EPSRC
Engineering and Physical Sciences Research Council

Engineering Visions *in Design*

Workshop Report
July 2010

Dr. Derek Gillespie
Portfolio Manager, Manufacturing and Design

MATERIALS MECHANICAL & MEDICAL ENGINEERING PROGRAMME

Contents

Acknowledgements
We would like to thank The University of Bath for providing the venue for *Engineering Visions in Design*, and Professors Chris McMahon, Steve Culley, Alex Duffy and John Clarkson for their initial inputs into the planning of the event.

1.0 Background

After the publication by EPSRC of our portfolio landscape documents, the Materials, Mechanical and Medical Engineering programme has held several discussions with our Strategic Advisory Team, focussing upon providing additional context to the landscape documents. These discussions have served to validate certain opinions, and to challenge others, contained within the landscape documents relevant to the programme.

Alongside these discussions, it was thought worthwhile to provide the design research community with an opportunity to articulate those issues which they would collectively identify as being worthwhile EPSRC taking note of in their views of the field, and also those issues around which the community could focus for future research challenges.

The workshop was held on Thursday 1 July, 2010.

2.0 Aims and Objectives

Engineering Visions in Design was planned with four central objectives:

- To bring together a representative sample of academics, industrialists and members of relevant professional societies that span the scope of EPSRC's support for design research.
- To provide an opportunity for a constructive dialogue between the design community and EPSRC during our planning period for the upcoming Delivery Plan 2011-14.
- To allow delegates to exchange views relating to, and take ownership of, the important challenges facing the design community and inform EPSRC of these challenges.
- To input into future strategy for the Materials, Mechanical and Medical Engineering programme.

3.0 Attendees

The workshop was attended by invitation-only, with the invitees being selected to represent a cross-section of the design community as supported by EPSRC.

Invitations were sent to fifty individuals in total, from academia (including representatives from the current Innovative Manufacturing Research Centres that have a specific focus on design), industry and a sample of professional societies. Also invited were a small number of attendees from various design consultancies.

Thirty individuals indicated their interest in attendance. A full list of attendees can be seen in Annex 1.

4.0 Strategic Context

Design research is a core pillar of EPSRC's focus upon support for manufacturing research (Figure 1), articulated *via* Manufacturing the Future. The EPSRC portfolio has been assessed at a Theme Day event in April 2010, which provided commentary on the design research portfolio – alongside other manufacturing-relevant disciplines – by an international panel. *Engineering Visions in Design* was a complementary exercise, allowing the design community to self-assess themselves, and discuss opportunities for the future with EPSRC staff.

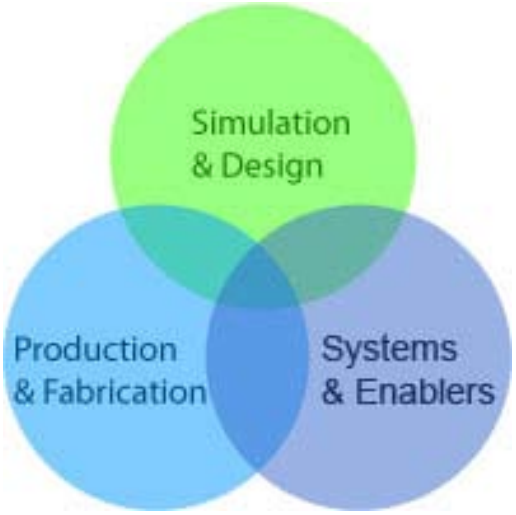


Figure 1: EPSRC Manufacturing Research

Delegates were given a summary of EPSRC's key goals for the Delivery Plan 2011-14 period, as encapsulated in the Strategic Plan 2011-14. This provided the context for discussions at the workshop.

Also provided as input were the outputs from a recent workshop help by the Cross-Disciplinary Interfaces programme to look at opportunities for collaborative research at the interface between the Social Sciences and the Engineering and Physical Sciences. This information is presented in Annex 2.

5.0 Workshop Outputs – Community Analysis

Delegates were invited to complete a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis of the UK design research landscape. The complete sets of outputs from this session are presented in Annex 3.

Strengths
Highlighted strengths focussed around the current people capability of the UK design research community, building upon a history of design initiatives, such as the Engineering Design Centres. There was a strong feeling that UK design research is internationally-respected and that UK researchers are leaders in several fields. Also strongly highlighted was the ability of the UK community to facilitate multi-disciplinary approaches to research, partly thanks to the presence of a good mix of product design and engineering design skills within the UK.

Weaknesses
Much of the discussion surrounding weaknesses focussed upon aspects related to a lack of common terminology for design research, and a

community that operates without knowledge of the larger research landscape – with the consequence that significant duplication of effort take place, or good research outputs are not built upon by other researchers. Also highlighted was the lack of experience of many researchers of design practice.

Opportunities
A wide range of potential opportunities were highlighted by delegates, including the application of design to innovative service solutions, design for an ageing population, design for the digital economy, and greater collaboration in design research *via* collaborative virtual enterprise.

Threats
The identified threats had a focus around people issues, with a lack of young researchers choosing design research, and a lack of research fellows in the area. A separate strand addressed the perceptions of design research by other academic disciplines, and a lack of perceived value attached to design.

Engineering Visions in Design delegates work on the afternoon sessions

6.0 Workshop Outputs – World Café Discussions

After carrying out the SWOT analysis and commenting upon the outputs, the workshop delegates then undertook a World Café exercise to expand upon their initial thinking. There were three questions, to be answered sequentially:

i. What are the potentially high-impact challenges?
ii. What is holding us back from tackling these challenges? Why can't we do this now?
iii. Is this challenge a threat if not addressed? Is it an important capability for the UK?

World Café outputs are complicated to summarise due to the nature of information capture. Maps of the World Café discussions are presented in Annex 4.

Delegates then selected the most interesting topics from their World Café discussions and were asked to carry out a clustering exercise to identify overlaps and commonalities between their conversations. Once this clustering had been completed, a prioritisation process identified those clusters to be discussed in greater detail.

Based upon the question, “What are the opportunities for the UK design community?” the clusters arising from the World Café were:

Collaboration

- Web-based collaboration
- Design research infrastructure
- Multi-disciplinary design
- Creative collaboration

Effective Working

- Better for less
- Understanding challenges
- Value drivers

Tools

- Multi-scale, multi-fidelity, multi-disciplinary virtual prototyping
- Visualisation
- Scenario building
- Design methodologies and tools to capture needs and solutions

Education and Training

- Developing tomorrow’s design research academics
- Enhanced design research and training

TRL 3 to TRL 6

- Lubricating the industry/academia interface
- Practical strategies for improved training, implementation and exploitation of developed processes
- Transferring research outputs to industry
- Direct link between design research and wealth creation

Socio-technical System Design

- System-level approach to design
- Design for behavioural change
- Inspiring the public and shifting perceptions

Design for a Changing Population

- Ageing
- Health
- Social Mobility

Design for Disruption
- Disruptive change
- Global challenges
- Technological change

Integrated Sustainable Design
- Life-cycle modelling
- Energy and resource usage
- Environmental impact

Holistic Systems and Services Innovation
- Life-cycle thinking
- Product-service shift
- Integrated understanding
- Design for longevity

Cognition and Neuroscience
- Understanding the process of design in cognition and neuroscience study

7.0 Workshop Outputs – Open Space Sessions

Eight of the eleven clusters created were further expanded upon in two Open Space sessions, during which the delegates were asked to expand upon the cluster topic following a series of questions:

i. Why is this idea worth exploring further?
ii. What would this idea entail?
iii. What is the academic contribution?
iv. Who else would need to be involved?
v. What crucial role would they play?

Delegates expanded upon their cluster headings, and all the ideas were presented back to the audience by a nominated speaker. The eight concepts presented were:

- Design for Disruption
- Collaboration
- Understanding the Design Process
- Holistic Systems and Service Innovation
- Socio-technical Systems Design
- Design for a Changing Population
- Integrated Sustainable Design
- TRL 3 to TRL 6 Research

After all the discussed concepts had been presented, delegates were invited to give their “gut reactions” to each concept, based upon three criteria of

novelty, appeal, and feasibility. This exercise was not a prioritisation process, but a means of rapidly assessing the audience reception of an idea as presented.

Delegates were also asked to provide contact details, if they were interested in exploring the concept further in the aftermath of the workshop.

Annex 5 contains completed Open Space pro-forma for each of the eight concepts, alongside their respective novelty, appeal and feasibility scores, and the contact details of interested delegates.

8.0 Conclusions

The Materials, Mechanical and Medical Engineering programme will take forward discussions held as a result of *Engineering Visions in Design* into our programme planning across summer and autumn 2010.

The contents of this report will be disseminated to other relevant EPSRC research base programmes, sector teams and RCUK mission programmes.

The onus is on the UK design research community now to take ownership of the ideas and concepts generated by the workshop and determine the best way in which to take these ideas forward. When required for further discussions, contact details for EPSRC staff can be found from the EPSRC website.

As always, we recommend that members of our research community subscribe to our RSS Feeds to remain up-to-date with applicable funding opportunities.

For specific questions or feedback related to *Engineering Visions in Design*, please contact:

Dr. Derek Gillespie (derek.gillespie@epsrc.ac.uk, 01793 44 4301).

EPSRC would like to thank all delegates for giving their time to attend the workshop, and for their willingness to engage in constructive and stimulating discussion during the day. We hope that every attendee found the day to be a worthwhile activity, and that the contacts made will be fruitful for the future.

Derek Gillespie
July 2010

Annex 1 Workshop Attendees

Professor	Cecil	Armstrong	Queen's University Belfast
Dr	Marco	Aurisicchio	Imperial College London
Professor	Tracy	Bhamra	Loughborough University
Professor	Sandy	Black	London College of Fashion
Professor	Simon	Bolton	Cranfield University
Dr	Julian	Booker	Bristol University
Ms	Libby	Brodhurst	Institution of Engineering Designers
Professor	Stuart	Burgess	Bristol University
Professor	Peter	Childs	Imperial College London
Dr	Mark	Claydon-Smith	EPSRC
Professor	Steve	Culley	Bath IdMRC
Dr	Elies	Dekoninck	Bath IdMRC
Dr	Terry	Dickerson	Cambridge EDC
Dr	Hua	Dong	Brunel University
Professor	Alex	Duffy	Strathclyde University
Professor	Christopher	Earl	Open University
Professor	Claudia	Eckert	Open University
Mr	Christopher	Exeter	Design Council
Dr	Derek	Gillespie	EPSRC
Professor	David	Harrison	Brunel University
Dr	Tom	Headen	EPSRC
Mr	Gareth	Jones	The Product Works
Mr	Tony	Keegan	Institution of Engineering Designers
Mrs	Phillipa	Knight	EPSRC
Dr	Vicky	Lofthouse	Loughborough University
Mr	Ed	Matthews	Royal College of Art
Professor	Alison	McKay	University of Leeds
Mr	Colin	McKinnon	Buro Happold
Professor	Chris	McMahon	Bath IdMRC
Professor	Raj	Roy	Cranfield University
Professor	Jim	Scanlon	University of Southampton
Dr	Louise	Tillman	EPSRC
Dr	Ash	Tiwari	Cranfield University
Professor	Ken	Wallace	Cambridge EDC

Annex 2 Opportunities at the Social Science Interface

Opportunity: Global Markets
cross Cultural issues –
languages e.g. Chinese
- Values affecting use/uptake
Impact: e.g. mobile phones & healthcare – developing world & aging population in the west.
~~Why now?~~ How companies adapt business models across globe

Opportunity: Global Ethics
- Future casting - proactive rather then responsive
- Ideologies + value systems as enablers – practice vs. barriers/process understanding value in a global context.
- Privacy of data, IP
Impact:
- Enabling research to take place more equally and with relevant core
- Give a broader understanding across RC and disciplines of research questions that may emerge
- Facilitating development of IT, healthcare, business in a global economy

Why now? Because we are now at the point where IT, interdisciplinary & global issues are converging & value systems may be facilitators of global ethics in dialogue.

Opportunity: Global Citizenship
(for a sustainable planet)
* Global value systems – sustainability
* What is our role as a society (western) in shaping aspirations of developing world.
* New business models. Alternative to global markets (sustainable)
Impact:
- slow down rate of damaging effects through unsustainable development.
- More globally aware people
- Long life for planet earth

Why now? Climate change – most pressing issues for generation

Opportunity: Develop global ethics for the future.
Why C-DIP? Not happening now across the board, which is where it's needed – needs to be proactive (see blue card)
New ethical implications of new technology – data deluge etc.

Global Ethics/Citizen

Opportunity: Civil Society / social capital enhancement.
Why C-DIP? Because it is not a solely social issue but involves a very wide range of disciplines, e.g. built environment, transport, heath / well being, management and organisation of work.

Opportunity: Invite the very best in their fields to design and manage a portfolio of projects (conducted by a broad range of investigators) addressing a 'grand Challenge'
Why C-DIP? Inherently interdisciplinary, with each of the best demanding the best from other disciplines.

Opportunity: Questioning regimes, challenging orthodoxies
Impact: Testing robustness of established 'system' thinking. Redirecting research priorities. Influencing decision-making processes & resource allocation
Why now? Info age in full flight, ageing, heath, climate all now of heightened concern
'Tweaking" with how we are used to doing things may soon no longer be enough. There may be substantial potential in "rethinking society"

Opportunity: Mass Behaviour & complexity science
Impact: Economic Values Major healthcare target
Why now? public heath / policy record, opportunity to provide mass improvement

Opportunity: Connected Communities
Impact: Scale – Built Environment – role of technology – advantages – disadvantages of community + connectedness
Why now? Concepts of community changing all the time Communities across world, physical / virtual dispersed

Opportunity: Engagement with science and trust.
- input to understanding.
- Understanding cultural diversity (including language)

Impact: improved interactions between scientific communities and other social groups
-improved interaction between global communities

Why now? Current approaches are not optional and need to be critiqued

Opportunity: Broader social science perspective on engagement, trust, valves and interests and ethics. In context of science – based EPSRC initiatives.
Why C-DIP? C-DIP can provide an overview of disciplinary interactions & systems of knowledge, including cultural traditions - AIM, ELWEC, heath care, sustainability, life sciences, synthetic biology, energy, IT & society.

Science and Trust

Tomorrow's World – People and Systems

Opportunity: Tomorrows people: understanding users of tomorrow
Young people growing up with fundamentally different experience with technology – what effect!
Why C-DIP? Needs;
- Social & developmental science
- engineering & computer science
- key application areas (e.g. health self management)
- leadership

Opportunity: (Tomorrows world)
Next generation healthcare: understanding users of tomorrow
Impact: Waste of money
Why now? Money already being spent. Need new model of (team (MD))

Opportunity: Young People and inclusion in society
Impact: Promote good intergenerational relations. Address social exclusion for young people. Integrate young people into society. Reduce socially disruptive behaviours e.g. on line abuse
Why now? Is a mega social problem. Reduce alternation amongst young people.
Promote intergenerational solidarity

Mobility in a changing World

Opportunity: Mobility in a changing world. Up - Mobile population; economic; political: social.
nature of social citizenship
Impact:
- "mobility" physical and virtual
- Modelling mobility – services, infrastructure, environment
- Disaster, natural, war etc

Why now? world more mobile than ever before in the range of dimensions

Mobility in a changing world
Opportunity: Physical / virtual / econ / Social
Possibilities for improving modelling - Spatial + temporal over wide
Why C-DIP? Range of scales. C-DIP brings together diverse range of scientists – computer scientists, maths OR; Social sciences (econ: demo; Sociology, geog)
Including "uncertainty"

Opportunity: New ways of working
* New technologies – space & time
* Interaction with design
* Enhance performance dimensions
* Well being dimensions

Why C-DIP? Opportunities for integrating a large variety of perspectives.

Understanding behaviours – Uncertainty and insight

Opportunity: Making smarter decisions: managing uncertainty
Impact: Economic Value
Why now? Silo research (economics / medicine / engineering)

Opportunity: Understanding real behaviours
– behavioural economics
– behavioural interventions
– Designing incentives
Impact: Most areas of policy e.g. health issues, Crime
Why Now? Potential for models based on significant amount of good data.

Opportunity: Insight and Uncertainty. cross cutting insights from risk, model failure, understanding vs. simulation in decision making / regulation: finance, environment, climate, infrastructure, health, deployment of "New" technology
Why C-DIP? Cross Cutting Combines from many fields

Opportunity: Dealing with "certainty"
Science is becoming better at prediction in a range of fields: Weather, health, genetics ect. Yet how we as 'humans' respond to such 'certainty' is much less well understood. This also raises interesting/profound ethical issues.
Why C-DIP? Requires real interaction / understanding between 'Scientists' and those who understand how societies function.

Opportunity: matching likely solutions with actual social science problem (should EPS consider problems in content more?)
Impact: More relevant, better joined up informing for decision making and policy support. Makes physical sciences more affordable to "students"
Why now? Urgency / time valve of understanding in health, climate, long legacy infrastructure (eg. Transport)

Opportunity: Engineering happiness
Why C-DIP? 'Happiness' or wellbeing is a very different metric of progress than economic prosperity or efficiency – it unsettles conventional thinking of what our goals should be.

Opportunity: Scientists are people too!
Bringing sociology of science + technology into design + shaping of computational chemistry + physics' equip areas of science + technology
Why C-DIP? Bring Social scientists into EPS heartland, currently under developed.

Opportunity: Use of ICTs to tighten feedback loops between scientist's knowledge & its application
Impact: More detailed & rapid understanding of the adoption of scientist's knowledge to meet the needs of citizens
Why now? Opportunities pounded by advanced ICTs

Opportunity: Bottom-up (real-time) technology development

Impact: Socially desirable + Acceptable technologies

Why now? Avoiding another GM controversy. Broader understanding of the social context & value of technologies

Opportunity: Innovation at bottom of pyramid

Impact: Low cost solution – re-use of existing technologies
Low income groups
UK firms selling to devolving countries

Why now? Expanding DC markets – greater potential for UK PLC
Britain in the world – risen profile
Re-use environmental solutions

Opportunity: Disruptive Technologies
New business models / Regulatory
Can technology ever serve the interests of the most marginalised?
Links to "bottom of the Pyramid"

Why C-DIP? Interface between ALL kinds of technology and society
C-DIP is rare in its ability to bring the right stakeholders to the take.
Need cutting edge technologies to engage with the challenge

Opportunity: Innovation at bottom of pyramid / disruptive innovation good ideas in several countries transferred to developed countries (parallel –from bottom of UK social pyramid…)

Why C-DIP? Engineering for global market
Not covered by ESRC – tech.. solutions very different form traditional EPSRC programmes – different set of users – non UK –products for the world

Opportunity: Disruptive technologies for development. E.g. Water and community ownership – gender relations
How can new technologies change traditional power relations to faster / support / promote development
Impact: Poverty down, human well being up, empowerment up, equity up
Why now? So many technological projects have "failed" in that unequally up. Many projects have warmed in favour of ruling elites. Understandings why this is the case + how technologies can promote sustainable well – being is essential. SS "poorer" now than in the past. Not sustainable in the next century.

Bottom of Pyramid Technology

Opportunity: Understanding conflicts and collaboration
- Understanding cultural contexts.
- Military/intelligence perspective (one application?)

Impact: Cultural Harmony
Why now? The world is a dangerous place

Opportunity: Designing for social inclusion reduces inequalities.
Impact? Enormous
Why now?
- Aspiration
- huge inequalities
- widespread policy failure.

Opportunity: Promoting resilience in society during extreme events
Impact: Disaster prone areas (earthquakes, volcano's) Community –owned solutions knowledge transfer. Advancing interdisciplinary plenary approaches
Why now? Extreme events increasing in frequency can impact on everyone and need urgent solutions

Opportunity: Designing for opportunity (cross disciplinary research for promoting social inclusion / Tackling inequalities)
Why C-DIP?
- Public / heath policy failed
- No one council addressing it
- Needs multiple disciplines
- Needs leadership
- Involves user engagement in research design.

Opportunity: Visualisation in medical imaging. – Designs, embedding + maintaining technology within (clinical) practice

Why C-DIP? Bring in SS expertise to existing eng-medical interface

Opportunity: Embrace the Open Government Data instructive. Opportunities for "understanding Government data" but also understanding the impact of openness on citizen, commerce, society.

Why C-DIP? CS Challenges = (Scale, Inference, Uncertainty)
SS opportunities = (using data to address research questions, but also subject of study)

New Methods for Data

Opportunity: New method for new data may show forms of social data available but needs new methods – and other data does too.
Why C-DIP? Social research benefits from computational techniques. Engineering captures data by instrumenting society. However, the NEW METHODS have application across disciplines, and need interdisciplinary to create.

Opportunity: Issues of openness: open Government data – challenges & ops (sc challenges, SS opportunities!)
Impact: Relationship between citizen & state. Balancing open source data with commercial requirements. "What if" scenarios
Why now? "making public data public" Initiative NOW ("putting the front line first")

Opportunity: Wealth of digital data about natural events and human activities.
Impact: Vastly expanded evidence base for all disciplines and for integration across disciplines
Why now? Because of the opportunities provided by the digital revolution.

Annex 3 SWOT Analysis Outputs

What are the strengths of UK design research?

Group 1

- Multiple perspectives
- Art colleges
- No separation of technical/artistic design in terminology
- Linking technology and people
- Good industrial involvement in research
- Flexibility and agility
- Speak English
- Design thinking
- Leadership/recognition in design research
- World respected expertise and skills
- Play leading in the roles international community
- Well respected by international community
- A cooperative community
- Leaders in design community
- Design communication and visualisation
- Thought prototyping – routes to new solutions
- Physical outputs that can be handled, photographed etc
- Good coverage of design disciplines
- Design drives new production of development – cross disciplinary
- Good at acting as a bridge between disciplines (interpreter)
- Facilitate dialogues across communities
- History of creativity
- Capacity for creative insight
- Understandable reference points (value impact stories)

Group 2

- The new holistic definition of manufacturing
- Manufacturing is more than production
- Diversity of different types of design activities – engineering & art based
- High value-added industries
- Using the design process as an enabler
- Design viewed a prestigious attractive career
- Established community of design researchers
- Good mix of aesthetic and engineering skills
- Better quality of students are attracted to design
- Track record of engineering design research *e.g.* EDCs
- Experience of collaborating with industry and strong links/collaboration
- Making stuff!

- Fast visualisation of problem solutions
- Good international collaboration
- Facilitating multidisciplinary research
- History of engineering innovation
- We do deliver benefits to stakeholders
- Pragmatic and leading to impact
- Ability to integrate perspectives
- Collaboration across discipline boundaries
- Product design (BSc) popularity
- Excellent researchers and research culture
- Long term plan
- Breadth and depth of expertise per head population – punch over our weight

What are the weaknesses of UK design research?

Group 1

- Poor PR
- Design and its relationship to new product introduction (NPI)
- Traditional engineering courses do not teach (even recognise) “design”
- Lack of industry engagement with design research
- CAD vendor leadership is non-UK
- “Design” is too nebulous a term
- Key manufacturing capability disappearing overseas therefore difficult to “design for”
- Articulating what is the general value to stakeholders
- Methodology of design research
- Inflexible, regional economies, especially SME base
- Little understanding outside design/development world about what it really does
- Unlocking SME capabilities
- Involvement with SMEs as a resource
- Challenge of post-research research
- UK-centric vision
- Researchers’ lack of experience of design practice
- Diversity in community – duplication of efforts
- Duplication and reinvention of the wheel
- Design research pro-paradigmatic
- Lack of design systems from through-life perspective
- Difficult to attract UK Design graduates into PhD research
- We don’t have a shared map of the design research landscape, which makes building on others’ work more difficult
- High teaching loads!
- Using the word design without an adjective – do we mean engineering design, product design, industrial design *etc*. This can lead to lots of confusion re: reviewing *etc.*

- Lack of support to PhD students in the design research field
- Lack of design of fast moving electronic products
- Communicating research outputs in an engaging way
- Fragmented and competing design research community – research not known across boundaries
- Diverse outcomes – different measures – bias to objectively measure
- Industry hesitant to fund design research

Group 2

- UK institutions!
- Understanding innovations ("creativity is easy, innovation is difficult")
- Design research
- Silos
- Narrow definitions of design
- Engineers ↔ design have very different focus and approaches but are dealt with under one umbrella (apart from engineering designers)
- No funding for student helpers to analyse/gather lots of→data qualitative bias
- Definitions: creativity; design; innovations
- Has potential to fall into the gaps between funding opportunities
- Design undervalued in UK businesses who manufacture (*cf.* Italy)
- Image of design as "art"
- Disparate sectors/disciplines. Lack of "single voice"
- Has not had the impact that its emphasis or innovation, globalisation, sustainability would suggest
- Lack of adventure in delivery of big business
- Mindsets
- Poor citation record
- Defining horizons (new and existing)
- Adoption of existing best practices
- Low rank of design research journals. ICED conference proceedings should be treated as "computing lecture notes" (high standard)
- Lack of national programme
- It is often unclear where design fits with engineering funding bodies
- Full implementation of design methods in industry is rare
- Value of design
- Focus on enterprise (about making money, or about benefitting society?): tendency to say one or another

What are the opportunities for the UK design community?

Group 1

- True integrated through life, top to bottom, broad/specific design and engineering
- Cluster development

- Designing innovative service solutions
- Environmental needs – sustainable design – energy consumption
- Establish and maintain a national research programme through mutual collaboration
- Need Eng Docs in design
- Design-led thinking to improve creativity in industry
- Building on craft-based design
- Service experience culture
- Working with cognitive psychology
- Working with business and design (a global trend)
- The nature of the work – will not be like now in ten year's time – *e.g.* home working; video conferencing; mobile computing; distributed systems *etc.*
- Digital natives/digital immigrants "generation y"
- Linking digital economy to design research
- International collaborations – *e.g.* same issues apply in the US
- Design a key way in which engineering sciences can be translated into value
- Delivery of more solutions through better "market questions"
- Design at system level
- Applying design beyond traditional boundaries
- Evaluating potential value of design
- High-valued people becoming unemployed could provide development engine room – agile innovation
- Design of services + P.S.S.
- Integrating "old" and "new" world of design
- Work with developing countries (*i.e.* China, India) to address engineering challenges
- Global growth in design research
- Alignment of opportunity to strategic demands
- Multi-scale, multi-fidelity; design analysis at different levels of maturity and fidelity
- User-centred design to make technology work!
- Design automation to achieve efficiency
- The virtual enterprise – collaboration hubs
- Build on Design for the 21st Century before benefits are lost
- Neuroscience
- Latest developments in ICT – web services grid
- Emphasis on innovation, globalisation, inclusivity; sustainability *etc*. - Very good match to national needs

Group 2

- Tap into green projects sustainable R.E. *etc.* Large scale infrastructure projects
- Rapid prototyping changes the dynamics of the design process

- Micro scale new product development (*i.e.* not RR/Airbus, BAE Systems)
- Bottom of the pyramid (new markets/users)
- Multi-disciplinary projects/multiple perspectives
- Mindset changing
- Wicked problems – new routes to solutions design thinking
- Sustainable product/service/innovation
- Big engineering design projects – nuclear; solar farm; carbon capture and storage; offshore facilities
- Funding opportunities are moving to design and something else to be topical and have impact
- Ageing population – need for inclusive design
- Multi disciplinary, multi-perspective discourses
- Development of new hybrid researchers across design/engineering/science interface
- SME capability development;
- Translation of product solutions into “service innovations”
- Creativity in technical/engineering design
- Increased prevalence of creation technology (web 2.0 for example) could offer new design opportunities
- Opportunities for behaviour change
- Free space opportunity to develop new thinking and impact
- Innovation high tech and low tech
- Design activities are critical to profit from technological innovation
- Need to reinvent all our technologies to achieve sustainable development
- Socially responsible growth
- Real need for a “sciences of the artificial”
- To make real beneficial changes to society
- Energy/material scarcity will require unprecedented innovation
- Linking big to small, small to big organisations
- Synergistic working
- Need to share ideas amongst universities on how best to “teach” design
- “Develop” (active) design leaders
- Boundary shifting “cross-over”

What are the threats to the UK design community?

Group 1

- Overseas development – export of IP with manufacturing
- Engineering graduates do not continue working/researching in the engineering field
- Multi-disciplinary research difficult to gain funding
- Lack of people who can appreciate creative design; engineering analysis and vigorous research methodology

- Attracting young engineers to design research
- Funding "valley of death" between research and commercialisation; "cash flow-capacity" of manufacturing industry to support
- Creative long-term collaborations with industry
- Development of academic staff with design breadth, *e.g.* no EPSRC Fellows in Design & Simulation.
- Sustainable funding to take research to the next stage
- Need for a change in focus for engineers – from applying solutions to understanding and responding to needs
- Funding cuts
- Research assessment metrics and multi disciplinary projects
- Continuity of funding
- Other disciplines view design as "idea generation" and do not value it
- Diversion of attention to teaching
- Saturation in design student job market
- Lack of opportunity for funding to keep up/update web based outputs
- High teaching loads
- Rhetoric of social science obscures challenges

Group 2

- India/China - ↑ graduates and focus on design and time↓
- No – there is lack of recognition/status for design
- Political focus on technology not processes of deployment
- Design research not seen as sexy/macho/rigorous enough
- "Science" emphasis in university engineering departments
- Design research students not fostered through mechanical engineering degrees – too much Engineering Science emphasis
- Lack of agenda and clear stories
- Students need to learn how to apply engineering science as opposed to just doing it
- Lack of academic staff with industry experience (ref. driven)
- The broad range of different disciplines under EPSRC can cause problems in reviewing re: misunderstandings in terminology and process therefore good projects drop out
- Emphasis in research assessment on traditional metrics
- Less £ and fewer contributors and consequences of it. More focussed funding to detriment of field
- Knowledge acquisition difficult in industry
- Referee focus on citations and impact factors
- Globalisation impacting on innovation
- Using old questions to answer new problems
- Loss of leadership in dpt. Research
- UK design industry dominated by SMEs who find it difficult to invest in research
- "Big boys" getting majority of funding
- Developing countries

Annex 4 World Café Outputs

Group 1

Black**: What are the potentially high-impact challenges**?

- Enabling wellbeing; better lives globally
- High impact challenge: when things go right the benefits are massive – when they go wrong the link becomes obvious
- Without the correct infrastructure, nothing will happen, therefore can be very limiting
- Socio technical design to tackle big society issues
- Challenge is to give more value to the non economic elements (environmental, social, economic) – high value delivers high impact (to whom)
- Whole system/life view
- Working closely – gap for research fellowship
- Wealth creation; news ways of working
- What if goal is to create wealth, not things? Wealth is measured as social economic and environmental;
- Health design
- Power supply
- Water supply/sewage
- Infrastructure
- Challenges – redefining the USP of design, knowing when a design is finished – meet needs vs. perfect solution. Optimised design process for an adequate product
- Challenges – to whom? Design. Research community – society – industry?
- How to design with limited resources e.g. time, money, doing more with less
- New environment we live in
- Repair/replace
- Off shoring/outsourcing of production
- What is design?
- Role of enterprise
- Global challenges: water security, food securing, aging population
- Specialism vs. holistic – infrastructure
- Designing & disruptive

Blue: **What is holding us back from tackling these challenges? Why can't we do this now?**

- Role of the designer is to identify and develop the products of the future and take these to market
- Coupling design research and industry

- Role of design – unmet need/technology available
- Designer
- Lack of long term policy
- Lack of adoption of "good" ideas
- Build long term relationship – NOW – transfer to point of application
- Exchange + transfer through graduates and PhD + infrastructure in companies/labs
- Practice based doctorates

Red: **Is this challenge a threat if not addressed? Is it an important capability?** (Sheet 1)

- Exploitation and implementation of ideas + processes INDUSTRY
- Negotiation – context; evaluation – YES! Dragons den
- Stanford; MIT – are we as good – YES?

Group 2

Black: **What are the potentially high-impact challenges?**

- Radical approaches from design thinking
- Satisfying human needs
- Wealth creation?
- Food production
- Behaviour change
- Aging population
- Education
- Role of design in wealth creation
- Micro changes?
- Transportation
- Challenges
- Multi touch points
- Better for less
- Less for more
- IMPACT
- Wealth creation
- Knowledge Impact
- Social value
- Sustainable value
- Mindset
- New questions – deeper thinking
- Meaningful engagement
- Social Industrial
- Research
- Industrial
- Creative Processing

- Environmental Technologies
- Low carbon technologies
- Capability building
- Value service experiences
- Adding new value
- Challenge environmental reference points
- Objectives - strategy tactics
- Moving from traditional models to new models
- New technologies
- SMEs
- Global computers
- Universities and organisations
- New respective
- Multi disciplinary communities
- Design research – innovation practise – impact change
- Socially responsible design
- Innovation infrastructure models
- Low carbon and resources
- "Big" engineering scale
- Demographics + delivering service
- Focus "wealth" creation
- Extend design thinking to many domains…..
- Challenges
- Need for holistic thinkers
- Need for invention of our technologies to achieve sustainability
- All aspects carbon food water……
- Globalised world economy
- Aging population
- Move from products to services
- Integrated disciplines

Blue: **What is holding us back from tackling these challenges? Why can't we do this now?**

- Do we have people able to think holistically?
- Agile enough
- Specialists'
- Funding is provided for specialism not for generalisations
- So many different issues and design to think about
- Different ways of collaborating, trust and openness on collaboration
- What is the motivator for change – not legislation? What…? Why do it – other than it's the right thing to do?
- A very broad overview is needed
- How do radical changes – how to link this to incremental damages
- Limiting infrastructure
- Transferring thought into practice

- Existing technologies
- Core Themes
- Technologies – economic technologies
- Mindsets need changing and supporting
- Very difficult
- Understanding customer behaviour and aspirations
- Mindset change required
- Value often measured by what your have

Red: **Is this challenge a threat if not addressed? Is it an important capability?**

- Design Research Role: Efficient (systematic, predictably); Radical Change
- Understanding the motivation for change and how to use this
- How can we make this happen- has to include all benefits societal and environmental and economical – no choice it has to be done
- More systematic delivery of radical change
- Sharing research methods and data
- We have done it before – e.g. smoking ban, whale oil, gas turbines
- Why are instrumental changes not enough?
- Behavioural changes
- Aging population
- Specialists verses generalists
- Copy automotive industry process
- Who improves efficiency by ½% per year over 10 years – need a more common approach
- Build capability to ensure more for less
- Focus
- Engineering design activity
- Share ideas and dataset / software
- Research activity

Group 3

Black: **What are the potentially high-impact challenges?**

- How do we obtain very high level system understanding to enable "what if" questions?
- Design research questions?
- How can we make radical design steps in a virtual environment?
- Applying design process and approach to emerging problems
- How can we understand what radical changes might be acceptable?
- Politics - Change behaviour - More with less – design
- Safety and security
- Design challenges – how can we design in virtual environment with confidence

- Learning from history/anthropology – inclusive design
- Designing society
- consumerism
- changing attitudes
- (re-manufacturing)
- Low impact manufacturing through design
- Knowledge and information managemen5t systems
- Designing in rapidly changing contexts and environments
- Understanding designers and designing (psychology cognition/design)
- Designs' role in quality of life/health
- Sustainability – environmental energy and resource use
- Big picture design – system – socio technical
- Understanding complex systems; interaction of soft-hard aspects
- High impact = competitiveness = to whom?

Blue: **What is holding us back from tackling these challenges? Why can't we do this now?**

- EPSRC has done public dialogue --- get societal view
- Holding us back:
- Silos
- Project – oriented nature – 1 person, 3 years
- Problems too big/broad
- Interfaces
- We don't systematically collect information
- Software vendors can "do it all" need "plug and play"
- Academic structures ---- infrastructures – need national integration

Red: **Is this challenge a threat if not addressed? Is it an important capability?**

- EPSRC - The research problem needs to be understood before assembling the research teams
- EPSRC needs a new mechanism for interdisciplinary research
- Want a research implementation fund
- Need accomplished generalists to manage multi-disciplinary/multi-institute programmes
- Understanding changing paradigms
- Measuring success
- Not innovative SMFs in methods and tools
- Lack of UK software developers in the UK limits potential to do design research

Group 4

Black: **What are the potentially high-impact challenges?**

- Creating a “happier” society with a sustainable “vision e.g. less stress etc, more balance etc, less materialistic, healthier, reducing drug taking; reducing crime, more secure
- Repair the “broken model”
- Coping with an ageing
- Managing “information overload”
- Retaining knowledge and experience
- Design of new pension scheme
- “Champion”
- Commitment – training
- Integration in PDF
- Valuation studies
- Training
- When to apply
- Life-long, or upgradeable products
- “Design in society”
- Design for sustainability – very broad, however*.
- Implementing what we know
- Creating a national research agenda and programme, (not just a funding programme but work/research
- Social, industrial and business impacts – doing it all
- Embodied carbon and water – how will effect design/consumption of products?
- Built environment – numerous idea
- Low carbon buildings
- Successful communities
- Design for productivity/well being
- Climate change mitigation/adaption
- Design for waste minimisation
- Sustainable design and can we challenge growth
- My car – can I have it? Can product development be infinitely variable – and should it be?
- Landfill design
- Transferring technology
- Applying complexities
- Sustaining and building or initiatives between arts and engineering (esp. Design for the 21st Century)
- UK to be seen as premier design centre in the world*
- Validating design research (share datasets)
- Knowledge of how to convert an idea into a big business
- Coping with co-creativity and co-design
- A mismatch between university educated design student numbers and the ability of the market place to employ them

- A growing skills gap in production between the UK and the rest of the world
- Preparing graduates to support the future of manufacturing
- Infrastructure
- Schools
- Water
- Energy
- Transportation
- Sewage
- Systems
- City of the future
- Countryside of the future

- Hit list:

1. multidisciplinary design
2. design for green economies; sustainability/LCM impact approach to design
3. systems approach to design
4. training, implementation, exploitation – practical strategies with industry
5. VP – uncertainty

- Design education more holistic approach
- Chemical loop combustion – design for clean coal technologies
- Customer based design – this is the customer does the design (not co-design or design for the customer)
- "Holistic" design – system, social, products *etc*.

Blue: **What is holding us back from tackling these challenges? Why can't we do this now?**

- Clear demonstration of solutions
- Not focussing on need
- Social reluctance
- No system/plan
- Lack of contact between industry and academia
- Funding focussed on "push" of problem solving rather than "pull" of need

Red: **Is this challenge a threat if not addressed? Is it an important capability?**

- USP of UK Designers?
- Ageing population is a huge issue ↔ threat if not addressed
- Wealth creation
- Attitudes required to change
- Redefining UK design USP – culture (western) brand – critical to address. Rate of change needs recognising.

- Holistic approach required but not often supported as they look flaky.
- Agility? Social Change?
- Changing role of design in industry and companies and societies, “what is design”?
- Lubricate interface between “industry” and academics (e.g. KTP, EngD)

Group 5

Black: **What are the potentially high-impact challenges?**

- Diverse range of discipline/philosophy within the “Design” heading
- “Design” is poorly / weirdly understood by public (including politicians…)
- What is design research?
- Virtual testing
- Competitiveness
- USP in global market
- High impact
- Quality of life
- Creativity
- Understanding
- Aging population
- New values
- Energy
- Free market drivers
- Regulatory drivers
- Design activities
- Design for disruption open source research
- What “if” tools
- Designers / engineers not is a strategic decision-making position
- Impact of virtual prototyping (CAE integration)
- Design process
- High level process
- Validation
- Simulation
- Controlled environmental impact
- Educate society about environmental issues and behaviour change
- Values/ objectives
- Cost
- Time to market
- Environment
- Manufacturing
- Interface
- New design areas
- Electro-mechanical design processes

- Lack of public understanding about designing things and manufacturing them
- Learn variant designs
- Real data
- Validated models
- Real constraints
- Simulation – virtual prototyping
- Efficient
- Algorithms
- High impact
- Competitiveness
- Quality of life
- Improvement
- Change
- Lack of power and influence of designers within enterprise
- Society
- Formalised needs
- Design
- Manufacturers
- Customers buying
- All research in layers understanding across one layer
- No vertical understanding on ownership

Blue: **What is holding us back from tackling these challenges? Why can't we do this now?**

- A mega model to do “what if scenarios”
- Sharing datasets
- Build enough previous work
- What’s holding us back?
- Society role of origin
- Regulation
- Next generation substandard
- Role of designers
- Designers as Batman – making efficient things
- Designers as the Joker – designing things that we don’t want
- Better folios
- Understanding drivers
- Technological barriers
- Societal
- Constraints
- Economic
- Wicked problems
- US = the design deferral community
- Success rate
- Grant application process

- 4 year PhD?
- 5 year PhD?
- SIM city
- New questions
- Understanding what those new questions are
- Society change
- Quality standards
- Service design
- Manufacturing introduction – design and development
- Society
- Service system - systems
- What “if” scenarios
- Technical
- Social
- “Tools” for what if questions
- Models/framework Q
- Don’t share data sets
- Expectations
- Impact
- Better for less
- Time
- Resources
- Aspiration
- Put into calls
- Design
- Opportunity development question
- Score/spectrum
- Lack of socio-technical design

Red: **Is this challenge a threat if not addressed? Is it an important capability?**

- Technological barriers
- Societal
- Constraints
- Economic
- Using threats to drive new dreams
- Joined-up thinking
- Creative tension
- Capability issues
- T-shaped strategies
- Dream tools
- Numerous outstanding problems on all levels, which otherwise become show stoppers

Annex 5 Open Space Session Outputs

A Note on the Novelty, Appeal, Feasibility Process
Each concept outlined below was rated on an arbitrary ten-point scale against the three criteria of Novelty, Appeal and Feasibility, with a score of one being low and ten being high. The ideas were all "marked" in isolation, and not relative to one another. The aim of the exercise was not to prioritise the ideas, but to give an indication of the "gut feel" of the delegates for each idea.

A low score in any one category is not necessarily a "bad" score – it is the overall balance of opinion that is useful. The results of the exercise are plotted graphically after each summary.

Design for Disruption

What is the challenge to be tackled?
• How can we prepare ourselves to respond to 'mega' change • Creating disruption (new and existing technologies) • Small scale as well as large scale disruption • Organisational culture • Social – economic disruption • (a) technology • (b) social
Why is this worth exploring further?
• Threat to UK plc • Opportunities for UK plc – disruptive innovation • Massive societal impacts need responding too – *e.g.* water wars • (a) Game Changing Strategies → impact on opportunity development • (b) Disruption as a driver Having enough skilled people to tackle disruptions
What would the idea entail?
• Tools • Infrastructure • Delivery experiences • Frameworks • Design for upgradeability (build out xxxxxx)
What's the academic contribution?
• Learning how to respond • Learning how to disrupt • Knowledge transfer skills • Research and design disruptive systems/processes with disruptive tech

- Research and designing approaches for mitigating disruptive scenarios positively

Who else would need to be involved, and why?

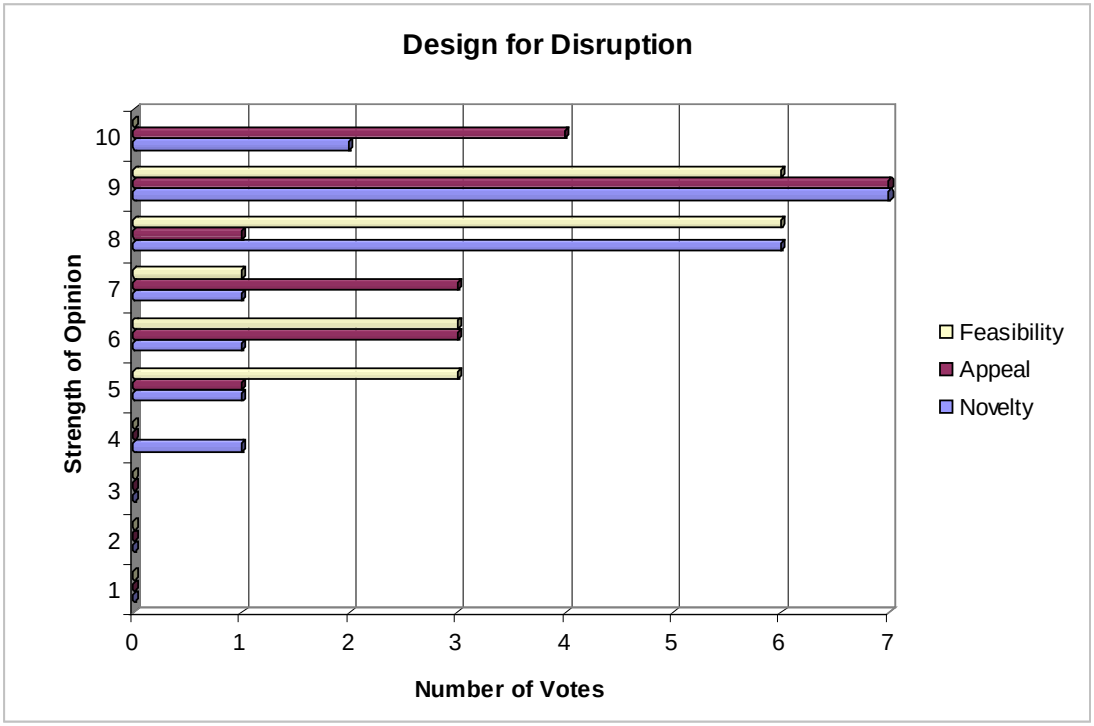
- Social scientists
- Pre-technologists

Comments and notes

- Japanese non committal approach … can this be developed?
- Disruption as driver = Red
- Disruption as game changer = Blue

I'd like to help develop this concept further.

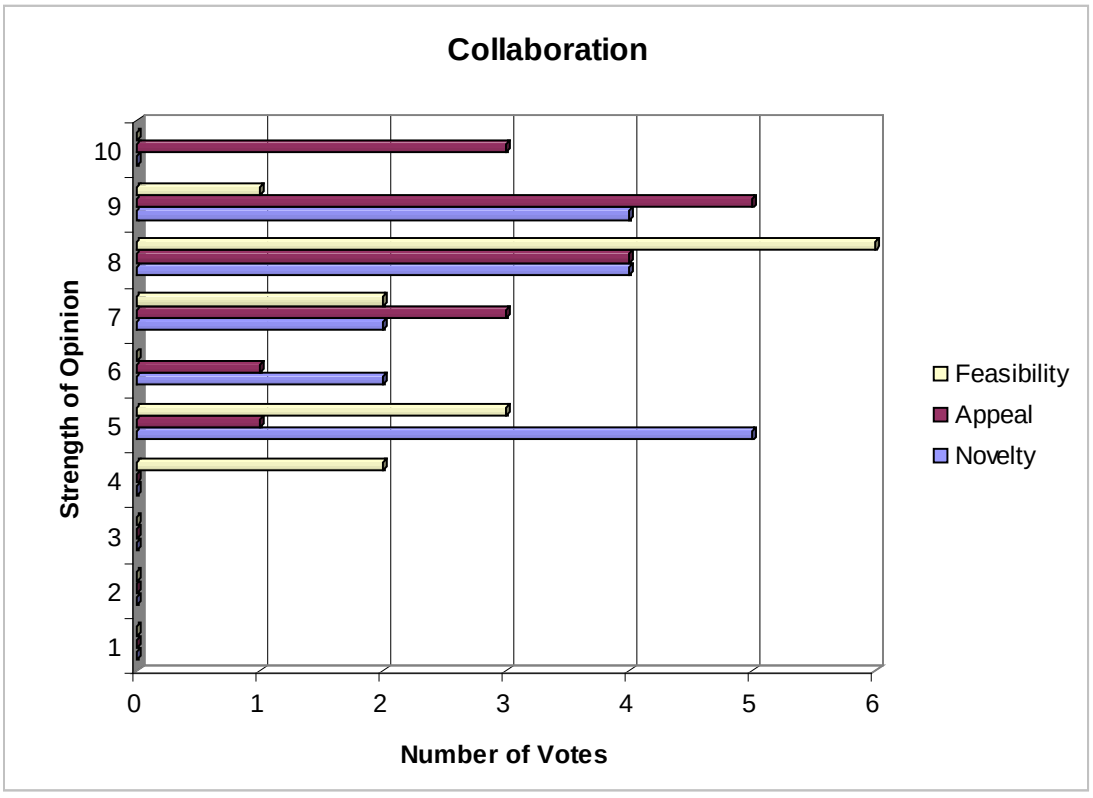
- Simon Bolton S.bolton@cranfield.ac.uk
- David Harrison David.harrison@brunel.ac.uk
- Sandy Black S.black@fashion.arts.ac.uk
- Colin McKinnon colin.mckinnon@burohappold.com
- Tracy Bhamra T.bhamra@lboro.ac.uk



Collaboration

What is the challenge to be tackled?
• Collaboration (a) research groups (*) (b) industry (supply chain) • Multidisciplinary design Infrastructure and publication
Why is this worth exploring further?
(*) Design research is challenging because: • It involves both human and technology aspects ie involves many research disciplines • Many interlinked factors influence the design process, ie it is difficult to isolate 'simple' research topics • No agreed taxonomy – research methodology not yet universally agree (progress has been made) • Gathering and analysing data from real projects in industry is time consuming and challenging
What would the idea entail?
• Different groups/disciplines working together! • Sharing databases, tools, methodology, open source • Reducing 'competition' culture • Improving 'RAE points' system for multidisciplinary Projects (currently favours narrow specialisms) • Providing design research infrastructure • Providing collaboration management support • Affordance of representations
What's the academic contribution?
• Different perspectives and approaches • More generic understanding • Understanding the similarity and diff. between types of design process/tools/techniques
Who else would need to be involved, and why?
• Industrial partners • EPSRC • KTPs (?) • NESTA • Academics from different types of design Fashion design Prod. Design Comm. Design Muf. Design/graphics Eng design • Design practices

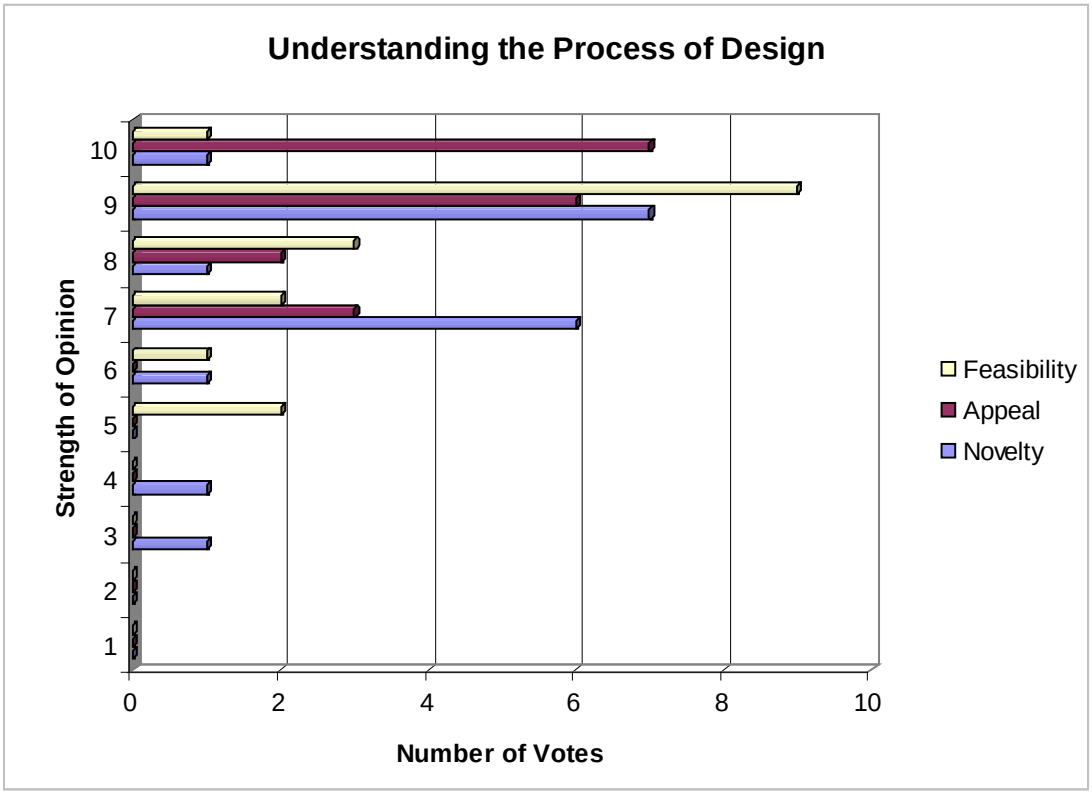
Comments and notes
• Collaboration is great in principle – difficulty in practice • Large collaboration carry a very high admin overhead
I'd like to help develop this concept further.
• Rajkumar Roy r.roy@cranfield.ac.uk • Hua Dong Hua.Dong@brunel.ac.uk • Sandy Black S.blck@fashion.arts.c.uk • Claudia Eckert C.m.eckert@open.ac.uk • Cecil Armstrong C.armstrong@quib.ac.uk • Colin McKinnon colin.mckinnon@burohappold.com • Tracy Bhamra T.bhamra@lboro.ac.uk • Simon Bolton S.bolton@cranfield.ac.uk



Understanding the Design Process

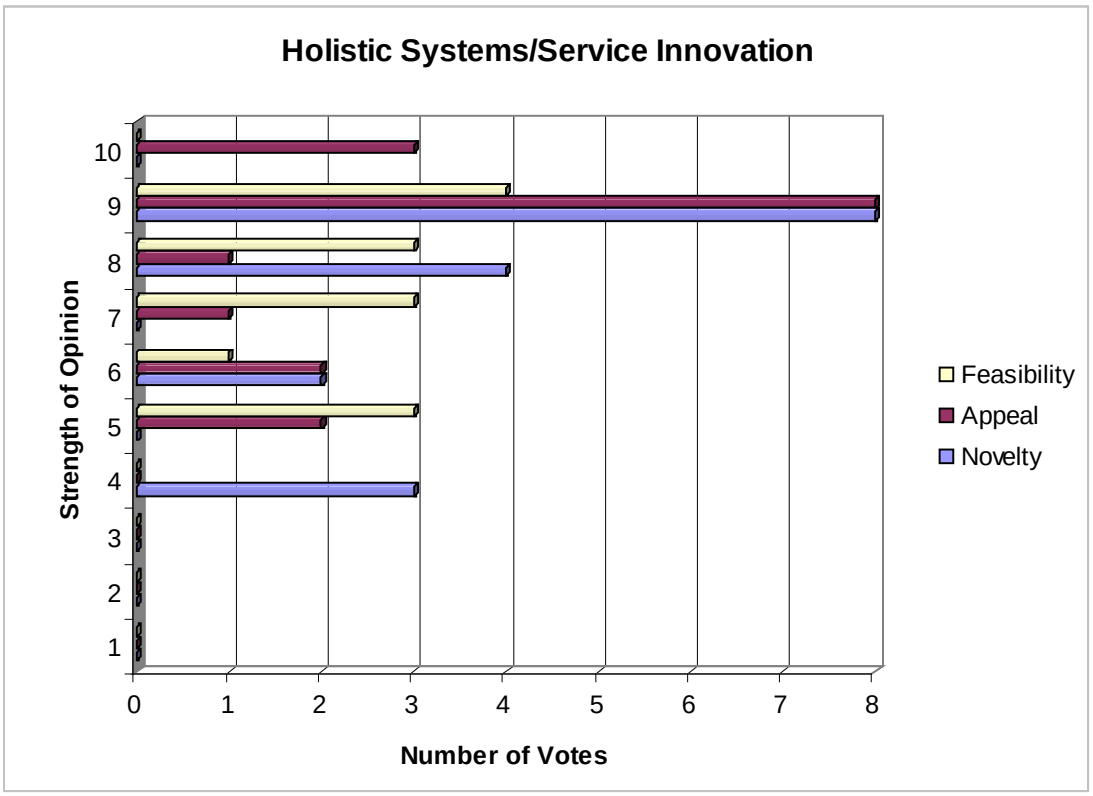
What is the challenge to be tackled?
• Defining design as (set of?) discipline(s) • Understanding the process of design
Why is this worth exploring further?
• This applies to using learning from other disciplines in design practice and research: • To help position design research and learn from each other • To help position design research industry practice • So that we can explain what design is and isn't • To identify new opportunities, future possibilities and potential stakeholders
What would the idea entail?
• Develop common understanding (and build languages on it) • Identifying similarities and differences across different domains • Characterising different domains – scale, product type, … • Specifying representative (realistic, rich) examples for bench-marking
What's the academic contribution?
• Understanding of and so connectivity/interface needs between design domains when designing large/complex systems • Understanding personality in designing → to understand outputs and how to manage design eg in new situations such as virtual teams and across cultural boundaries • A philosophy of designing (written by/with philosophers)
Who else would need to be involved, and why?
• Philosophers • Cognitive psychologists • Design historians • Engineers and designers from different domains • Neuroscientists • Business • Ethnographers • Human behaviour/need understanding • (academic and practitioners) – OEMs independents • Emotional response
Comments and notes
• Should be priority number one! • Neuroscientists now have a tool so there is an opportunity
I'd like to help develop this concept further.
• Chris Earl c.f.earl@open.ac.uk • Vicky Lofthouse V.a.lofthouse@lboro.ac.uk • Rajkumar Roy r.roy@cranfield.ac.uk

- Sandy Black S.blck@fashion.arts.c.uk
- Claudia Eckert C.m.eckert@open.ac.uk
- Tracy Bhamra T.bhamra@lboro.ac.uk
- Simon Bolton S.bolton@cranfield.ac.uk
- Alison McKay a.mckay@leeds.ac.uk
- Marco Aurisicchio m.auvisicchio@imperial.ac.uk
- Ash Tiwari a.tiwari@cranfield.ac.uk
- Peter Childs p.childs@imperial.ac.uk



Holistic Systems/Service Innovation

What is the challenge to be tackled?
• How to model the system and understand/manage interaction/ dynamics/emergence • Evaluating diff domains? • Synthesise specifications • How is a holistic system designed? • What system should be designed?
Why is this worth exploring further?
• Improving existing systems/affordability • Developing new systems – multiple perspectives Configuration • Competitiveness
What would the idea entail?
• What if capability for system evaluation? • Innovative systems
What's the academic contribution?
• Modelling interaction/tools to understand the interrelationships and dependencies • Understand causal drivers/barriers/design theory / methodology • Understanding the process to transfer Q need spec to technical spec.
Who else would need to be involved, and why?
• Complexity • Social Science • Engineering • Industrial Discussions • Systems Engineering • Mechatronics • Customer/suppliers
Comments and notes
• None
I'd like to help develop this concept further.
• Alex Duffy alex.duffy@strath.ac.uk • Rajkumar Roy r.roy@cranfield.ac.uk • Alison McKay a.mckay@leeds.ac.uk • Ash Tiwari a.tiwari@cranfield.ac.uk • Claudia Eckert C.m.eckert@open.ac.uk


Holistic Systems/Service Innovation
Strength of Opinion
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
8
Number of Votes
Feasibility
Appeal
Novelty

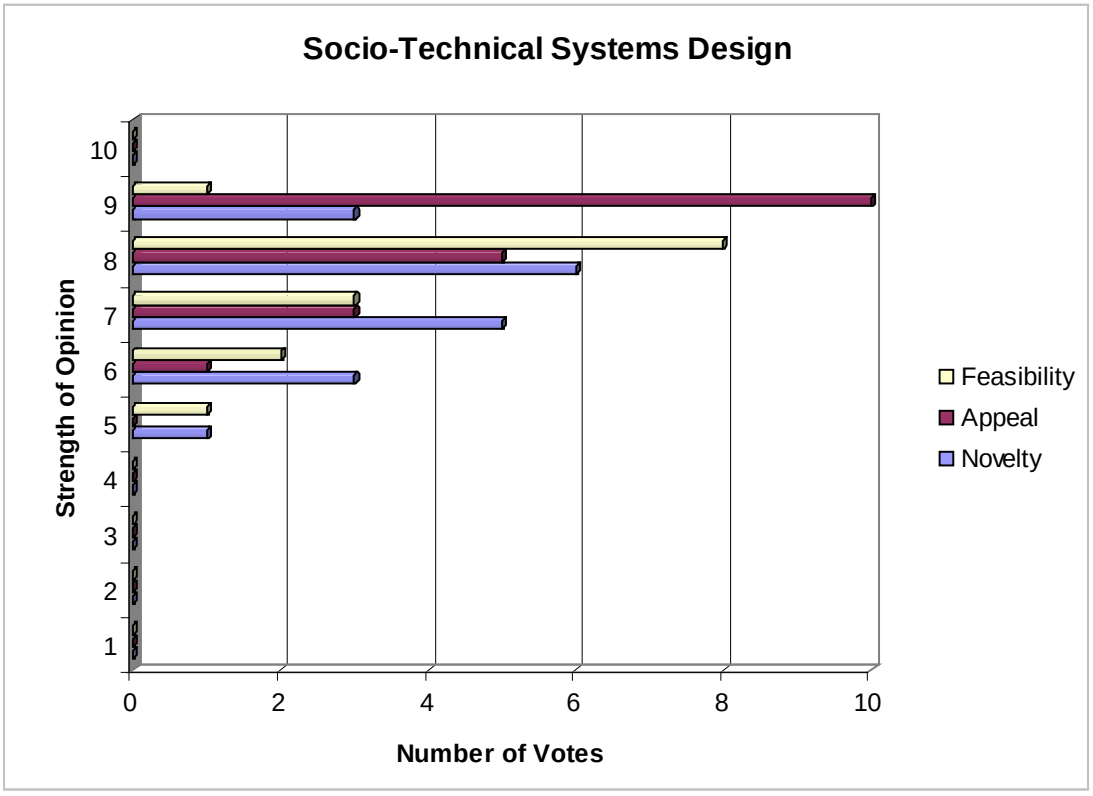
Socio-Technical Systems Design

What is the challenge to be tackled?
• Socio-technical system design
Why is this worth exploring further?

• Real world problems include people
• Move from "product supply" to "Product-Service Systems"
• Systems are getting more complex
  o Technical
  o Human – depends on human performance
• Interesting problems to be solved!
• Consequences are getting larger (things going wrong for right)
• Can't just rely on technology
• Enable resilience

What would the idea entail?
• Cross-disciplinary working • User engagement • Link to legislation and policy • Case studies/real examples
What's the academic contribution?
• New ways of designing big systems • Understanding the systems through Modelling/Simulation • New models of engaging stakeholders • Scenarios planning – what if? – Human, Technology, Uncertainty
Who else would need to be involved, and why?
• Business • Politicians • Social Scientists • Policy makers • Public implementation or realisation of research outputs
Comments and notes
• Need to identify case studies or grand challenges
I'd like to help develop this concept further.
• Terry Dickerson tld23@eng.cam.ac.uk • Alison McKay a.mckay@leeds.ac.uk • Stuart Burgess s.c.burgess@bris.ac.uk • Ash Tiwari a.tiwari@cranfield.ac.uk • Chris Earl c.f.earl@open.ac.uk • Chris McMahon enscam@bath.ac.uk • Tracy Bhamra t.bhamra@lboro.ac.uk • David Harrison david.harrison@brunel.ac.uk • Vicky Lofthouse v.a.lofthouse@lboro.ac.uk

- Alex Duffy alex.duffy@strath.ac.uk
- Simon Bolton S.bolton@cranfield.ac.uk
- Rajkumar Roy r.roy@cranfield.ac.uk



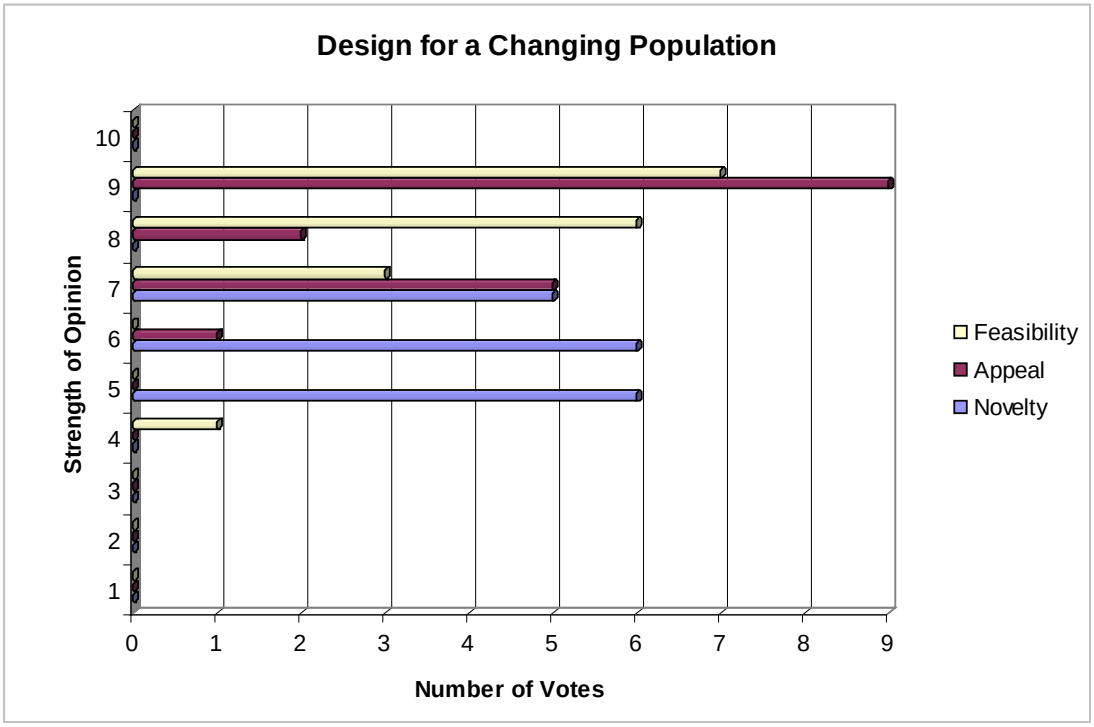
Design for a Changing Population

What is the challenge to be tackled?
• Design for disability vs. design for all • The “old old” (75-85) • The “old old old” (85+) • Social interaction enhancement – systems and their design which meet the social need too • Addressing cultural context in design • People need people
Why is this worth exploring further?
• Still lots of design issues to be tackled • Aging population well recognised • Not everyone want the same thing • There is an opportunity to develop our industry in this area prior to the population bulge in China becoming old • Community enhancement (people need people) • Need new models of Health and Care delivery
What would the idea entail?
• Design outputs • User centred design • Enhance people’s quality of life • Cross systems understanding research/modelling • Balance imposition with independence
What’s the academic contribution?
• New understanding • New design approaches • New concepts that can inform UK plc • Engaging end-users creatively an effectively • User-centred design methodology
Who else would need to be involved, and why?
• End users • Occupational therapists • Psychology • Helen Hamlyn Institute • Special interest groups – charities, *e.g.* RNID, Reach support organisation • All stakeholders – manufacturers, installers, regulators • Clothing can be key • Materials/textiles/fashion specialists
Comments and notes
• Smart textiles/textile sensors are developing at a rate which needs support as research rather than spin-put companies • Inter-disciplinary tech-in social context *i.e.* socio-technical

- Compare new dynamics of ageing

I'd like to help develop this concept further.

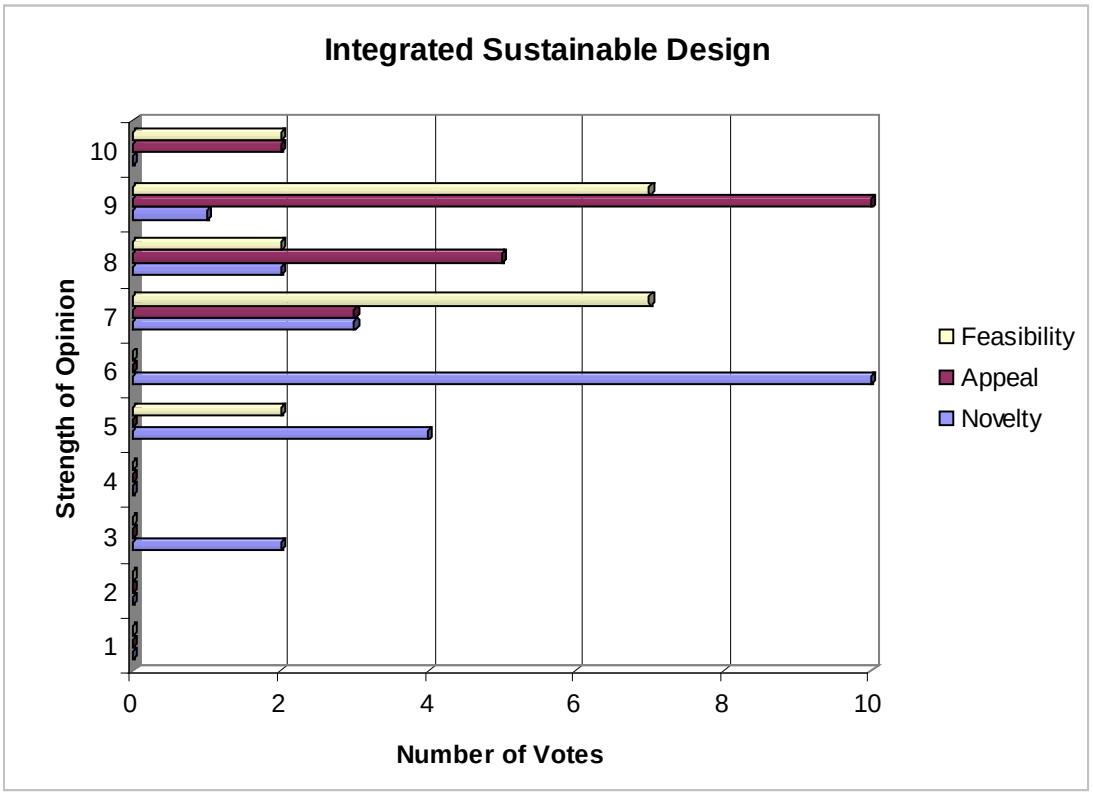
- Hua Dong Hua.Dong@burnel.ac.uk
- Sandy Black S.black@fashion.arts.ac.uk
- Vicky Lofthouse V.a.lofthouse@lboro.ac.uk
- Ash Tiwari a.tiwari@cranfield.ac.uk
- Chris McMahon enscam@bath.ac.uk
- Claudia Eckert C.m.eckert@open.ac.uk
- Peter Childs P.childs@imperial.ac.uk
- David Harrison David.harrison@brunel.ac.uk



Integrated Sustainable Design

What is the challenge to be tackled?
• Making sustainability issues as straightforward to consider as financial one • Balance between free market and legislation • Lack of adequate validated data sets • No common format • Integration of research areas to seamlessly address challenges • Recognition of social and environmental issues
Why is this worth exploring further?
• Finite resources • Increased population consumption
What would the idea entail?
• Making the decision making incidental • Looking at people, how they interact with technology and infrastructure. • How people react, perceive things • Improved collection and validation of data • Intelligent products and buildings, including intelligent fabrics… • Needs identification • Information
What's the academic contribution?
• Validating and improving data set • Understanding how users make use of sustainability issues • Understanding how designers engage effectively with sustainability information • Understanding usage patterns for products and systems • Development of "lightweight" assessment tools
Who else would need to be involved, and why?
• Policy makers • Interaction designers • Legislation • Psychologists • Town planners • Social sciences • Design consultancies • Software developers
Comments and notes
• Socially sustainable design
I'd like to help develop this concept further.
• Hua Dong Hua.Dong@burnel.ac.uk • Sandy Black S.black@fashion.arts.ac.uk • Vicky Lofthouse V.a.lofthouse@lboro.ac.uk

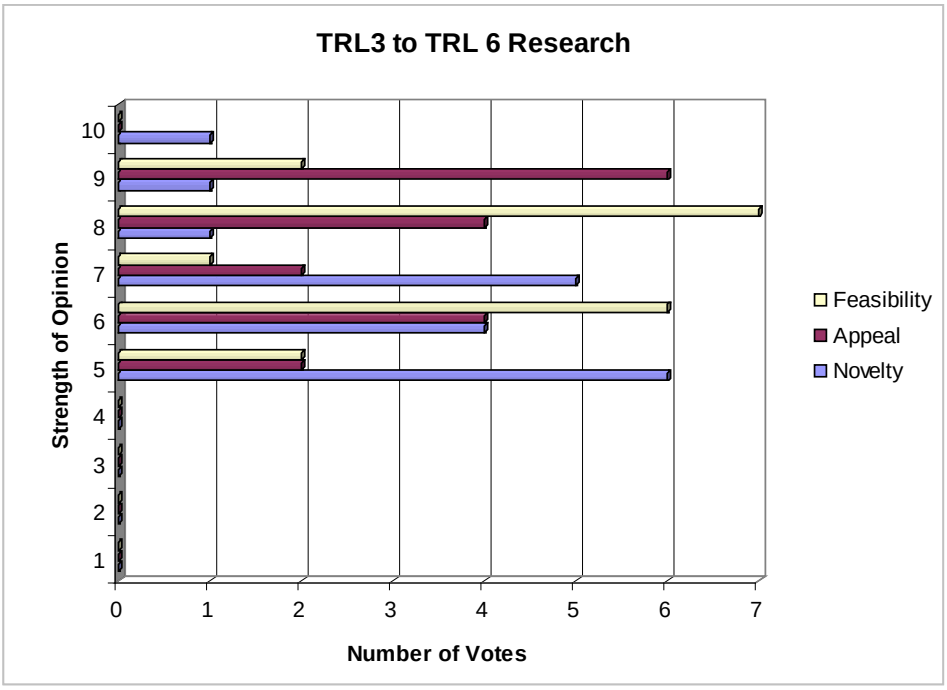
- Chris McMahon enscam@bath.ac.uk
- Peter Childs P.childs@imperial.ac.uk
- Stuart Burgess s.c.burgess@bris.ac.uk
- David Harrison david.harrison@brunel.ac.uk
- Julian Booker j.d.booker@bris.ac.uk
- Tracy Bhamra t.bhamra@lboro.ac.uk
- Cecil Armstrong c.armstrong@qub.ac.uk
- Claudia Eckert c.m.eckert@open.ac.uk
- Alex Duffy alex@cad.strath.ac.uk
- Chris Earl c.f.earl@open.ac.uk



TRL 3 to TRL 6 Research

What is the challenge to be tackled?
• Inspiration vs. perspiration (Edison) • "10,000 hours for musicians" • Genius • TRL 3-6 • Post-research research • "making into methods" • Filling the gap • More use of research in industry • "Twilight" • Ideas not a form to implement • People in industry too busy to take forward
Why is this worth exploring further?
• For results/methods to be taken up by industry they must be: o Sound o Simple/user friendly o Robust o Provide rapid benefit • To support/enable the impact agenda • Ref design research 2000 (Bath) Utilisation – industry The "gap" making into methods (who?) Research – university vs. post-research research
What would the idea entail?
• Requirement – PhD plus (EngD plus) Filter Accept failure Maybe – 1 in 10? • Does it need a big team? • Consolidation/testing/developing/simplifuying/packaging/communicating/process adaption • "PhD plus" • "Team based approach" Wall | extra PhD | Impact ↑ "Realisation" End of ⟶ PhD
What's the academic contribution?
• Value to UK, genuine impact potential • Further validation of process and approach • Generic "making into two methods" • Get "RAE points" for working on the gap

Who else would need to be involved, and why?
• Transfer probably works best when the final method is developed in collaboration, *i.e.* university and industry • Many 'methods' research output far too ambitious with exaggerated claims
Comments and notes
• 'Product' improvements are easier to introduce than 'process' improvements • Strategy for funding • Strategy for whom responsible? • 'Champion' for introduction • Ideas are best transferred through 'people' transfers • Universities cannot transfer ideas into industry • Someone in industry must take responsibility • Rolls-Royce have 'key' technology customers for their UTCs • University staff get no 'RAE points' for working on the 'Gap' • Industry don't see it as their job to work on the 'Gap'
I'd like to help develop this concept further.
• Hua Dong Hua.Dong@burnel.ac.uk • Peter Childs P.childs@imperial.ac.uk • Tracy Bhamra t.bhamra@lboro.ac.uk • Cecil Armstrong c.armstrong@qub.ac.uk • Alex Duffy alex@cad.strath.ac.uk • Steve Culley s.j.culley@bath.ac.uk • Marco Aurisicchio m.aurisicchio@imperial.ac.uk



Topics Not Expanded Upon During Workshop

Education and Training

Developing tomorrow's design research academics

- Need pathways incl. Fellowships to go from PhD/PDRA to Lecturer or industrialist to Lecturer (possibly *via* PhD)
- Education and training
- Enhanced design education and training

Interested Parties:

- Alex Duffy alex@cad.strath.ac.uk
- Chris earl c.f.earl@open.ac.uk
- Alison McKay A.Mckay@leeds.ac.uk
- Elies Dekoninck E.a.dekoninck@bath.ac.uk
- Terry Dickerson tld23@eng.cam.ac.uk

Tools

Tools for multi-scale, multi-fidelity, multi-disciplinary virtual prototyping
"What if" tools

- Visualisation
- Scenario building
- Thought prototyping
- Free spaces
- Link to disruptive change
- System level

Using design methodologies and tools to capture needs and solutions
Understanding the process of design via neuroscience, cognition study

Interested Parties:

- Alex Duffy alex@cad.strath.ac.uk
- Chris Earl c.f.earl@open.ac.uk
- Cecil Armstrong C.armstorng@qub.ac.uk

Effective Working

- Better for Less
  - Understanding challenges
  - Value drivers
  - Working together more
  - Societal level
  - Technical level
  - Political level

Interested Parties:

- Alex Duffy alex@cad.strath.ac.uk