrate some form of culture or the other, and foster culturally contextual ways to innovate.

In cultures that are driven by faith, inspirations for innovation are a highly nuanced affair, with metaphors and symbolic expressions representing even consumer spaces. The conversion of a cell phone into a torchlight (as a source of light in a rural space without electricity) and the user's obvious delight at being able to find this simple at-hand solution speaks volumes of a culture (in rural India) where material deprivation isn't the end of the road. Cultural spaces and communitarian living often go to annotate these material absences.

The cellphone company that had envisaged this idea was Nokia. Considered modest in price, culturally-mediated in its approach to a solution of a lack of a light source while trucking across long distances, and a robust option of a cell phone especially for rural areas, Nokia's physical presence in India drove its understanding of the local culture. The icing on the cake was of course the cultural cues that emerged through its local (India)-global (Swedish-Continental) partnership.

Amazingly, the solution had come from a context (lack of electrification) that is unimaginable for its host country, Sweden.

In other words, the reason to understand technology and culture's place in society is crucial to realizing their relationships with innovation itself and accordingly frame the questions for pursuing the idea of 'cultural loss' in the notion of 'cultural loss' and ways to plug this

(V) The new realities for innovation (2) – an alternate perspective containing both technology and culture to plug 'cultural loss'– an emerging anatomy of innovation:
In this altered perspective, we ask a few leading questions and mark some observations that will help outline some key requirements for innovation:

I.   to begin with, isn't innovation *an act germane to one's everyday life* itself – the "unconscious daily round?" (as eminent material historian Fernand Braudel (1979) characterizes innovation as). And obviously not necessarily originating from the specialist worlds of business, science or technology. Alexander Graham Bell or Steve Jobs are not the average innovator.

II. isn't technology a tool for achieving an end result? Although quite at odds with the way technology is today perceived as, and not necessarily for the best reasons, it is inspiring to remember Marcel Mausse's (Braudel, 1986) view of technology, complete in its abstraction: "What I call technology *is a traditional action made effective*." Braudel himself says in his classical work on Civilization and Capitalism:

"In a way, everything is technology: not only man's most strenuous endeavors but also his patient and monotonous efforts to make a mark on the external world; not only the rapid changes we are a little too ready to label revolutions (gunpowder, long-distance navigation, the printing press, windmills and watermills, the first machines) but also the slow improvements in processes and tools, and those innumerable actions which may have no immediate innovating significance but which are the fruit of accumulated knowledge: the sailor rigging his boat, the miner digging a gallery, the peasant behind the plough or the smith at the anvil."

III. in spite of the generic nature of its association with the human's existence, doesn't innovation tend to take on *distinct forms of its own across different geographies and cultures* rather than unfold uniformly without variations? For instance, in China… "[the most common] tools have something peculiar in their construction, some difference, often indeed slight, but always clearly indicating that, whether better or worse fitted for their purpose than those used in other countries, the one did not serve as a model for the other. Thus, for example, the upper surface of the anvil, elsewhere flat and somewhat inclined, is among the Chinese swelled into a convex form." Sir George Staunton in Braudel, (1986) An authentic account of an Embassy… to the Emperor of China, 1797, Vol II, from Braudel (1979)

IV. to understand these distinct forms, isn't there a need to go back to the *origins of human history and societal development*, recognizing these to be essential milestones of the human's interactions with available resources and modes of production – notably in the form of its natural resources, technology and its cultural framework? And given the ongoing crisis of the natural environment, isn't there a need to add an ecological perspective to the already domineering perspectives of economies and societies?

V. all things being equal, isn't it possible to conceive at this stage of development, *the idea of a worldview* making an entry, and which, by intersecting with society's evolution trajectory gives to society its distinctive brand of culture, and through it, its innovations? Braudel observes: "if civilization is the ancient settlement of a certain section of mankind in a certain place…with humanity divided between different planets, each the home of an individual civilization or culture, with its own distinctive features and age-old choices…" Even if they were to meet with each other, they would still retain the distinctive nature of their solutions.

That, supposedly, is the power of how a worldview can shape a culture. Given this, it is unlikely that cultural diversity will give way to complete homogenization. And recognizing this could have implications for innovation by those located outside of the boundaries of these cultures.

VI. depending on its particular outlook of viewing its world through the prisms of either 'technology' (as in the West today) or 'culture' (as in many other parts of the world, such as in India, the Middle East, Africa of South America)? Wouldn't these *societies emerge with a distinctive identity of their own*, and for sake of convenience, nomenclatured as one of two societal-types: a culturally-mediated society (s1c) or a technologically-mediated society (s2t)?

VII. thus making it compelling for us to not only recognize this inter-societal distinctiveness but also pursue *innovation not as a value-neutral, universal proposition*, but as part of one's customs and habits and rituals? And, lastly

VIII. since every society is endowed with culture, would it not be rather inviting to put to test the application or efficacy of this culture-proposition by way of investigating if there were any noticeable 'cultural loss' accrued to society? 'Cultural loss' being representative of ideas and technologies of an exogenous nature that have leeched on account of their failure to grow adequate local roots – and a concept fore-fronted by Jared Diamond in the late nineties in his seminal work on cultures' progress through technology across human history (Diamond, 1999)

(VI) In conclusion:

To recapitulate the above, the need to address the bias for technology in the context of innovation comes from its tendency to narrow down innovation's wider field of accomplishments as well as its problems, by completely obfuscating the idea (as briefly mentioned above) that innovation (as indeed design) as an activity, has a wider locus, and remains germane to the very manner in creativity to overcome constraints in order to make their lives more liveable as also more aesthetic and enjoyable. This generic nature of innovation is testimony to its

earliest roots, going back to the first known tool that the human carved out of stone a hundred thousand years ago by simply splintering a stone to leverage its sharp curved edges in order to chisel other things into shape. It may not be an over statement, therefore, that innovation (and design) has remained our constant companions since the dawn of history.

Dr. Ajanta Sen
International Director, Solar Project, Mumbai, India
ajanta@colorsofindia.com

Prof. Ravi Poovaiah
Industrial Design Centre (IDC), Indian Institute of Technology Bombay (IITB), Mumbai, India
ravi@iitb.ac.in

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Panel 10
Interdisciplinarity/ Transversality

Qian Sun

Embedding learning-to-learn into the curriculum

1. Challenges

Postgraduate studies involve dynamic mixtures of reflective, creative and analytical work, which requires students to take deep learning approaches to their studies. This is significantly different from the learning environment at lower levels. In educational literature, it has been recognised that the appropriate methods for teaching adults are distinct from those for children and teenagers. The adult learning experience should be a process of 'self-directed enquiry' which allows students to draw on their distinctive work and real-life experiences (2009). Gibbs (1981) suggested a greater emphasis on a more student-centred, open-ended approach to improve particular aspects of the study process. Given the promised dynamics and cohesiveness, student-centred approaches have been widely encouraged in HE teaching and learning practice. In a student-centred learning environment, students assume a high on degree of autonomy to take responsibilities for the way they learn.

On the other hand, it is often assumed that students entering postgraduate programmes should be prepared for and fully aware of this change, given that most of them have either been successful in undergraduate studies and/or have gained some work experience. However, students' perception of the learning environment is likely to differ significantly across individuals, which leads to considerably differing approaches they take to learning and further impacts on their performances. The widening participation and internationalization agendas adopted by most HEIs in the UK have increased the diversity of student profiles at postgraduate level. This has led to an impetus for a better understanding of the diversities of student learning, and for ways of supporting students to develop 'learning to learn' skills as well as general transferable ones (Cuthbert 2010).

In Art and Design, although a majority of HEIs have begun to acknowledge that the curriculum need to change to reflect the diverse backgrounds of their students, it has not been a straightforward task. Design ed-

ucation at postgraduate level is a relatively young entity, although HEIS in the UK is seen to have a long history in educating artists and designers. It was only in early 1990s that a trend emerged among students towards taking higher degrees, with a subsequent expansion in modular and postgraduate courses (Williams 1994).

Given its newness, postgraduate teaching and learning in Art and Design has been influenced by the apprentice and studio-based traditions. As a result, it is often the case that HE in art and design focuses heavily on learning specific craft skills. Yet, some, e.g. (Houghton and Fortnum 2007), have argued that student centred learning is in the bones of most studio based learning environment and that the concept of creativity is intrinsically linked with the idea that students develop their way of thinking and doing, which requires students to take responsibility for their learning and development. However, the practice-oriented tradition has, to some extent, prevented teaching and learning at postgraduate level from pursuing greater academic credibility and from moving the learning environment away from skills-based and more technical teaching, to one where creativity and problem solving are fostered. This has been used to justify the teaching and learning practice for not engaging theoretical, analytical, and reflective work which should however be essential to a postgraduate curriculum. For example, there is a perception that art and design students *'are not very good at writing, that they don't want to write, and furthermore, that writing gets in the way of the real business of making art'* (Kill 2006). This has been reinforced in the literature as, for example, pointed out by Apps and Mamchur (2009) who suggest that the task of writing about the process of making and contextualising art can be overwhelming for some graduate students in a practice-based arts thesis.

Recently Art and Design schools and colleges in the UK have been presented by the Government with substantive cuts in funding in from 2012. Although concerns are shared widely that these cuts might result in '*washing the innovation baby away with the educational bath water'* (Powell 2011), there is an urge for each HEI to review its academic portfolio to reflect changes in economic and social environment. Postgraduate programmes become vulnerable in most HEIS and urgently need to demonstrate their economical viability and market potentials. It is very likely that postgraduate programmes will have to explore opportunities from non-traditional student markets. This will inevitably pressurize HEIS to improve the learning environment in order to better facilitate changes.

This will present a challenge to Art and Design postgraduate education in the UK which have already been considered problematic in a number of areas. For example, given the increased representation of international students, it has been noted that these students can suffer feelings of alienation from the HE learning experience (McSwiney 1995), and seem to want and expect considerable support and structured input (Evans 2010). It is debateable as to how to *'transform the practices and curricula rather than viewing the students as the problem, working towards creating an environment that embraces diversity'* (University of Salford 2010). Similarly, this is related to the debate around the employability of postgraduate-level graduates. As citied by Andrews and Harris (2009), some education commentators have criticised graduates from Master's programmes as not being adequately equipped for the 'real-world' of competitive and innovative enterprise, which further raises doubts about the nature and quality of the current teaching and learning practice at the postgraduate level (Thompson 2002).

After a number of years' teaching on the MSc. Design Management programme at the School of Art and Design, I have come to realise that one of the fundamental challenges lies in the alignment of students' expectations and the learning environment. What strikes me most is the significant diversity within each student cohort, not just in background and subject knowledge, but also in student expectations and their views towards the learning environment. I have come to believe that these differences have profound impacts on learning outcomes and student performance during the study. I have found it is especially relevant when students assume a high level of autonomy in a student-centred learning environment, which challenges the assumption that students have the appropriate skills, confidence and knowledge to manage their studies. Therefore, in this study, I propose to outline an understanding of student learning by analysing the linkage between students' perception of learning environment and their backgrounds. The finding will inform the challenges faced by postgraduate education in Art and Design related subjects.

2. Research focus and approach

Research into student learning appears to have moved away from evaluating the effectiveness of traditional study skills methods to exploring how students perceive their academic environments, the demands of their courses, and their own learning approaches (Norton and Crowley 1995). This shift of attention is largely driven by a recent discovery re the linkage between students' approaches to learning and their knowledge about learning (Gibbs 1981; Van Rossum and Schenk 1984). These findings have explained, to some extent, why teaching study skills may not be the most effective way of helping students cope with the demands of a postgraduate programme. For example, Wade and Reynolds (1989) have found that the traditional study

skills approaches, such as sessions on note-taking, essay writing, examinations and time management, often do not work, because these courses often fail to take into account how learners perceive the academic task and thus may interfere with what they are already doing effectively. Alternatively, Cloete and Schochet (1986) proposed a new 'learning to learn' approach to provide students with knowledge about the cognitive processes involved in complex learning.

This perspective has led to the idea of 'metacognition' as an essential part of the 'learning to learn' process (Biggs 1988). As cited by Cubukcu (2009), metacognition refers to *'the knowledge, awareness and control of one's own learning',* and three subsets of metacognitive awareness are identified as task awareness, strategy awareness, and performance awareness (Wade and Reynolds 1989). In this context, Cuthbert (2010)'s interpretation of 'learning to learn' is adapted to represent the acquisition of the more complex, higher-level, adaptive skills required at a postgraduate level, rather than more simplistic, prescriptive, static study procedures. The importance of developing metacognition has been widely agreed in literature. For example, Biggs (1988) suggests that students need to be aware of their motives, of task demands, and of their own cognitive resources, and to exert control over the strategies appropriate for handling the task. Wade and Reynolds (1989) argues that students will be effective and efficient learners only by knowing what to study, how best to study it, and whether it has been learned.

Many researchers and practitioners have thus focused on teaching 'learning to learn' skills (Norton and Crowley 1995), either through a 'distributed model' where the metacognitive skills are distributed through the rest of the curriculum, or a 'concentrated model' where the study and learning skills are taught as a stand alone unit. However, others focus on learning environment to encourage the development metacognition in a situated context. This, according to Entwistle and Peterson (2004), is based on numbers of empirical studies which have identified the relationships between prior knowledge, conceptions, approaches, levels of understanding, and perception of the teaching-learning environment; more importantly, all these variables are linked with how the design and content of the teaching and learning environment is constructed to support quality learning. As suggested by Cuthbert (2010), the academic environment relates to the choice of methods of teaching and learning, and class management, making available to students relevant theoretical models of metacognitive processes and the use of assessment which helps to promote metacognitive thinking and practice.

My enquiry relates particularly to one of the modules I teach – Design Industry and Professional Practice.

It is a 15 credit module delivered to students on three programmes: MSc. Design Management, MA Product Design, and MA Communication Design. The class size of this cohort is around 20 students. In order to encourage the students to take deep learning approaches and ultimately enhance their learning experience, I have tried to embed theories and good practice developed through research into student learning.

The specific focus is on creating a context / learning environment where the students are at the centre of the curriculum. As such:

- It is a self-directed module, where students are to negotiate an assessable outcome of individual personal or professional interest relating to an aspect of, or issue within the design industry and/or professional practice, including in depth case studies.
- The learning and teaching strategy involves a variety of approaches, including lectures, group discussions, seminars with guest lecturers, and tutorials, together with independent student learning.
- In the introductory session at the beginning of the module, three relevant learning methods – 'inquiry based learning', 'team based learning', and 'reflective learning' – have been introduced to the students.
- In this module, students are encouraged to keep a diary of reflection and a series of proformae with prompting questions are provided to promote reflection.

I had presumed that these attempts had created a cohesive learning environment, which should encourage students to take deep learning approaches. However, halfway through the module, I noticed that not all students were equally engaged in the process, which raises a question as how students respond to the responsibility and learning skills required in taking this module. I have noticed that some individual students, normally with little work experience or from different educational backgrounds, are often confused and lack confidence; whilst, others, normally having work experience, are keen to learn and benefit significantly from these approaches. As a result, I suspect that their performance indicated by their marks may be dramatically polarized. In the meantime, this has placed significant pressure on the tutor to further tailor the teaching approaches to individual students. I suspect that this can be problematic especially when the student profiles are particularly diverse.

This leads me to wonder whether some prerequisite/preparation, such as stand-alone 'learning to learn' skill training workshops, should be put in place to ensure the success of student-centred and open-ended approaches. As suggested by Prosser and Trigwell (1999), student learning approaches are subject to a range of

variables, such as their conceptions of the subject, perceptions of the learning environment, prior study experiences and performance on assessment. Given that students at the postgraduate level have a wide range of expectations and prior experience, and in order to embed equality and diversity in the curriculum, I feel it is essential to understand how these variables are related to their perception of the learning environment. Given this, this study uses a questionnaire survey to identify ways to support different students to learn, by understanding:

- the extent to which their conceptions of learning differ;
- whether these differences are associated with their backgrounds; and
- the extent to which and how the learning environment impacts on their learning.

The questionnaire has been distributed to students during group tutorials. Of a total of 20 students on this module, 13 of them have completed the questionnaire. The data has been analysed and is discussed in following section.

3. Findings and discussion

3.1. Student Background

The first part of questionnaire is related to student backgrounds, including information about: undergraduate study, professional experience, age, and registration status. These questions have been designed to identify how student backgrounds are related to their conceptions of learning and perceptions of the learning environment. I suspected that their professional experiences and registration statuses (i.e. whether they are international or part-time students) might be key in influencing their learning. Among these 13 students, 3 are part-time and 1 is an international student. Interestingly, a large proportion of students who failed to complete the questionnaire are international students. Because of this lack of international student input, this research cannot unfortunately draw conclusions in relation to the international student population.

3.2. Conception of Learning

Saljo (1982)'s method, using a simple but open question '*what do you actually mean by learning*?', has been adopted in the questionnaire to measure students' conceptions of learning. The answers have been measured by comparison with a five level descriptor proposed by (Saljo 1982), as shown in the first column of Table 1 .

The fundamental differences underlying these conceptions are that at lower levels (especially conceptions

Table 1   Measuring Conception of Learning

Conception 1:	learning as the increase of knowledge	8%
Conception 2:	learning as memorizing	31%
Conception 3:	learning as the acquisition of facts, procedures, etc., which can be retained and/or utilized in practice	38%
Conception 4:	Learning as the abstraction of meaning	15%
Conception 5:	Learning as an interpretative process aimed at the understanding of reality	8%

Adapted from (Gibbs 1981) P81

1 and 2) knowledge is external to the learner; whilst at the higher levels (especially conceptions 4 and 5) knowledge is construed by the learner as a result of an active effort to abstract meaning from a discourse and to relate this meaning to an outside reality (Gibbs 1981). The general exception is that a majority of students at a postgraduate level should possess a high conception.

An independent panel has been used to analyse the data, to avoid any biased opinions. It has been found that the answers vary considerably across the sample, indicating that the students understand 'learning' very differently. Among the answers,

- 8% (one student) fit the conception 1 description. The student seemed to see learning as '*… to have taught lessons as well as more one to one tutorials …*', where, apparently, considerable input from the tutor was expected.
- 31% of the answers (four students) were at level 2. These students saw learning as experiencing and memorizing, for example:
- '*Deeper investigation of a subject through research, gaining valuable experience through peers and lecturers.*'
- 38% of the answers (five students) seemed to have focused more on the application of knowledge, for example:

  '*Learning to see issues in broader context and learn to apply recommended theories and models to practical examples/cases and reflect on them.*'

  '*Postgraduate learning allows more self directed and independent work, which allows you to focus on what you enjoy doing and have more time doing it on things you want to study and continue when you leave the course.*'

• 15% of the answers were at level 4, where learning is about abstracting meanings, for example:

'The ability to reflect on a deeper level and formulate learning conclusion based on intensive enquiry. The ability to develop understanding rather than reciting knowledge'

• Another 8% reached level 5, where learning has become an interpretative process aiming at the understanding of reality:

'Development of my own ideas that can be supported with research and critical analysis. Structured thinking that can develop processes and solutions to problems of any scale. The sharing of ideas, theories and thought processes.'

In summary, a majority of the answers (77%) were at lower levels (conceptions 1, 2 and 3), which indicates that these students are unlikely to be actively involved in abstracting meaning from a discourse and relating this meaning to an outside reality; instead, they probably intend to passively receive knowledge from the tutor. The remaining 23% of them seem to have developed the conception of learning which is appropriate to the studies at a postgraduate level. This finding is close to what I suspected and therefore supports the idea that developing students' metacognitive awareness is essential to a postgraduate curriculum.

3.3. Perception of the Learning Environment
In designing and delivering this module, specific focus has been put on the creation of a context / learning environment where students are encouraged to take deep learning approaches and to develop their metcognitive awareness. This part of the questionnaire has been designed to evaluate the effectiveness of these efforts, with a focus on how they respond to these features. An open question has been included at the end for them to provide any comments they consider beneficial to their learning. Their answers are discussed in the following sections.

SELF-DIRECTED ENQUIRY
In this self-directed module, students can negotiate the assignment based on their individual personal or professional interests. This reflects the principle stated earlier that the adult learning experience should be a process of 'self-directed enquiry' which allows students to draw on their distinctive work and real-life experiences (Andrews and Harris 2009). My immediate concern was when students passed over the autonym as suggested by Gibbs (1981) p88, as to whether they were confident enough to assume responsibility. Very

encouragingly, the result shows that they generally felt confident in taking a 'self-directed' project.

Further, the promise of enquiry based learning is that when undertaking enquiries, students can be engaged actively and creatively with the questions and problems of their disciplines. Given that 'open-ended' is a key characteristic of enquiry based learning, which Kahn (2005) described as *'enquiry tasks facilitate exploration and investigation of issues or scenarios that are open-ended enough for different responses and solutions to be possible'*, another concern I had was that during the process of refining the enquiries, students might have difficulties in interpreting and using the enquiry activities to guide their own studies. As a result, they might have gotten lost at times. The students' comments in the questionnaires have confirmed my suspicion, as such:

'I felt that the path taken to develop the research topic was very complex and time-consuming.'

'Progression. I have found this very broad and deep and my learning has jumped between different aspects. Not always easy to keep in context. Sometimes contradictory.'

However, apart from the recognised difficulties, the benefits were perceived by the students as:

'…this did end up providing a context that I wouldn't have initially selected.'

'From this module I feel the structure is beneficial to my learning as it allows me focus on one aspect of the project at a time and then reflect on it the following week. I also feel it helps me to research the design industry future which will benefit me when I finish the programme and want to look for a job within this area.'

This has confirmed the principle of adult learning based on a 'self-directed enquiry'. However, in order to obtain a more objective evaluation about this approach, it is important to compare their assignment marks.

RESPONSES TOWARDS VARIOUS
LEARNING SETTINGS
The learning and teaching strategy in this module involves a variety of approaches, including lectures, guest lectures, group discussions, seminars, tutorials, and independent student learning. These choices of teaching and learning methods reflect the trend in educational theory that a greater emphasis should be placed on the student-centred, open-ended approaches, as suggested by Gibbs (1981). According to Bower and Hedberg (2010), student-centred approaches result in a much

higher level of student engagement and create a learning environment where students are encouraged to take deep learning approaches.

Questions have been asked as to the extent to which these learning settings are perceived as beneficial to the individual student. The result is shown in Table 2 below.

Table 2   Responses towards various learning settings

Teaching and Learning Approaches	Perception of Benefit (0 –1)
Lectures and guest lectures	0.85
Team-based learning (seminar discussions, workshops, etc.)	0.62
Tutorials	0.92
Independent Learning	0.85

It is interesting that tutorials have received the most positive feedbacks from the students, with an average score of 0.92, having run one round of one to one tutorials and one round of group tutorials. One of the students suggested in the questionnaire that '*more tutorials'* would benefit learning. Given that this module is based on a 'self-directed inquiry', each student is undertaking a project that is considered relevant to her/ himself, but can be dramatically different from each other. Tutorials are probably the most effective way for them to discuss their ideas with the tutor and to receive formative feedback on their projects. In the meantime, because of the difficulties they have encountered in conducting enquiry learning as discussed in the earlier section, talking with the tutor can therefore help them to regain confidence.

This finding indicates that a high level of customization is needed in delivering a self-directed enquiry module, as I suspected. What concerns me is therefore that a significant amount of staff time is required to achieve this, especially when the student population has a wide range of profiles within each cohort.

Surprisingly, 'team-based learning' has received the lowest score. This challenges the general view in literature towards team based learning. For example, Michaelsen (2002) suggested that the high level of cohesiveness developed within student learning groups could lead to a wide variety of other positive outcomes, including, for example, improving problem-solving (Barber 2001; Thomas 2007; Beatty 2009), and interpersonal understanding and critical reflective practice between participants (Sense 2005). However, these values seem not to have been perceived by all the students. When taking a close look at their answers to the open question in relation to team based learning, it is found that

opinions are divided. On one side, some did not feel team based learning beneficial because they felt that not all team members were able to contribute to the discussion equally:

> '*mixed level/improvement/investment made some of these hard work.'*

On the other side, some students seemed to find it more beneficial, where:

> '*Debates with peers and lecturers… a different insight into how we look at the industry as a whole'.*

> '*Mixing with other MA students creates balanced and interesting debates. Students get to make more contacts with experienced peers.'*

> '*…Everyone has something to contribute.'*

I have also found that their opinions seem to have a close link with their professional experience and subject knowledge. Those who had a positive opinion towards team based learning seem to the young or less experienced ones; whilst, those holding negative ones are more experienced. The divided opinions present a challenge in organising team-based learning, particularly when there is a diversified student population. I feel that the focus should be on the solution as to how to ensure equal contribution among team members.

RESPONSES TO THE REFLECTIVE DIARY

In this module, in order to encourage the students to keep a diary of reflection, a series of proformae with prompting questions have been provided. Reflection has been considered as '*a form of response of the learner to experience'* (Boud, Keogh et al. 1985) P.18, and keeping a diary has been recommended as an effective way for promoting reflection (Entwistle and Peterson 2004). However, the result shows that the students did not particularly value the proformae (indicated as a low average score of 0.62); the reason might be, for example:

> '*I found these an added deadline during a particularly hectic time – the fact that they are not assessed.'*

My own experience in incorporating reflection into my own learning has led me to believe that reflection is at the centre of deep learning approaches, as suggested by Entwistle and Peterson (Entwistle and Peterson 2004); however, I have also come to realise that there is unlikely to be a universal way to record the process that is suitable to everyone, given that reflection can sometimes happen unconsciously and sometimes can be a very personal thing. In this way, in order to encour-

age the students to adopt reflective learning it may be more effective to facilitate them with knowledge about reflection, rather than using a set of questions or proformae.

AWARENESS OF LEARNING THEORIES AND TECHNIQUES

More specifically, Cloete and Schochet (1986)'s study has found that the difference between successful and unsuccessful students is often not the study skills methods used, but whether the students are aware of why they are using a specific technique. Given this, in the introduction session at the beginning of the module, three relevant learning methods – 'inquiry based learning', 'team based learning'; and 'reflective learning' – have been introduced to the students. According to Cuthbert (2010), making relevant theoretical models of learning processes available to students increases students' metacognitive awareness.

To evaluate the effectiveness of this effort, in the questionnaire the students were asked whether having the knowledge about these learning methods was of benefit to their learning. The responses to it were very positive. However, when asked whether knowing these learning methods helped them to intentionally apply these methods in their studies, the answers were much less positive. This might be because the students could not see the relevance of these methods in their studies. If Cloete and Schochet (1986) and Cuthbert (2010)'s conclusions, as explained earlier, are correct, I feel it is important to explore how to increase the perceived relevance, perhaps by reinforcing these concepts in the later stages of the module.

3.4. Correlations

More importantly, this research aims to identify the relationship between student learning and background. This research has found that among the five background variables used in the survey (title of first degree, age, years of professional experience, registration status,

programme), 'professional experience' shows a significant correlation with their conceptions of learning and perceptions of the learning environment. Therefore, the respondents are divided into two groups: those with less than 2 years' work experience (group A) and those with more than 2 years' (group B). This is shown in Table 3 below.

The students in group A (62% of the sample) tended to feel less confident in taking responsibility for directing their own study and were less certain about 'self-directed enquiry features of the module. In contrast, the students in group B (38%) felt much more confident to conduct self directed study.

Similarly, group A has shown a significantly lower average score in their conception of learning, which indicates that they generally consider learning as the increase of knowledge or memorizing, with a few considering as the acquisition of facts, procedures for which can be retained and/or applied in practice. This is considerably different to the other group of students with more work experience, who understood learning as the abstraction of meaning and as an interpretative process aimed at the understanding of reality.

However, this tendency is reversed when it comes to perception of the learning environment. Group A students tended to be more agreeable towards the teaching and learning settings used in this module than the other group with more work experience. This probably indicates that the current learning environment is more appropriate to those who progress directly from undergraduate studies. This presents a challenge to the idea of combining 'continuing professional learning' with the traditional HE.

In particular, the two questions in relation to their responses towards the learning methods introduced and the proformae provided to encourage reflective learning, shown a significant discrepancy. The students in group B did not think that knowing the learning methods encouraged them to apply them, or that the proformae were helpful. This finding is interesting in show-

Table 3 Correlations

	Group A (with 2 year professional experience and less)	Group B (with more than 2 year professional experience)
Population (%)	62%	38%
Conception of Learning (1–5) (what do you actually mean by learning?)	2.38	3.60
Confidence (0–2) (in conducting 'self-directed enquiry' learning)	0.99	1.20
Perception of the Learning Environment (0–1)	0.85	0.58

ing the difference in the degree of autonomy students pursue. I feel that this may be because the students with more work experience have developed their own methods of learning, and are therefore less willing to be interfered with; whilst, those with less work experience are open to new methods and tools in helping them study.

4. Conclusion and implications

The findings confirmed that students' conceptions of learning differ significantly across the board. Not a surprise, however, is that only a small proportion (23%) of students possesses higher conceptions of learning (at the conception levels 4 and 5) which are considered to be appropriate to postgraduate study. Although most students have considered learning as the application of knowledge acquired, they are expected to engage with knowledge more actively, by being able to abstract meanings and to further develop their own ideas and interpretations.

The generally low conception of learning to some extent reflects the technical and skills-based orientation in art and design curriculum, which in return results in reluctance among students to engage in analytical and theoretical approaches to postgraduate learning. In order to pursue a greater academic credibility, it is crucial to reinforce the importance of developing a dynamic mixture of reflective, creative and analytical approaches to learning. To facilitate students to adjust themselves, it is vital to incorporate 'learning to learn' in the curriculum, based on the assumption that equipping students with appropriate knowledge about learning improves their conceptions, and further encourages them to take deep learning approaches.

Further, the findings have suggested that the students perceived the academic environment significantly differently. In terms of their perceptions of the learning environment, tutorials have received the most positive feedback and team based learning has been the least favourable learning setting. In general, it seems the current teaching and learning settings have been perceived more positively by these students who progress directly from undergraduate studies. The data shows that the difference in conception and perception of the learning environment is closely associated with their professional experience. The students having more work experience tend to have higher conceptions and those with little experience tend to take learning as a one way process of in-taking knowledge from the outside.

This throws a question as to the potential direction for postgraduate programmes. Given the cut in government funding to Art and Design education, there is an expectation that postgraduate programmes will have to involve more in CPD, non-traditional and international student markets. However, the results point

out the potential risk which lies in the diversified responses received towards the learning environment. It is therefore crucial to develop a learning environment that is sensitive to the diversity of student expectations, if this is the future of the postgraduate programme. This then supports the idea of embedding learning-to-learn into the curriculum, which facilitates the students to adjust themselves to the learning environment.

Qian Sun
School of Art and Design,
University of Salford, UK
q.sun@salford.ac.uk

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- Universidade do Valo do Rio dos Sinos (UNISINOS) Design School, **Porto Alegre**
- ESDI – Escola Superior de Desenho Industrial, **Rio de Janeiro**

CANADA (4)
- OCAD University **Toronto**
- Emily Carr University of Art and Design, **Vancouver**
- University of Montreal, School of Industrial Design, **Montreal**
- School of Industrial Design, Carleton University, Ottawa

CHILE (3)
- Pontificia Universidad Católica de Chile (PUC Chile), FADEU, **Santiago**
- Instituto Profesional DuocUC, School of Design, School of Communication, **Santiago**
- University of **Valparaiso**

CHINA (10)
- 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**
- **Hong Kong** Design Institute
- School of Design, Jiangnan University, **Wuxi**
- **Shanghai** Institute of Visual Art (SIVA), Fudan University

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 (2)
- Estonian Academy of Arts, **Tallinn**
- University of **Tartu**

FINLAND (6)
- Aalto University School of Arts, Design and Architecture **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 (18)
- 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 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 Superieure 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**
- ESAIL (Ecole Supérieure d'Architecture Intérieure de Lyon), **Lyon**
- école intuit lab, **Paris**

GERMANY (8)
- 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
- FH-**Dortmund**, FB-Design

GREAT BRITAIN (11)
- Arts University College at **Bournemouth**
- **Edinburgh** Napier University, School of Arts and Creative Industries
- 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**
- ▸ **London** College of Communication, University of the Arts
- ▸ **Leeds** College of Art
- ▸ **Nottingham Trent** University
- ▸ Central Saint-Martins College, **London**

GREECE (2)
- ▸ Technological Educational Institution (T.E.I) of **Athens**, Faculty of Art and Design
- ▸ AKTO Athenian Artistic Technological Group, **Athens**

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

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

INDIA (3)
- ▸ Ujwal Trust, Srishti School of Art, Design and Technology, **Bangalore**
- ▸ Indian Institute of Technology **Bombay** (IIT), Industrial Design Centre (IDC)
- ▸ MIT Institute of Design, Maharashtra Academy of Engineering and Educational Research (MAEER), **Pune**

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

ISRAEL (1)
- ▸ **Holon** Institute of Technology

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**

MAROCCO (1)
- ▸ Ecole supérieure de Design, Art'Com Sup **Casablanca**

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 (4)
- ▸ Unitec New Zealand, Department of Design and Visual Arts, **Auckland**
- ▸ Victoria University of Wellington, Faculty of Architecture and Design, **Wellington**
- ▸ Massey University, **Wellington**
- ▸ Otago Institute of Design, **Dunedin**

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 (3)
- ▸ Jan Matejko Academy of Fine Arts, **Cracow**
- ▸ Academy of Fine Arts, Faculty of Industrial Design, **Warsaw**
- ▸ Polish-Japanese Institute of Information Technology, **Warsaw**

PORTUGAL (3)
- ▸ Instituto de Artes Visuais Design e Marketing (IADE), Escola Superior de Design, **Lisbon**
- ▸ Escola Superior de Artes e Design (ESAD), **Senhora da Hora**
- ▸ University of **Aveiro**

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)
- ▸ **Saint Petersburg** State University of Technology and Design, Department of Design
- ▸ **Saint Petersburg** State Polytechnical University
- ▸ Faculty of Arts, **Saint Petersburg** State University
- ▸ Interior Design Chair, **Nizhny Novgorod** State University of Architecture and Civil Engineering (NNGASU)

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 (4)

- Escola Superior de Disseny Elisava, **Barcelona**
- **Mondragon** Goi Eskola Politeknikoa, Mechanical Department and Chair of Industrial Design
- Escola D'Art Superior de Disseny de Castello **Castelló**
- Escola d'Art i Superior de Disseny de **Valencia** (EASD Valencia)

SWEDEN (9)

- 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
- **Lund** University (LTH), Industrial Design
- Beckmans College of Design, **Stockholm**
- Konstfack **Stockholm**
- **Umeå** University, Umeå Institute of Design
- **Linnaeus** University, Department of Design

SWITZERLAND (6)

- 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
- **Bern** University of the Arts Department of Design and Fine Arts

TAIWAN (2)

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

THAILAND (1)

- School of Architecture and Design, King Mongkut's University of Technology Thonburi, **Bangkok**

TURKEY (3)

- **Istanbul** Bilgi University, Visual Communication Design Department
- Anadolu University **Eskisehir**
- **Istanbul** Technical University

USA (7)

- 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**
- School of Design, **Savannah** College of Art and Design
- Department of Design, The **Ohio** State University, Columbus

LIST OF CUMULUS ASSOCIATE MEMBERS 6/2011

1 country & 1 member

BELGIUM (1)

- Design Innovation, **Charleroi**