Title of paper: **Design Thinking and Design Innovation Scotland**

Contact: Prof Stuart MacDonald OBE
             Head, Gray's School of Art
             The Robert Gordon University
             Aberdeen
             AB10 7QD
             Scotland, UK

             Telephone number: +44 (0)1224 263601
             Fax number: +44(0)1224 263636
             E-mail: s.w.macdonald@rgu.ac.uk

PROF. STUART W. MACDONALD OBE

Resume

Prof. Stuart MacDonald OBE is Head of Gray's School of Art, The Robert Gordon University, Aberdeen. Previously, he was Director of The Lighthouse, Scotland's National Design Centre, which was a case-study of an international innovation centre in the (2005) Cox Review of Creativity in Business commissioned by HM Treasury. He led the £13million development and opening of The Lighthouse during Glasgow's reign as UK City of Architecture and Design, 1999. He studied fine art at Grays School of Art, Aberdeen, later completing a PhD at the University of Liverpool.

In his current role Stuart MacDonald is responsible for the strategic vision and planning of Gray's which is focused on the development of the *professional art school*. This means leading a team of 60 academic staff and managing a budget of £10m to deliver undergraduate, postgraduate and research degree courses, research, knowledge transfer, industry consultancy, and professional development. Central to this role has been the successful raising of Gray's profile, the internationalisation and diversification of its student population, and the extension of its academic portfolio to encompass new developments in the Creative Industries and the wider community. In his previous role he was responsible for developing the vision for the National Design Centre, achieving an international profile by working with the centre's board and a wide range of governmental and non-governmental stakeholders.

Stuart MacDonald has served as a trustee of the UK Design Council, a director of the Creative and Cultural Industries Sector Skills Council, sat on the UK Creative Apprenticeships Taskforce and was on NESTA's Creative Pioneer Programme Commmittee. He was a member of the British Council's Design Review Group and a member of the Ministerial Working Group on the Creative Industries in Scotland. As Director of the Lighthouse he was a key figure in the promotion of Scotland's design & creative industries policies, and worked with Scottish ministers to initiate the Six Cities Design Festival. Previously, he was Education Director for Glasgow 1999 UK City of Architecture and Design, and Glasgow's 1996 International Design Festival.

Stuart MacDonald is an active researcher and has published and lectured widely on Creative and Cultural Industries Policy and its interface with urban regeneration and cultural renewal. He has extensive experience of UK Higher, Further and Secondary education and quality systems as a member of degree validation panels and as an external examiner, for example: Master of Design at the University of Dundee, the University of Wales in Cardiff and De Montfort University, Leicester. He has also chaired validation panels for the Scottish Qualifications Authority.In addition, he is a member of key networks; past President Reseau European Art Nouveau Network, and is a member of the EU funded European Design Training Incubator involving 6 EC member states.

Stuart MacDonald was editor of "Scottish Architecture 2002 – 2004", and "Design Issues in Europe Today", which has been translated into 6 European Community languages. In 2004 he was voted onto *Design Week's* "Hot 50" – people who have made a huge contribution to Design in the UK, and in the same year was made an Honorary Fellow of the Royal Institute of British Architects. In 2006 he was awarded an OBE for services to design and architecture. He is a fellow of the National Society for Education in Art & Design.

Design Thinking and Design Innovation Scotland

Keywords: *Design Thinking, Mass Innovation, User-led Design, Design Challenges, Studio Programme, Extreme Collaboration, Transformation Design.*

Introduction

This paper takes as a case-study of Design Thinking, *Design Innovation Scotland* (DIS), a partnership focused on Creativity, Design and Innovation. DIS is a virtual network involving the Scottish Government, The Scottish Parliament's Futures Forum, Highlands and Islands Enterprise (HIE), Scottish Enterprise, The National Endowment for Science Technology and the Arts (NESTA), business and academia, including The Robert Gordon University, The University of Glasgow and the Glasgow School of Art. This unique partnership aims to develop radical solutions to real-world challenges based on a view that, in the past, innovation policy was over-dominated by technology. That approach can no longer meet social and economic aspirations and secure competitive advantage. The consensus is that future wellbeing and prosperity will be driven by open, collaborative and trans-disciplinary means of innovating. What is needed, are new, transformational ways of thinking and acting - an approach that embraces science, technology, the humanities and design, while engaging the private, public and civic sectors. In that sense, it perceives an expanded role for designers and Design Thinking within a wider constituency.

The strategic context for DIS is both local and global. Innovation, according to NESTA (2007), is vital to Scotland's future economic prosperity and social wellbeing. At the same time the Scottish Government's Economic Strategy (2007) has indicated the need for a broader approach that moves beyond innovation as the domain of science and technology alone and recognises the importance of working with customers, suppliers and competitors. Confronting major, national, social challenges such as an ageing population, health and environmental sustainability (Scotland has particular challenge sin the area of health) also demands a distinctive approach to innovation policy and by implication a changed role for designers. Equally, it is recognised that innovation is changing; there is an increasing discussion about the emergence of open innovation, mass innovation, social innovation, IvT, Innovation 2.0, user-led design and service design. Innovation is becoming a more open process involving a variety of actors – suppliers, users, designers and companies.

Internationally, a converging range of authors such as Mulgan (2007), Leadbeater (2006), Tims and Wright (2007) and Tapscott (2007), indicate that mass innovation and mass

creativity are "the next big things". They recognise that creativity is produced, deployed, consumed and enjoyed quite differently in post-industrial societies from the way it used to be. This bottom-up innovation movement is leading not only the creation of new products like the mountain bike and Facebook but helping people to become involved in the production of culture and meaning. Innovation is fast becoming a popular past-time. But to harness individual or collective creativity in order to make ideas real you need design thinking, the key ingredient in the realisation of products and services. So, the case-study aligns with practitioners like IDEO's Tim Brown (2007), who believes that Design Thinking allows us to focus on new problems.

The paper therefore proceeds by looking firstly at the evolution of Design Thinking into its current manifestation. This is connected to issues of multi/inter/trans disciplinary working, which are inexorably linked to Design Thinking. It then examines the development of the linkages between creativity, design and innovation, and the intervention of policy-makers and influencers. The need is then discussed for a facility in Scotland focussed on design innovation and the role of Design Thinking as a central element within it. This is illuminated by looking at models and exemplar projects, leading onto the conclusion which underlines the unique approach encouraged by the government in Scotland in supporting a transdisciplinary network bringing together academia, business and the public sector.

Who is doing the Design Thinking?

Wikipedia, in its definition of Design Thinking, describes design" as the "transformation of existing conditions into preferred ones". Design Thinking is, then, in that sense, usefully linked to an improved future. At the same time, the term is being used to define a way of thinking that produces transformative innovation or an empathetic, customer-led approach to innovative problem-solving. Hence, the present interest of the business world in design, design thinking and the latest fascination with d.schools. However, there is nothing particularly new in all of this - the thinking processes of designers have been the subject of study for over two decades (Lawson 1990). Also, the "fuzzy front end" of human-centered design has been developing rapidly since before the end of the twentieth century; likewise movements that encourage participation early in the front end, largely because this is seen as necessary to drive human-centered product development (Sanders 2001). The latter movement has also prioritized creativity as a means of involving end-users early in the development process, whilst evolving strategies such as co-design and emphasizing the need

for tools to take this forward (Sanders 2003). In this context customers have evolved into users, and users into co-designers.

More recently, and much more prominently, The Design Council's Red Team identified a new community of practice that was building on traditional design skills to address social and economic issues, and which used the design process to enable a wide range of disciplines and stakeholders to collaborate in what it termed "Transformation Design" (Cottam et al 2006). When the Red Team's Director, Hilary Cottam was awarded the title "Designer of the Year" by the Design Museum, London for her work in applying design thinking to social problems like prisons, schools and health, there was an uproar in the design industry because she was not a designer. Nonetheless, what that successfully opened up was a debate about the contemporary role of design and the need for a wider recognition of how it was changing, namely, who was doing the designing or more appropriately, who was doing the Design Thinking? Apart from underlining the efficacy of the interdisciplinary approach that is central to Transformation Design, the RED Team also set out some challenges for designers in terms of the need to apply design thinking in broader social economic and political contexts, to collaborate fruitfully with other disciplines, and champion human-centered design. The RED Team no longer exists but Cottam has picked up her own challenges and moved onto setting up Participle - a new social venture to design the next generation of public services, working with Charles Leadbeater, and others.

The issue is not really whether Design Thinking signals an extension of traditional design skills or a departure into a new discipline. Nor is it necessarily to do with the use of design processes and methods, including the questioning of briefs, making early speculative proposals and developing iterative prototypes to foster innovation and contribute to business growth, important though these things are. Equally, it is not solely to with being a management tool that enables the development of a creative business culture, generating new business or public sector models. Rather, it is the aggregate of all of those things, it would appear.

Multi, Inter or Trans?

Design Thinking has now become inseparable from the integration of analytical thinking with the practicality of prototyping. Whilst this approach not new it is, nevertheless, the subject of renewed appreciation and demand from mainstream business, not least, because it can be used by different professions. Integrating specialist knowledge about one area with a broader understanding of several others has also been associated with Design Thinking. IDEO's T-shaped model with its "vertical" specialization, complimented by the "horizontal" awareness

of other disciplines and professional contexts being one good example of this approach. As a fact-finding visit to the USA by the Higher Education Funding Council for England (HEFCE) and the Design Council (2006) discovered, to prepare future generations of creative specialists and business leaders, different types of creative professionals are needed - "design thinkers, who come from design and other subject areas, and can operate across disciplines". Multi-disciplinary and interdisciplinary team-based project work – like that undertaken by IDEO, is characterized by flat hierarchies and teams of like-minded people. The Design Council/HEFCE fact-finding visit also discovered that leading schools such as MIT's MediaLab and Stanford d-school put great stress on building cross-disciplinary teams, even to the extent of using psychological profiling to construct teams.

Hybridity has now been reinforced by the idea of transdisciplinarity, the term now being used to describe transcending boundaries between disciplines and areas of knowledge. This development is advancing in the emerging field of the digital practitioner – hybrid practitioners who are using computer-mediated technologies to transect art and design - and has been linked to global technological change and the rise of new models of practice. For example, customers can, by seeing emerging digital products, have a direct input into the design process and become digital co-designers. In parallel, a new set of technologies is emerging from the business community that enables innovation to happen more rapidly than ever before. It is reckoned that "Innovation Technology" (IvT) which includes rapid prototyping, virtual reality, simulation and modelling techniques, will have a profound effect on both economic growth and social wellbeing (Gann and Dogson 2007)). Importantly, developments in the same context are believed to herald a new *sixth generation* innovation process that is convergent with advances in design thinking, one driven by enhanced opportunities "to utilize creativity and ideas distributed amongst many actors".

Creativity, Design and Innovation – A New Narrative

Because of the recognition of the potential impact of design and design economically and socially, the other thing that has happened is the strengthening of the linkages between creativity, design and innovation and the intervention of policy-makers and influencers. The Cox Review (2005) defined and interconnected creativity, design and innovation, giving them for the first time the endorsement of official policy. The Cox Review was occasioned by the rapid and disruptive change happening across industries both new and old and the realisation that it is no longer enough to outperform the competition; to thrive in a world of ceaseless change, business has to out-imagine the competition. Cox successfully put the seal, not only on co-creation and co-design, but also on mass-innovation. Innovation policies around the world are increasingly recognising that innovation is wider than just science and technology,

moving beyond a linear, pipeline model of R&D. But innovation cannot be institutionalised or planned in a top down manner. The challenge for policy-makers and public support agencies is to design and test new models that encourage open and collaborative innovation practice – practice that impacts across the economy. A new set of capabilities is required; capabilities that allow working across business sectors, academic disciplines and public agencies and recognise the systemic nature of the challenges and opportunities we face.

In common with other countries, innovation is seen as vital to Scotland's future economic prosperity and social well-being, and the Scottish Government has indicated that a broader approach is needed for innovation – one that moves beyond a narrow focus on R&D. A new narrative is needed that is appropriate for the age of design thinking and mass innovation and tells a different story about Scotland and its creative ambitions. Organisations like NESTA and DEMOS have already instigated a new debate that places creative protagonists at the centre of self-supporting networks. The emphasis is on tool kits instead of policy directives, self-help over dependency, networks as opposed to agencies, and brokerage as an alternative to managerialism. DIS is central to that new narrative.

Of course, there are some who argue that what really distinguishes Design Thinking and Transformation Design from its predecessor initiatives is the new influence of "policy wonks" (McCullagh 2007). McCullagh quotes design guru John Thakara and his criticism of official efforts to promote social change where behaviour is determined by policy. There is no doubt that Design, especially when it is linked to improvements in public services, appeals to the state because of its ability to engage with citizens through user-centred methodologies. However, McCullagh also quotes Austin Williams director of the Future Cities project, who believes that criticism of the state's intervention in the decision-making of private citizens does not vitiate the need for politicians to intervene, it just criticises the heavy-handed or ineffectual way in which government sometimes operates. DIS, therefore, because of its distributed model, is not party to a new paternalism.

Design Innovation Scotland

This is, therefore, the context and the impetus for the emergence DIS. It responds to both a global and local need for a catalyst to make things happen, to break down the barriers to collaboration and help drive a new era of economic growth and social improvement. In addition, DIS seeks to establish Scotland as a leader in innovation policy and creative practice. However, what will differentiate this Scottish initiative is the bringing together in its partnership architecture of different capabilities in order to create a unique capacity: research by Scotland's universities and art schools; practice by Scotland's key design practices and

consultancies; policy advocacy by Scotland's International Futures Forum; and access to a high profile investor network. This differentiation will be underpinned by the relationship management of Scotland's close familial relationships both public and private, cross-membership of key groups and organisations, the proximity of Parliament and politicians and, most important of all, high level network management intersecting local and international connections. What will make the Centre and Scotland truly unique will be the involvement of international design experts and entrepreneurs setting national design challenges.

Real-world opportunities framed as design challenges are at the heart of the approach, including: incubating future innovators; brokering extreme collaboration; creating and incubating new ideas and businesses; creating tool-kits for self-production; developing creative portfolios; encouraging conversation; and facilitating knowledge exchange. A series of design challenges will be set, framed by an advisory panel including international experts. These challenges will explore areas of national significance - issues with clear national and political consensus. Examples include sustainable development, health and wellbeing, transport and the environment. Brokering extreme collaboration means that DIS will run a 'Studio' programme to build Scotland's creative capability. The Studio programme will facilitate transdisciplinary working between different academic areas in partnership with creative practices and private investment expertise in order to tackle the design challenge. Cross-fertilisation of ideas will be fuelled by radical collaboration between industry, the investor community and universities at local, national and international levels. DIS will focus on more than the development of new technology; it will explore the challenges in a more systemic way – looking at user engagement, processes, services and new business models as well as new applications for technology.

As well as linking to current policy research by NESTA, DEMOS and others, the approach therefore builds on the research of the UK Design Council's former RED team and its work on Transformation Design, particularly its emphasis on capacity building. In that sense, attention is not just on new solutions but also on creating tools, skills and organisational capacity for ongoing change. Therefore, a research and publication capacity will be built into the initiative to capture knowledge on the effectiveness of different approaches, tools and techniques and the impact they have on businesses and communities. In turn, this will be related to recent research by HM Treasury on UK investment in intangible activities such as "brands, design and training" and their importance in terms of innovation and the knowledge economy (2007).

Fundamental to the initiative is a view of Design Thinking that it is not the exclusive realm of designers but a necessary skill that anyone can and should learn to achieve successful innovation. The key is looking at problems through multiple lenses, and the application of

systems thinking and synthesising information. It is not the realm of a single specialist and design projects are typically team based, working across multiple disciplines.

Models

There are a number of local and international models from the public, private and academic sectors worthy of investigation in terms of the development of DIS. For example, Innocentive www.innocentive.com is a network that supports innovation within the global science community. Its web-based community matches scientists to R&D challenges presented by companies worldwide. Citris http://ucberkeley.citris-uc.org/about/mission in California aims to create information technology solutions for many of our pressing social, environmental and healthcare problems. Kaos Pilots http://www.kaospilot.dk/docsAbout.asp in Denmark takes a transdisciplinary approach to the development of entrepreneurial and creative young people who wish to make a positive difference and shape the society of tomorrow. Rubicon Academy http://www.rubiconacademy.co.uk is a private sector, Scottish initiative focussed on nurturing design talent and ideas and helping them to market. Its unique approach is based on access to high quality studio space coupled with the best business advice. Imagination@lancaster http://www.lancs.ac.uk/facilities/pdf/ar_1-17.pdf is a research laboratory based at Lancaster University which wishes to use design and innovation to enable interdisciplinary research into products, places and systems for the future. Design to Order http://www.cuusoo.jp/muji based in Japan and run by consultancy Elephant Design, is a commercial initiative aimed at co-creation and co-production. People post ideas on the consultancy website and anyone can suggest alterations and improvements. If enough people vote for a product a deal is then made with a manufacturer.

What each of the above has in common is a research-oriented approach, a multi-disciplinary platform, a web-based Open Source facility or studio-centred facilitation. While DIS will incorporate this approach it is also important that its governance and management structure supports its vision and mission. While no similar facility exists in Scotland, there are places devoted to design and innovation in England, usually located within universities. Middlesex's Interaction Design Centre, the Centre for Design Research at Northumbria and C3RI at Sheffield Hallam are examples. However, apart from being primarily technology transfer focussed, what these centres lack is the combination of anthropological research, business connectivity and policy development capacity that will characterise and differentiate the new Scottish facility.

Exemplar Projects

The three exemplar projects indicate below how DIS will address some of the challenges, the possible solutions and the perceived benefits of innovation.

1. The Oil Industry and Hidden Innovation

Challenge

Oil is hugely important to the UK's economy. Innovation in oil production depends upon collaboration between production and service companies to develop and prove new techniques and technologies. Research by Nesta (2007) has found that innovation is hidden - traditional metrics wrongly suggest that it is a low innovation sector - because it is distributed. Nesta has also suggested that innovation could be improved and enhanced, mostly through changes to the fiscal regime. However, another way would be to encourage greater collaboration between higher education, training and research in connection with the industry and to apply Design Thinking to the problem.

Solution

Through a partnership with the new Energy Institute in NE Scotland, this project will seek to improve technological innovation by integrating design and Design Thinking into strategy within the supply side of the oil industry. This will proceed through a series of design-led workshops - including advice on how to commission and work with designers - developing into specific projects with service SMEs.

Benefits of Innovation
- enhanced collaboration between Higher Education research and industry R&D especially with oil-related service sector SMEs
- new networks created involving academia and the oil exploration and its service sector

2. Sustainability: empowering designers, design teachers and students

Challenge

Sustainability is the big issue. But how can we create maximum impact? Public suspicion of politicians and business is compounded by the fact that in the world of design – arguably the place where a real difference could be made - there is as yet little demand. Design could make a massive contribution supporting the public and private sectors to create ecologically sound and attractive alternatives to existing products, services and environments. Hence the need for a focus on sustainability that permeates both the work of DIS, and is a significant project in its own right. Even though environmentally aware clients are looking for design solutions that respond to the demand for greener products and services, designers do not necessarily have the right skills and expertise. Very few university design courses incorporate elements of sustainable design. As the recent report, High-level skills for Higher Value (2007) has indicated, teaching about the principles of sustainable design remains under-developed at all levels of design education. The same Design Council report also found that designers placed a low priority on developing skills to tackle environmental and sustainable design challenges.

Solution

This project will seek to address the need for a new mindset as well as a new skill-set. Using DIS's approach of setting design challenges, it will enlist key industry practitioners, educationists, and students themselves, to create a multi-disciplinary tool, available on-line for design teachers and students to develop Design Thinking, and that can be easily slotted into existing curricula and programmes. In addition, this tool will be available to design companies and other businesses to allow them to take on board design methods for altering patterns of materials use, production, consumption, product disassembly and recycling.

Benefits of Innovation
- Dramatically increases design sector's capacity to innovate in terms of sustainability
- Ensures access to technology for designers, design teachers and students
- Empowers designers and teachers, enabling them to develop new methods to create green products and services

3. Designs on Health

Challenge

Why are ambulances dangerous? Why do hospital beds look like instruments of torture? Why do hospital environments make us feel ill? In the UK medical errors are alleged to have cost the NHS £2.4billion in extended hospital stays and clinical negligence settlements. The media abounds with medical scare stories blaming human error, but Lucian Leape of the Harvard School of Health has demonstrated that human beings make mistakes because the systems, tasks and processes they work in are poorly designed. A 2003 report on patient safety found that there was no systematic feedback between users, buyers, designers and manufacturers of equipment and, therefore, the chance to reduce risk through design was squandered. Many healthcare solutions are designed with little knowledge of the system or how they would be used.

Solution

By pooling the knowledge and expertise of the medical devices sector, health service professionals and designers, this initiative will aim to locate design as a strategic tool within the health sector taking telemedicine a model for identifying performance requirements. For example, anthropological research methods will be utilised to analyse user-needs and Design Thinking deployed to develop ergonomically centred solutions.

Benefits of Innovation
- enables all members of the community health process to transform healthcare into patient-centric solutions.
- enhances healthcare delivery in a distributed community model.
- cuts costs by minimising risk through a design-led approach.

Conclusion

This case-study of the new Design Innovation Scotland set out to demonstrate that Design Thinking is a powerful methodology that can individuals, economies and societies. It has also indicated that, more and more, the object of design is not a finessed product but the development of creative tools that allow people to become co-designers or design experiences for themselves. Design Thinking is an irreducible element within in that process. At the same time, it can be seen that design is no longer the exclusive domain of designers but a twenty-first century skill that anyone can and should learn innovate successfully. Though there are certainly specialist design practitioners, Design Thinking helps apply multiple viewpoints to a problem. In that sense, design projects are typically team-based, transecting disciplinary boundaries and Design Thinking synthesises information across multiple disciplines. Because human ingenuity is bottomless, innovation strategies utilising Design Thinking, and that tap into hitherto neglected intellectual capital and connect it better with financial capital, can help businesses, communities and the public sector thrive in an increasingly complex and changing world.

Pulling all of the above capabilities together, the new DIS is a singular demonstration of the recognition by policy-makers and influencers of the contemporary import of design thinking, socially and economically. This has gone beyond mere appreciation on the part of government in Scotland to directly supporting the establishment of a unique capacity that networks the skills and knowledge of academia, business, and public sector agencies, in order to address the major problems that are facing the country.

References

Brown T. (2007), *The Challenges of Design Thinking*, Intersections 07 transcript, http//:www.designcouncil.org

Cottam H. et al (2006), *Red Paper 2 Transformation Design*, London, Design Council

Cox G. (2005), *Cox Review of Creativity in British Business: building on the UK's strengths*, London, HMSO

(2007), *High-level Skills for Higher Value*, London, Design Council/Creative and Cultural Skills

Gann D and Dogson M. (2007*), Innovation Technology: How new technologies are changing the way we innovate*, London, NESTA

HEFCE/Design Council (2206*), Report on the Design Council/HEFCE fact-finding visit to the United States*

Leadbeater C. (2007), *We Think; The Power of Mass Creativity*, London, Profile

Lawson B. (1990), *How Designers Think*, Princeton, Architecture Press

Marrano M.G., Haskel J. & Wallis G. (2007), *Intangible Investment and Britain's Productivity: Treasury Economic Working Paper No 1*, London, HM Treasury

McCullagh K. Transformation Design, in: *Blueprint*, October 2007

Mulgan G. (2007), *The Ten Habits of Mass Innovation*, NESTA, Provocation 01 November 2006

NESTA, (2007), *Policy Briefing, Driving Innovation in Scotland*, London

Sanders E.B-N. and William C.T., Harnessing People's Creativity: Ideation and Expression through Visual Communication, in: Langford J. and McDonagh-Philp D., eds. (2001*), Focus Groups: Supporting Effective Product Development*, New York, Taylor and Francis

Sanders E.B.-N., Scaffolds for Building Everyday Creativity, in*: Creating Communicational Spaces: An International Conference Exploring Interpretation, Interaction, Negotiation and Culture in the Creation of Meaning*, Edmonton, Canada, 2003

The Scottish Government, (2007), *The Government Economic Strategy*, Edinburgh

Tapscott D. & Williams D. (2006), *Wikinomics, How Mass Collaboration Changes Everything*, New York, Portfolio

Tims C. & Wright S. (2007), *So, what do you do? A new question for policy in the creative age*, London, DEMOS