

**Designing for the 21<sup>st</sup> Century**  
Interdisciplinary Methods and Findings

Edited by Prof. Tom Inns

**GOWER**

## Introduction

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Welcome to the second book describing projects that have been undertaken as part of the Designing for the 21<sup>st</sup> Century Research Initiative. The first book was published in December 2007 and tracked the work of 21 research cluster projects that were supported by Phase 1 of the Initiative funding.<sup>1</sup> This second volume describes the work of the 20 project teams that were supported through Phase 2 of the Initiative's research funding.

<sup>1</sup> INNS, T. (ed.), 2007. *Designing for the 21<sup>st</sup> Century: Interdisciplinary Questions and Insights*. Aldershot: Gower Publishing.

This introductory chapter provides a guide to the material within the book. This starts with a brief overview of the Designing for the 21<sup>st</sup> Century Research Initiative: its history, aims and structure. The generic format of all the chapters is then described, followed by a summary of each contribution and a brief rationale of the chapter sequencing. The introduction concludes by suggesting key lessons that might be learnt from the Initiative as whole. This is achieved by reflecting on progress made against all three of the Initiative's key aims and describing future strategies that might fast-track the realisation of future opportunities.

## Overview of the Designing for the 21<sup>st</sup> Century Research Initiative

Academic research in the UK is supported by seven of the research councils, each covering their own portfolio of disciplines and subject interests. The councils provide the university sector with research funding through a mixture of research grants and studentships. Historically, much of this funding has been made available through responsive mode support (individuals make a direct application to the research council that funds research in their discipline). Increasingly, however, funding is also directed into strategic programmes. These are themed (usually around issues of government and sector priority) and are often interdisciplinary, being

<sup>2</sup> RCUK, 2009. *RCUK Annual Delivery Plan Report, 2008–09* Swindon: Research Councils UK.

<sup>3</sup> DCMS, 2001. *Creative Industries Mapping Document 2001*. London: Department for Culture Media and Sport.

supported by more than one research council.<sup>2</sup> The Designing for the 21<sup>st</sup> Century Research Initiative is an example of a strategic programme. The programme was conceived in 2002, as a response to growing policy interest in the creative industries<sup>3</sup> and out of recognition that many of the design challenges facing society in the 21<sup>st</sup> century require investigation through interdisciplinary research.

The AHRC and EPSRC each committed £3.25 million to fund the Initiative activities between January 2005 and December 2009. The total budget of £6.5 million was split between two phase of research. £1 million was used to fund the Phase 1 research cluster projects; £5.5 million was used to support the Phase 2 research projects. The Phase 1 research cluster projects were reported in the first Designing for the 21<sup>st</sup> Century book mentioned earlier. This book reports on work completed as part of Phase 2 of the Initiative. Across both phases of activity the Initiative had the following aims:

- To help build a new diverse research community with a common interest in 21<sup>st</sup> century design.
- To help stimulate new ways of design thinking to meet the challenges of designing for 21<sup>st</sup> century society.
- To help support leading edge design research that is reflective, socially aware, economically enterprising and internationally significant.

### *Phase 2 research projects*

The Phase 2 research call documentation was drafted during the second half of 2005, this was informed by the community of researchers engaged with Phase 1 research cluster projects. In November 2005 a two-day workshop with 75 members of this community helped define the profile of the Phase 2 research call and the criteria that might be used for project assessment (one of the first times that a research council programme has actually been designed through a participatory design process).

The Phase 2 call was announced in January 2006. The aim of this funding was to support substantive interdisciplinary research projects of 12–24 month duration. Funding of up to £400,000 was available for each project. In April 2006, 65 proposals for Phase 2 research funding were submitted. Following a detailed process of peer review over the summer of 2006, a commissioning panel met in September 2006 to consider project applications. Table 1 provides a very brief overview of each of the 20 Phase 2 research projects, more detailed information is available at [www.design21.dundee.ac.uk](http://www.design21.dundee.ac.uk) or by accessing the relevant URL in column 4 of the table.

Project title	PI	Institution	URL
Considerate Design for Personalised Fashion Products	Prof. Sandy Black	University of the Arts	<a href="http://www.consideratedesign.org.uk">www.consideratedesign.org.uk</a>
Branded Meeting Places	Prof. Richard Coyne	University of Edinburgh	<a href="http://ace.caad.ed.ac.uk/branded">http://ace.caad.ed.ac.uk/branded</a>
Practical Design for Social Action	Dr Andrew Dearden	Sheffield Hallam University	<a href="http://www.technologyandsocialaction.org">www.technologyandsocialaction.org</a>
DEPtH: Designing for Physicality	Prof. Alan Dix	Lancaster University	<a href="http://www.physicality.org">www.physicality.org</a>
Embracing Complexity in Design	Prof. Jeffrey Johnson	The Open University	<a href="http://www.complexityanddesign.net">www.complexityanddesign.net</a>
Inclusive New Media Design	Dr Helen Kennedy	University of Leeds	<a href="http://www.inclusivenewmedia.org">www.inclusivenewmedia.org</a>
Designing Services in Science and Technology-based Enterprises	Lucy Kimbell	University of Oxford	<a href="http://designingforservices.typepad.co.uk">http://designingforservices.typepad.co.uk</a>
Stress Computation, Visualisation, and Measurement	Dr Wanda Lewis	University of Warwick	<a href="http://go.warwick.ac.uk/design21">http://go.warwick.ac.uk/design21</a>
Design Synthesis and Shape Generation	Dr Alison McKay	University of Leeds	<a href="http://www.engineering.leeds.ac.uk/dssg">www.engineering.leeds.ac.uk/dssg</a>
Design Scoreboard	Dr James Moultrie	University of Cambridge	<a href="http://www.designscoreboard.org.uk">www.designscoreboard.org.uk</a>
The Welcoming Workplace	Prof. Jeremy Myerson	Royal College of Art	<a href="http://www.welcomingworkplace.com">www.welcomingworkplace.com</a>
People-centred Computational Environments	Prof. Ian Parmee	University of the West of England	<a href="http://www.ip-cc.org.uk">www.ip-cc.org.uk</a>
Designing for Affective Communication, Personalisation and Social Experience	Prof. Chris Rust	Sheffield Hallam University	
Bike Off 2 – Catalysing Anti Theft Bike, Bike Parking and Information Design	Adam Thorpe	University of the Arts	<a href="http://www.bikeoff.org">www.bikeoff.org</a>
Emergent Objects	Prof. Mick Wallis	University of Leeds	<a href="http://www.emergentobjects.co.uk">www.emergentobjects.co.uk</a>
Democratising Technology	Lois Weaver	Queen Mary, University of London	<a href="http://www.demtech.qmul.ac.uk">www.demtech.qmul.ac.uk</a>
2020 Vision – The UK Design Industry in 2020	Prof. Alex Williams	University of Salford	<a href="http://www.ukdesign2020.org/about2020.php">www.ukdesign2020.org/about2020.php</a>
Sustainability for Metadesign	Prof. John Wood	Goldsmiths College, University of London	<a href="http://attainable-utopias.org">http://attainable-utopias.org</a>
Multimodal Representation of Urban Space	Gordon Mair	University of Strathclyde	<a href="http://web.mac.com/raymond.p.lucas/iweb/Multimodality/Home.html">http://web.mac.com/raymond.p.lucas/iweb/Multimodality/Home.html</a>
Realising Participatory Design with Children and Young People	Dr Andree Woodcock	Coventry University	<a href="http://www.coventry.ac.uk/researchnet/d/418/a/2906">www.coventry.ac.uk/researchnet/d/418/a/2906</a>

Table 1, Summary of Phase 2 research projects

## How This Book is Structured

The Phase 2 projects started in late 2006/early 2007 and were completed by the beginning of 2009. Each of the project teams has followed their own individual dissemination strategy, producing conference contributions, journal papers, exhibitions and books for special-interest groups and stakeholders. In addition each team has also contributed a chapter to this book. The aim, in doing this, has been to create a central repository that captures activity across the Initiative's project portfolio, helping signpost the reader to more specialist publications and outputs. The book also aims to provide a reference for readers interested in design research methods and their applicability to different types of design research problem.

Each of the chapters describes the background to the project in question, who the researchers were, how they became involved in the project and what their motivations might have been. The aim has been to try to capture the reality of how interdisciplinary research teams are formed and how they go about the process of negotiating research project activity.

The chapters then describe the approach taken by each team, providing details of the research methods that have been used within each project, where these methods find their origins, how methods have been blended to support an interdisciplinary approach, and, where appropriate, the iterative nature of the research journey – as you read the chapters you will see how methods have often evolved during the course of the research.

Each chapter then concludes with a review of the new knowledge and understanding generated through the project work, locating these insights into contemporary understanding of the topic.

Each one of the research teams has addressed a very different facet of 21<sup>st</sup> century design. Outlined below is a brief summary of each team's work and a rationale for the sequencing of the chapters.

The book begins with two contributions that look at the current position of design. James Moultrie's and Finbarr Livesey's chapter explores the challenges associated with comparing design capabilities in different countries; in doing this the authors make some interesting observations about the position of design in different parts of the world. The global theme is then taken up in the following chapter in which Alex Williams

*et al.* explore where the UK design industry might be in ten years' time and how it might respond to potential global challenges and opportunities. Again, this chapter makes a useful contribution to both our understanding of design and the methods that can be used to research the sector.

Lucy Kimbell then examines the role of the service designer, an increasingly significant form of design practice. This chapter profiles many approaches for capturing key aspects of designer/stakeholder interaction for analysis from an interdisciplinary perspective. Sandy Black *et al.* focus on the role of the fashion designer, another under-researched discipline within design's canon, focusing in particular on how fashion might respond to technological change and its environmental responsibilities.

These four descriptions of change and emergence provide a useful preparation for Katerina Alexiou's *et al.* contribution on embracing complexity in design. This presents a framework for unpacking the relationships between design and complexity science – relationships that if pursued bring valuable insights for both disciplines.

The next six chapters all examine how different tools and methods might bring greater clarity to the process of design. Each is located within a particular context, but the lessons have the potential for wide application. John Wood describes metadesign, an approach that allows design to deal with complexity and, particularly, the challenges of sustainability by pursuing principles of synergy between design team members. Joslin McKinney *et al.* then examine the contribution the performing arts can make in catalysing innovation within design. Approaches for encouraging participation are then explored further by Ann Light. She describes how methods from collaborative art practice might allow more democratic discussion of technological change with the groups often most marginalised by it. Richard Coyne *et al.* maintain the focus on technology and people describing interventions that shed light on the interaction between ubiquitous digital technologies and notions of place. The challenges of designing meaningful encounters between individual and content are then analysed by Chris Rust and his team in their project My Exhibition. This chapter provides insights into interdisciplinary collaboration and the issues associated with understanding tacit knowledge and user's value sets. Alan Dix *et al.* develop the theme of human interaction, but in their chapter the focus shifts to understanding the role of physicality within the design process and how it affects the

nature of designed outcomes. Raymond Lucas *et al.* then investigate how multiple sensory modalities can be captured to inform the design process; their research explores the use of tools to support the capture of sensory information in the urban environment, but the approach clearly has potential for export to other areas of design.

The subsequent set of five chapters investigate the role of design in a series of key 21<sup>st</sup> century social issues. Many research approaches have been used, and all of the work culminates in guidelines and principles for use by future design teams. The first of these chapters describes the work of Jeremy Myerson and Jo-Anne Bichard, whose research is based on evaluation of carefully planned design interventions; this time the aim is to build greater understanding of the workplace needs of older knowledge workers. Their chapter provides a rich description of the many strategies and techniques (from the design stable) that can be used to investigate a key issue confronting 21<sup>st</sup> century society. Andrée Woodcock *et al.* explore practices used in the design and refurbishment of schools. This work investigates the use of participatory design approaches within this key area of 21<sup>st</sup> century public expenditure, again with clear reporting of research methods and best practice. Adam Thorpe *et al.* report on how design can be framed as an ‘open innovation approach’ for dealing with the challenges of bike crime, and once more the description culminates in clear guidelines for others who want to address the this issue within their design work. The next chapter profiles the work of Helen Kennedy *et al.* who explore the use of guidelines in the work of web designers; the research focused on social inclusion particularly, for those with intellectual difficulties, but also tells us a great deal about how designers use guidelines in their practice. Finally, Andy Dearden *et al.* report on the work of a large team who investigated how the capability of social-action organisations might be extended by appropriating and adapting information communication technologies through a design approach.

The final three chapters of the book explore how different forms of computer modelling might enhance the act of designing. Ian Parmee *et al.* describe how a team of researchers drawn from many design disciplines have systematically developed a framework describing the challenges of undertaking conceptual design in a digital environment. The framework provides a powerful platform for framing future research. Alison McKay *et al.* stay with the issue of computer-supported conceptual design, but focus on the challenges and opportunities associated with building better shape recognition and manipulation systems for designers. As with Parmee’s work, the approach is novel in the way it takes an interdisciplinary approach to a problem confronting all design disciplines.

The final chapter by Wanda Lewis and John Brew explore the challenges of digitally modelling complex fabric structures, which have widespread application in architecture. She demonstrates how this knowledge base can be readily transferred to support innovation in other areas such as fine art conservation.

### **Key Lessons**

It is useful to reflect on this broad portfolio of work and consider the progress that has been made against all three of the Designing for the 21<sup>st</sup> Century Initiative's key aims: i.e., research community building, exploration of design thinking and development of leading-edge research.

#### *Research community building*

Realistically, the Initiative was never going to deliver one overarching community for design research. Instead, the work has helped groups of individual researchers build new highly productive communities of research interest (often across traditional discipline boundaries). In parallel, new relationships with practitioners have been formed with new approaches to knowledge exchange. From this a great deal can be learnt about the strategies that both individuals and interested organisations might adopt to facilitate community building in the future. To maintain this momentum the following ideas might be usefully pursued.

#### **Locating communities through a topography of design research**

It would be extremely useful to capture the topography of design research communities operating both in the UK and beyond. Such a landscape is obviously highly emergent, but there are many established research societies, communities of research interest and networks of publication all with steadily evolving aims and objectives. Initiatives such as Designing for the 21<sup>st</sup> Century augment these with new communities of interest, often short-lived, convened to address a specific topic of interest. Banking the high-level knowledge generated in these interactions and providing intelligent signposting for interested parties could make a significant impact on development of the design research landscape. Considerable investment is currently being made in building each entity, but less attention is currently paid to locating networks relative to each other. Both activities probably add the same value, yet we are currently blind in our understanding of the whole.

### Finding new research partnerships by applying dual thinking to research portfolios

The Designing for the 21<sup>st</sup> Century Initiative was originally conceived as a platform for nurturing relationships between technological perspectives on design with those from the arts and humanities paradigm; hence the sponsorship from both the EPSRC and AHRC. Many of the projects have negotiated new interactions in this space and offer insights into how different perspectives can be integrated to the mutual benefit of each participant:

- Ian Parmee's work on People-Centred Computational Environments, has, for example, supported '*collaboration of seemingly disparate cognitive disciplines that require a common core expertise*'. The work, which brings together perspectives from engineering, drug design, software engineering, biosensors and graphical design has built a common framework of terminology, issues and research questions for computational environments.
- The team led, by Alison McKay, has worked on Design Synthesis and Shape Generation, taking a generic problem faced by design disciplines from across the spectrum of engineering and design. By applying interdisciplinary thinking, a new visual perspective on the problem of shape recognition and manipulation has emerged.
- The work of Sandy Black involved three fashion design projects reviewed through two modelling techniques taken from the world of engineering. In their conclusions the authors suggest that '*learning generated from the fast-moving fashion industry can be quickly applied to the engineering sector, for which product cycles are longer*'. In parallel, they also describe the benefits a systematic approach from the world of engineering brings to fashion design.

Now we have insight into how these interactions are built and managed it would be beneficial to systematically explore how dual thinking could energise research right across the portfolio of both communities. What common problems confront design in both its technological paradigm and design discipline setting? How could dual-thinking help build new insights for stakeholders from both communities?

### **Building communities interested in design as a knowledge transfer process**

Design has also proved its potential as an integrating theme for researchers from disciplines beyond Technology and the Arts and Humanities. The Designing for the 21<sup>st</sup> Century Research Initiative has operated at a time of growing interest in knowledge transfer (driven by government policy, which in turn is influenced by the urgency with which many issues confront business and society in the 21<sup>st</sup> century). Researchers from many disciplines now have an interest in design as a process for translating research needs into research projects and out into relevant applications of knowledge. An understanding of this design approach could be embedded much more widely within the entire research community. Many interesting models for achieving this have been created by Designing for the 21<sup>st</sup> Century project teams. Adam Thorpe *et al.* describe their approach to catalysing anti-theft design based on an open innovation model. They suggest that *'visualisation of research knowledge (by applying design) helps interdisciplinary synthesis happen. It aids communication and knowledge transfer between disciplines and stakeholders'*.

### **Building communities that engage practice in design research**

Of key importance within much of the Initiative's research activity has been the need to link research with design practice in a meaningful way. In order to improve how design is practised, it often needs to be studied in a real-life context; developments then need to be suggested and evaluated. To capitalise on this research, worthwhile developments then need to be integrated back into practice. Many of the Initiative's researchers report on the difficulties in doing this. In the Design and Physicality project Alan Dix describes how *'Access is always a problem in ethnographies as the idea of being observed can be disturbing'*. In Helen Kennedy's work exploring inclusive new media, the team describe how direct observation of designers was not that revealing and getting direct access was difficult to choreograph.

Within the portfolio of Phase 2 projects many useful strategies have been adopted for overcoming these problems and ensuring that research engages with the work of practitioners:

- Both Dix's and Kennedy's teams overcame problems of access '*by taking practising designers out of the workplace*' through specifically designed workshops.
- In the work of Lucy Kimbell, which examined the role of service designers when working with science and technology-based firms, the research team '*asked [service design] consultancies and enterprises to work together for six days over five months, with the designers paid a flat fee for their participation*'.
- Alex Williams worked in partnership with the UK design industry body, British Design Innovation (BDI) when building a 2020 Vision for the design industry. He comments '*Working with the BDI, a design membership organisation, was key in promoting the project to the sector and ensuring significant levels of participation from designers*'.
- Jeremy Myerson's and Jo-Anne Bichard's exploration of the Welcoming Workplace was steered by an '*expert group comprising academics and industrial partners*'. Working with key stakeholders from the project outset allowed outputs such as design guidelines to be endorsed by leading industry bodies – all strategies that integrated the work of the team with that of design professionals.

Central to all these projects is a sense of co-creation, with the research team working with the practice base in an integrated way. The examples suggest that building a research community that can co-create in this way requires:

- A considerable investment in time. All of the project teams working in an integrated way with practitioners had long-standing relationships with their partners. There needs to be investment in building relationships between the research base and those engaged in practising design professionally (as a precursor to research project partnerships).
- Finding appropriate ways to use research funding to support co-creation. There is a long tradition of academic researchers working in partnerships with large corporations. Working with the creative industries is, however, problematic as most businesses are small. The models suggested above are founded on a true exchange of value between researchers and practitioners.

<sup>4</sup> BROWN, T., 2008. Design thinking. *Harvard Business Review*, June.

<sup>5</sup> THACKARA, J., 2005. *In the Bubble: Designing in a Complex World*. Cambridge MA: MIT Press.

- Shifting the dissemination culture associated with design research. The academic base is driven by the requirement to publish in peer reviewed formats such as journals, books and exhibitions. This is important as this verifies research quality and codifies research knowledge. New emphasis is needed, however, on disseminating findings in a form that practice can readily absorb (for example, by creating guidelines and workshops). In turn, this can only be achieved by understanding how that practice works and how new knowledge might be most readily exchanged. This is a zone that is ripe for new innovations.

### *Exploration of design thinking*

During the period of the Designing for the 21<sup>st</sup> Century Research Initiative there has been an explosion of interest in design thinking. In the US, authors, such as IDEO's Tim Brown,<sup>4</sup> regularly discuss the role of design thinking in business. The Initiative's projects have shed light on our understanding of design thinking in two distinct ways: firstly, by reflecting in detail on what some of the core skills and knowledge sets associated with design thinking might be; secondly by providing examples of how design thinking might add value when used as an approach in academic interdisciplinary research.

### *Unpacking design thinking for the 21<sup>st</sup> century*

The projects have contributed to our understanding of design thinking on many fronts. The Embracing Complexity in Design project has systematically explored design's relationship with complexity science. Many authors have written about this relationship,<sup>5</sup> and the team has provided a bank of outputs explaining these connections. The team led by Alan Dix has explored the whole issue of physicality, the role of prototypes being much discussed in design-thinking literature. A large number of the projects feature descriptions of participatory design – again, central concepts in a design-thinking approach. In this book many examples of practical tools and techniques are clearly described.

### *Interdisciplinary academic discovery through a design-thinking approach*

The Initiative has also explored the contribution a design-thinking approach can make to interdisciplinary research in an academic environment. Adam Thorpe *et al.* systematically review this contribution and describe the ways in which design research can, observe, visualise, create briefs, critique, realise, test and evaluate. Having a design-trained research team (or team member) has allowed design-thinking approaches to be used to build bridges between interdisciplinary research perspectives, speculate on future positions and embody research outcomes. This contribution is not surprising, as the role of designers in interdisciplinary situations has been discussed for over twenty years in interdisciplinary business activities, such as new product development, that classically involve engineering, marketing, finance, human factors and production).<sup>6</sup> In the Designing for the 21<sup>st</sup> Century project portfolio, researchers have demonstrated this contribution in research teams involving a variety of disciplinary partners. Within this zone there is considerable potential for design thinking. UK research funding is increasingly focusing on issues that are of strategic interest to the economy and society – for example, obesity, an ageing population, connected communities, global warming etc. All of these issues require an interdisciplinary research approach that can be facilitated through a design-thinking contribution.

<sup>6</sup> JONES, C., PERKS, H. and COOPER, R., 2005. Characterising the role of design in a new product development an empirically derived taxonomy. *Journal of Product Innovation Management*, 22(2), pp. 111–127.

To capitalise on this opportunity, further articulation of design's potential contribution is needed to both research funders and interdisciplinary research teams. In parallel, design researchers have to build confidence in their skill-set to take on these new roles within the interdisciplinary landscape. Above all, innovative new research relationships need to be brokered between discipline specialists and design research facilitators.

### *The international significance of the Initiative*

The final aim of the Designing for the 21<sup>st</sup> Century Research Initiative was to support research activity that was internationally significant. International interest in the work can be clearly demonstrated at two levels.

Firstly, each of the Phase 1 and Phase 2 research projects has located its activity and findings in an international context through conference presentations and other research outputs (as evidenced by the outputs listed in this book). Some of the research teams have been proactively working with international partners who recognise the significance of the expertise that has been built through the support of the Initiative.

Secondly, there is a growing recognition internationally in the need to invest in design research. The Designing for the 21<sup>st</sup> Century Initiative provides a useful model of how a programme of design research can be structured at a national or regional level, initially with research cluster projects and then through a process of co-creation (supported by intensive workshop activity) into a phase of substantive research projects. The model is not perfect, and the reflective lessons described in this chapter suggest actions that would enhance the quality, timeliness and impact of a future initiative of this sort. The activity has, however, highlighted the huge potential that further design research investment might bring in addressing many issues confronting society in the 21<sup>st</sup> century. It will be very interesting to track the impact of this legacy over the coming years.