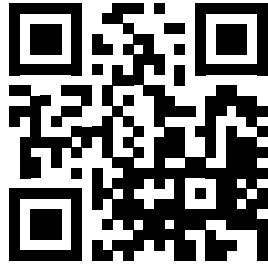


The State of the Art of Design in Health

An expert-led review of the extent of the art of design theory and practice in health and social care



www.designinhealthnetwork.org

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Valerie Shanks-Pepper

Head of Research and Innovation.

NHS England Policy, Partnership and Innovation Central Team.

“The NHS faces unprecedented challenges as it adapts to meet changing demographic and societal needs. These challenges will require different forms of problem solving, and the NHS can and must learn from other disciplines, such as design, to develop and continue to deliver excellent care. This report highlights the breadth and depth of work already being done and serves as an excellent foundation for the further exploration of design in health.”



Mat Hunter

Chief Design Officer at Design Council

“Design Council has spent 70 years advocating for the power of design to improve life, helping to persuade sector after sector of the value of ensuring that what they do really meets peoples needs and wants. From housewares to buildings, cars, trains and planes, consumer electronics, retail, banking services and beyond, few world-leading businesses have got there, and can stay there, without design being a core part of their innovation practice.

The health and care sectors now recognise the urgent necessity of human-centred innovation and a pioneering few have understood that design practice has much to offer, but we believe that the adoption of high-quality design practice must move far faster if we are to meet the challenges ahead. Design Council has learned repeatedly how significant the communication challenges are in conveying the value and embedding the practice of design in each sector that we have addressed.

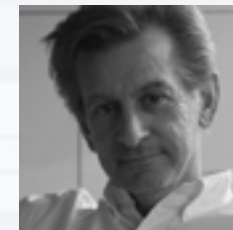
We warmly welcome the conclusions of this research and urge all that believe in the imperative of healthcare transformation to recognise, adopt and further share its findings.”

Core Project Team

Sheffield
Hallam
University

Executive Summary

This report describes an investigation funded by the Arts and Humanities Research Council (AHRC) to establish greater understanding of the extent of design theory and practice within the context of health. Led by researchers from Lab4Living, based within the Art & Design Research Centre at Sheffield Hallam University, researchers from Coventry University, Glasgow School of Art and the Helen Hamlyn Centre at the Royal College of Art, formed an Expert Network that bring together a critical mass of excellence in design research for healthcare. An expert advisory group was appointed to provide an additional reference point for the network. The report presents background and rationale for the research, outlines the activities undertaken by the Expert Network, and describes the research methods adopted. The findings from the research are described and presented visually and exemplar case studies from each of the network partners articulate the valuable contribution of design in healthcare. The report draws some conclusions on the potential implications from the findings.



Professor Paul Chamberlain – Design Director Lab4living and Head of Art and Design Research Centre at Sheffield Hallam University.

Paul is a graduate from the Royal College of Art. His focus of interest lies in how research within art and design can be applied and utilised beyond its traditional disciplinary boundaries both to engage and inform pertinent societal questions. Paul has a track record in both industrial and academic design practice and research that explores the role of critical artefacts in multi-disciplinary human-centred research. Paul has led major projects with diverse academic specialists and commercial partners realising new knowledge that often informs and is demonstrated in commercial outputs. Paul has applied this research in the design of furniture, medical, healthcare, special needs and therapeutic products and systems that have achieved international recognition through publication, exhibition and awards.

Paul has delivered keynote lectures at leading international venues on innovation strategies and sustainable approaches to design and manufacture. Paul's work has been instrumental in the creation of Lab4Living (ENOLL member), a collaborative research initiative between art and design and health research at Sheffield Hallam University that seeks to propose and develop creative strategies for the development of future living environments. Core to this activity has been the development of creative methods and tools for user and public engagement in participatory research and co-creation.



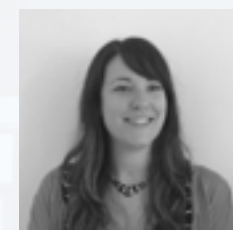
Daniel Wolstenholme – Core Project Manager, NIHR CLAHRC YH, and Visiting Researcher in the Art & Design Research Centre at Sheffield Hallam University.

Dan undertook a first degree in Neuroscience before training as a nurse. During this time, Dan completed an MMedSci in nursing and healthcare studies and lectured on pre- and post-registration nursing courses within the School of Nursing at the University of Sheffield. Following this Dan worked in Research management and governance in Chesterfield and Sheffield Hospitals before taking up his role as project manager and clinical researcher on the User-centred Healthcare Design project within the NIHR CLAHRC SY (National Institute for Health Research Collaboration for Leadership in Applied Health Research for Care South Yorkshire). Dan's current role for the Yorkshire and Humber CLAHRC involves managing research, using design and creative practice to mobilise knowledge and supporting innovation in healthcare. Dan is a visiting Researcher at Lab4Living and holds honorary contracts with both Sheffield and Sheffield Hallam University. Dan's own research interests lie in exploring the potential of the theory and practice of design in healthcare.



Dr. Matt Dexter – Designer and researcher within the NIHR CLAHRC YH.

Matt originally trained as a Mechanical Engineer, but changed to study Product Design - taking a professional interest in the design and development of medical products. Through working with industry partners, the direction of Matt's work shifted to the methodological implications that a User-centred approach could have on the development of medical products. Matt pursued an MA where he developed novel Telehealth technology leading to a position as a designer at the NIHR funded CLAHRC SY User-centred Healthcare Design team. Matt was involved in developing Participatory Design approaches for NHS service redesign across a number of projects - leading to an interest in how design can be used for positive impacts in the self-management regimes of those living with chronic conditions. Matt completed his PhD in 2014 around creating open-source medical products collaboratively designed by a distributed network of people living with cystic fibrosis from the United States of America and the United Kingdom. Matt's research and practice interests lie in developing novel methods for people to be part of the design and development process for medical technology.



Lizzie Seals – Information Adviser at Sheffield Hallam University Adsetts Centre.

Lizzie has been working in academic libraries since 2008. She began her career in a medical library where she worked for three years and first became interested in health information. Lizzie completed an MA in Librarianship in 2012 where she developed an interest in specialist literature searching. She researched her dissertation on representations of communities in local media. After completing her MA, Lizzie worked as an Information Adviser for Design, supporting students and researchers in this subject area. Lizzie's professional interests include open access research, technology-enhanced learning, and user-centred library design. Lizzie currently works as an Information Adviser supporting the subject areas of International Business and Economics. She is also a copy editor for the Journal of Information Literacy.

The core team would also like to thank **Dr. Claire Craig** and **Dr. Joe Langley** for their invaluable contributions.

Expert Advisory Group

Professor Sue Mawson – Core Project Manager, and Director NIHR CLAHRC YH.

In 2008 Sue led the successful South Yorkshire application to become a National Institute of Health Research Collaboration for Leadership in applied Research and Care (CLAHRC). This multidisciplinary research community was driven by both the needs of people with long term conditions and the need to address health inequalities within our South Yorkshire communities. Following the initial pilot Sue led the successful application for a Yorkshire and Humber White Rose, NHS bid to NIHR launching the new collaboration in January of 2014. The CLAHRC's in England are charged with undertaking applied research in chronic disease management and public health, identifying new ways of enabling the adoption and diffusion of evidence based innovations. The Yorkshire and Humber CLAHRC has an emphasis on participatory design methods underpinned by principles of codesign, engagement and reducing health inequalities. www.clahrc-sy.nihr.ac.uk;

As a Professor of Health Services research Sue's work focuses on improving the quality of life of people with long term conditions, capitalising on new innovations in sensor and digital technologies. This interdisciplinary work, has integrated clinical researchers with engineers, designers, and digital media specialists. This has led to close links with industry and a number of publications in the field of telehealth.



Dr. Christopher McDermott – Reader in Neurology, Consultant Neurologist, University of Sheffield.

Dr McDermott studied for his medical degree at the University of Leeds graduating in 1994. He then continued his general medical and specialist neurology training in Leeds before taking up a clinical research training fellowship at the University of Newcastle upon Tyne. He moved to the University of Sheffield with Professor Dame Pamela Shaw in 2000 to undertake his Wellcome Trust Research Training PhD Fellowship and to complete his Specialist Training in Neurology to become a Consultant Neurologist in 2006. Dr McDermott, now a Reader in Neurology at SITraN, is Co-Director of the Sheffield MND Care and Research Centre and a Consultant Neurologist at the Sheffield Teaching Hospitals Foundation NHS Trust, regularly undertaking specialist clinics in Sheffield and Barnsley.

Dr McDermott's is passionate about designing and developing modern and assistive technologies for patients with neuromuscular weakness; harnessing skills and engineering techniques to produce new advanced materials and clothing to help patients better manage their physical symptoms due to muscle weakness. Examples include the "Head Up" study where a new neck support collar was designed from scratch and manufactured to help MND patients who were suffering from neck droop. Another research project is looking at using telemedicine technology to enable more interactive communication between patients, carers and their clinical management team in order to better manage their condition.



Professor David Cotterrell – Professor of Fine Art, Sheffield Hallam University.

David Cotterrell is an installation artist working across media and technologies to explore the social and political tendencies of a world at once shared and divided.

The practice is typified by an interest in intersection: whether fleeting encounter or heavily orchestrated event, Cotterrell's works explore the human condition and the breaks or nuances that can lead to a less ambiguous understanding of the world they inhabit. Encapsulating the roles of programmer, producer and director, Cotterrell works to develop projects that can embrace the quiet spaces that are the sites for action, which might (or might not) be clearly understood in the future. Cotterrell's work has been commissioned and shown extensively in Europe, the United States and Asia.



Network Team



Professor Jeremy Myerson – Director of Helen Hamlyn Centre for Design at the Royal College of Art.

Jeremy is the first-ever holder of the Helen Hamlyn Chair of Design, with a remit to encourage 'design that improves quality of life'. An academic, author and activist in design for more than 30 years, he began his working life as a journalist and was founder-editor of Design Week in 1986. He co-founded the Helen Hamlyn Centre for Design at the RCA in 1999, and his research interests focus on the role of design in social, demographic and technological change. A graduate of the RCA, Jeremy Myerson is the author of many books, chapters, papers and articles on people-centred and inclusive design. He chairs the WorkTech series of international conferences on workplace design, and sits on the advisory boards of design institutes in Hong Kong and Korea.



Ed Matthews – Reader and Senior Research Fellow in Healthcare Design at the Royal College of Art.

Ed joined the Helen Hamlyn Centre for Design in 2007 to lead the centre's work in design for healthcare and patient safety. His first degree was a BSc in Mechanical Engineering from the University of Bath, followed by a Masters in Industrial Design from the RCA. He consulted in product design and development over a wide range of industries for ten years. He then focused on the design and engineering of medical devices for more than 20 years, During this period he ran a successful design firm.



Gianpaolo Fusari – Senior Research Associate, The Helen Hamlyn Centre for Design.

Gianpaolo holds a joint MA/MSc in Innovation Design Engineering from the Royal College of Art and Imperial College London. He joined the Helen Hamlyn Centre for Design in 2010 and is a Senior Research Associate in the Health & Patient Safety Lab. His specialism is design and research: using advanced user-research tools to derive evidence-based design briefs and working with users and stakeholders to design, evaluate, develop and commercialise cost-effective solutions. Gianpaolo has worked on projects such as: the Emergency Ambulance; initiatives to reduce violence and aggression in Emergency Departments and a portable workstation to improve safety, consistency, workflow and information management for General Practitioners.



Jonathan West – Research Fellow, The Helen Hamlyn Centre for Design.

Jonathan graduated from the Royal College of Art in 2003 and has now spent over a decade working on medical design. His work at the Helen Hamlyn Centre for Design focuses on design for health and patient safety. Projects he has researched and designed include: a new resuscitation trolley; improved drug packaging; a new bag for doctors to use on home visits and a number of systems-based interventions for community care. Several of these have won awards. Jonathan was the lead designer on the influential 'Designing Out Medical Error' project. His work has been published internationally in journals, books and as papers.

THE GLASGOW SCHOOL OF ART

Professor Alastair Macdonald – Senior Researcher at the School of Design, within the Glasgow School of Art (GSA)

Alastair heads a small team of researchers with a focus on design research for ageing, health and care. He has a 20 year+ pedigree of pioneering interdisciplinary research in these areas operating at the interface between design, health and care practice, and people's experience of products and services. His track record of RCUK and NIHR funded research, within multidisciplinary teams as both a PI and Co-I, includes work on spinal cord injury rehab, end-of-life care for people with dementia, hospital-associated infections and nutrition for older hospital patients. For such work, he and his team develop and integrate design approaches into the over-arching research methodologies and use these to probe, provoke, prototype and evaluate concepts and interventions.



Dr Louise Moody – Reader in User-Centred Health Design, and Director of CEPAD

Louise graduated from the University of Birmingham with a BSc in Psychology and Sport Science in 1998, and with a PhD in Electronic and Electrical Engineering in 2002. Her PhD research focused on the design of simulated environments for training and evaluating surgical skills. This led to an EPSRC funded post at the University of Warwick to apply Human Factors to the development of a virtual reality training system for knee surgery. After then working in occupational psychology consultancy for 2 years, Louise joined Coventry University in 2006. Formerly the Director of the Centre for Excellence in Product and Automotive Design (CEPAD), she is currently appointed as Reader in the School of Art and Design and works within the Centre for Transportation and Mobility. Louise's research interests lie in embedding Human Factors within the design and evaluation of systems and products for healthcare. Recent projects have focussed on the specification and development of computer-based systems for healthcare, and the design and evaluation of assistive technology.



Professor Andree Woodcock – Professor of Educational Ergonomics and Design. Director of the Centre of Excellence in Product and Automotive Design.

Andree holds a BSc in Psychology and Social Biology with an MSc in Ergonomics from UCL. My PhD concerned an investigation of the use of ergonomics in automotive concept design acquired from Loughborough University while Andree was a Daphne Jackson Research Fellow. Most of Andree's research has been located within design departments, looking at applying user-centred design to wicked problems in the areas of health, education, regeneration and transportation. Andree has been awarded grants in excess of £10 million since coming to Coventry University in 1999, mainly from RCUK and in collaboration with UK and European partners. These have included research on the design of polysensory school environments for children with ASD, an analysis of the involvement of children in the redesign of schools as part of the Building Schools for the Future Programme, the use of social networking by informal groups, the spontaneous, voluntary contributions of citizens to urban regeneration (VoiceYourView), and the development of a patient held record system (MyCare). Andree have worked with the HDTI on two projects developing a user testing toolkit for SMEs (IDEAL-ALIP project) and a decision support system for SMEs moving into the assistive technology market (COMODAL). Transport related research has included looking at the in car safety and security of female car occupants, an analysis of HMI of electric vehicles, an stakeholder analysis of an electric bus, a review of social transport and the leadership of an FP7 project to develop a Pan European tool to measure the quality of the passenger experience.



Introduction

There are many drivers for health service reform; a rise of long term conditions, an ageing population, a health service that has evolved to deliver acute care rather than primary care, reduced funding and rising expectations from an increasingly informed population. These are some of the key challenges to society today, and ones that require a new way of thinking, a radical step change and innovative approaches in the ways we deliver care.

In recent years there has been growing interest in the potential of design approaches to transform health care where we can draw on a tradition of creative and divergent thinking to address these fundamental and yet practical challenges to our societies' health. These challenges are by definition 'wicked problems', ones where there is no single true answer and where design's strength lies in creatively responding to these complex interdependencies. Design in health is an emergent theme in design, one where there is activity across key institutions in the UK but where currently there is no one network to consolidate and share the best practice experience and research.

This project builds on links forged through Lab4Living's International Design4Health conferences (2011, 2013) at which a critical mass of practitioners from design and health have come together to discuss and debate these issues. This collaborative research has the potential to inform both policy and practice and the beneficiaries of such work is broad. In health and social care it is broader still as we look at the potential value to service delivery and patient experience.

While there are synergies between the disciplines of design and healthcare their practices and approaches to research are most often disparate. Formats for dissemination can

be diverse within design while healthcare adopts a more traditional approach to the publication of research. The different disciplinary cultures and protocols in creating knowledge also present significant challenges in accessing and sharing this knowledge. Consequently much valid design research is not brought to the attention of the health community who might benefit from it.

The project network led by Lab4Living, a specialist unit within the Art and Design Research Centre at Sheffield Hallam University, and comprising of leading practitioners and researchers from Glasgow School of Art, Helen Hamlyn Centre, Royal College of Art, University of Coventry have creatively explored the 'state of the art' of design in health. The research project has been an opportunity to bring together a multi-disciplinary group of experts around an emergent topic to undertake a new review of activity providing the basis for design to articulate it's potential contribution to healthcare and allow cross-institutional and disciplinary discourse.

The research network has allowed for critical reflection leading to fresh insights and research questions to inform the positioning of design at the centre of innovation within healthcare. This report describes the methods, results and houses the references generated from this novel process.

Prof Paul Chamberlain

Director Lab4Living

Head of Art & Design research Centre

Sheffield Hallam University



Network Activities

In early 2014 we were notified that we had been successful in securing funding from the Arts and Humanities Research Council to undertake a programme of research to understand the range and state of the art of the use of design research and practice in the health domains.

To further develop and refine the research enquiry a series of workshops with key partners from across the UK was held. There was representation from all partners at each event and these meetings had a direct impact on the direction and form of dissemination that might arise from the project.

Network Activities

To develop the proposal and support the practice of this network's aims we held a series of workshops with key partners from across the UK. There was representation from all partners at each event and these meeting had a direct impact on the direction and outputs of the project.

Glasgow: May 13th 2014

The first meeting provided an opportunity to present the methodological approach developed by the core team (Lab4Living, Sheffield Hallam University) to the collaborative partners (Coventry University, Glasgow School of Art, Royal College of Art) The aims and objectives of the research were reviewed as was the individual roles and responsibilities of the collaborating network partners. The multidisciplinary approach to not only the network but to how we would gather the evidence was central to the research rationale. The coding system developed by the lead partner was presented, discussed and refined. The partners engaged in a structured session to help outline current health agendas that this work could potentially contribute and align to. Collectively we determined who our target audience or audiences were for the findings of the research and how these might be suitably shaped, formatted and located in terms of dissemination

Coventry: July 9th 2014

Two main tasks were identified for presentation and debate by the partners at this meeting.

(1) The presentation of the interim outcomes revealed through the searches. These were then used to identify themes with respect to the NHS Outcomes Framework (DoH 2014) so that we

would align our research with the stated priorities of the NHS.

(2) The review and development of coding protocols. Outputs from the partner institutions were used as case studies to further test and develop the coding. This trial coding exercise validated the rigor of the coding and approach taken by the network.

London: September 4th 2014

London was our opportunity to share findings with a wider invited audience and to provide more insight through selected case studies from each of our partner organisations. The use of video testimonials proved very compelling in capturing the essence and impact of what the research and practice of design in health brings. It also allowed us to showcase the significant work undertaken by the expert network, which epitomizes the potential of this innovative approach. These testimonials are replicated in the Case Studies section of this report.

Sheffield: October 15th 2014

With the majority of the data collection and analysis complete this provided an opportunity to discuss the dissemination and the potential for further development of the project. It was also agreed that a report notating the literature review would be published and also made available online to help future generations of researchers and practitioners interested in design in health. While this would represent findings at a fixed point in time the network felt it appropriate that a web based version of the report might be created that, perhaps with future funding, could become a live repository for designers and health care researchers and practitioners to further build and refine and continue to add their work and further build capacity.

As a holding first step a website housing a searchable library of the resources identified will be available alongside the physical document. Supporting our Network we had a group of key expert practitioners in the field who offered formal and informal support and reviewed and commented on key documents and findings throughout the process of the project.

Research Methods

Overview

The primary goal of the network was to deliver a picture of the extent and state of the art of design practice and theory in health. This next section will describe the three concurrent activities we undertook to achieve this. These three activities combined to provide a literature review of outputs in the public domain.

The first approach was to undertake a **Library Database Review**. This review was devised as if a 'health outsider' to the design world was using a standard method of performing an initial enquiry—a (rigorous) keyword search to a prominent database indexing a large number of journals.

Secondly an **Expert Network Review** was used to understand where the gaps in the literature might be; and drawing on the expertise of the practitioners in the network to identify projects.

Finally, the review and network were supported by a purposive **Grey Literature review** (unpublished works), using a combination of a Google search and papers from key conferences in the subject area.

The outputs of these three processes were 1912 abstracts or summaries of unpublished works, which had to be screened to determine if the abstracts were in scope. For the purposes of this project we defined the scope as:

“The paper or output describes a design process taking place in a health or social care context”

Of the 1912 abstracts the team determined 439 to be in scope. These 439 were subsequently coded by members of the project team and expert network into a range of themes and categories determined by a participatory process.

Full descriptions of the codes are provided in the results chapter.

The rest of this section provides a detailed description of the methods applied for each of these strategies.

Library Database Review

The review was designed to synthesise the existing literature on health and design innovation and practice. The following methodological approach will highlight the breadth, depth and rigour of this comprehensive literature search.

Search Strategy

The core team were supported by a librarian from Sheffield Hallam University, her input was fundamental to the approach developed below.

Where to search

The first stage was to identify which library databases to search. 11 databases were searched (titles and abstracts) based on their coverage of health or design subject areas, or because of their multidisciplinary coverage. These were:

Art Bibliographies Modern (ProQuest), Art Full Text (EBSCO), ASSIA (ProQuest), CINAHL (EBSCO), Cochrane Library (Wiley), Design and Applied Arts Index (DAAI), Health Source Nursing (EBSCO), MEDLINE (EBSCO), PsychINFO (ProQuest), Scopus (Elsevier), Web of Science (Thomson Reuters)

What to search for

We then had to create the search strategy, the words and combinations of words that would most likely deliver the papers we were looking for. An iterative process was undertaken to develop the strategy; search terms were developed around the varying domains of design and innovation in healthcare in consultation with the core team and with respect to seminal key publications in the field. Three strands of the search strategy emerged: (1) *design* (2) *stakeholders* (3) *outcomes* (Figure 1).

Terms relating to *design* methodologies or theory were phrase search e.g. “experience-based design”, “user-centred”, “person-centred”, “participatory” and their variations.

A range of *stakeholders* (those who were affected by, or involved in the research) were identified. These included communities, design researchers and practitioners, healthcare professionals and patients.

Terms relating to *outcomes*—for example: an improvement to health or well being through design, were proximity searched with synonyms for improvement or innovation (e.g. ‘health’ within six words of ‘enhance’).

Where available, controlled vocabulary or MeSH (Medical Subject Headings) were utilised in each database search. See Figure 1 for full list of search terms. An example search string from SCOPUS is included (Figure 3).

Figure 1 - Full list of search terms

Terms relating to DESIGN	Terms relating to STAKEHOLDERS	Terms relating to OUTCOMES
<i>Accelerated experience-based co-design (AEBCD)</i>	<i>Communit*</i>	<i>A proximity search of the following terms within 6 words of “health*” and “wellbeing”:</i>
<i>Co-creation</i>	<i>Design*</i>	
<i>Co-design</i>	<i>Healthcare professional*</i>	
<i>Co-production</i>	<i>Patient*</i>	<i>Creat*</i>
<i>Co-research</i>		<i>Develop*</i>
<i>Collaborative design</i>		<i>Enhance*</i>
<i>Creative practice</i>		<i>Improve*</i>
<i>Critical artefact*</i>		<i>Inform</i>
<i>Cultural probe*</i>		<i>Innovat*</i>
<i>Design probe*</i>		<i>Quality</i>
<i>Design thinking</i>		<i>Redesign*</i>
<i>Evidence-based design</i>		<i>Reform*</i>
<i>Experience-based design (EBD)</i>		
<i>Experience-based co-design (EBCD)</i>		
<i>Human-centred design</i>		
<i>Inclusive design</i>		
<i>Interactive design</i>		
<i>Open design</i>		
<i>Participatory design</i>		
<i>People-centred design</i>		
<i>Practice-based design</i>		
<i>Practice-led design</i>		
<i>User-centred design</i>		
<i>User involvement</i>		

Pilot Search

A pilot search was undertaken in SCOPUS (as the largest of the databases to be interrogated) and the findings reviewed by the core team. Some established areas of design methodology were not revealed in the pilot study therefore search terms were refined, added, and excluded to optimise the potential for finding relevant literature.

Certain terms relating to design methodologies were excluded such as communication design, service design, participatory research, and design methodology. It was found that these terms yielded results that were either too general (e.g. design methodology and participatory research are terms used in many research papers), or were yielding results from other disciplines that were irrelevant.

Importantly this did not mean we were excluding papers about these subjects that were otherwise in scope just that the terms did not add to the identification of abstracts. Any results that did appear relevant based on these terms would have been identified through existing search terms.

The cross disciplinary nature of the topic meant that high numbers of search results were likely to be revealed through SCOPUS, yet it was important to attempt to cover all aspects of design methodologies. An initial review of the findings confirmed the term ‘design’ is almost ubiquitous in published literature, therefore it is not useful as a means to discriminate ‘design practice’. In contrast health research has a complex and discrete way of describing practice by clinical specialism and methodology of research to name but two, which makes it more straightforward to narrow down searches to specific areas.

Define and apply Scope

The aim of the literature search was to be comprehensive and attempt to cover the breadth and range of literature in the subject area and as such, no limits of date range, language, or type of publication were used.

A pilot screening took place: all results from the databases were screened twice, independently, based on title and abstract. The screening was then discussed and debated and inclusion criteria agreed - which was then applied to all database search findings:

“The paper or output describes a design process taking place in a health or social care context”

We chose to reject the paper if there was no abstract and/or it was unclear as to whether it was relevant (title/abstract screening only)

Both primary research and theoretical/review papers were included, the main focus of the paper was design/innovation in a health or wellbeing setting.

The searches, across all the databases, yielded 1185 results when duplicate results were removed (Figure 2).

Limitations

Due to the number of papers identified through the scoping phase, a pragmatic decision was made not to request full papers for all articles. This was not a problem in determining scope for well-written abstracts, but this was a limitation when coding the accepted articles.

Study Selection

The full scoping was undertaken by two of the core design team and the librarian. Triangulation was used to ensure consistency of decision-making, and from the 10% of articles triangulated, no divergent decisions were revealed. This process reduced the abstracts to 195 that were in scope.

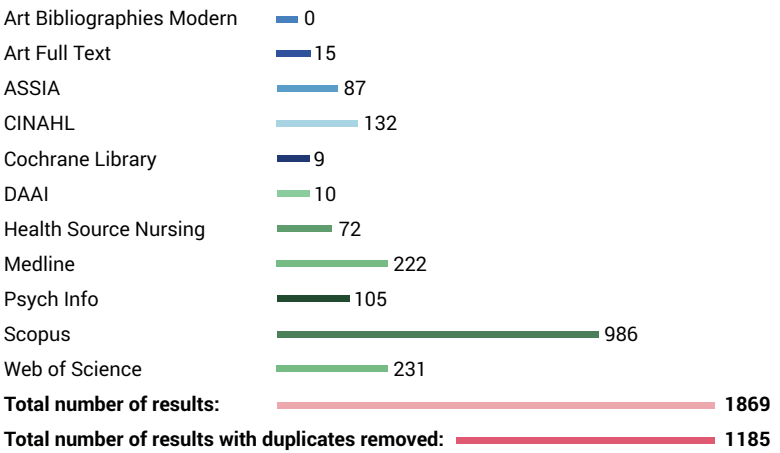


Figure 2 - Numbers of results, per database

((TITLE-ABS-KEY("collaborative design" OR "design thinking" OR "cultural probe*" OR "design probe*" OR "human centred design" OR "human-centred design" OR "human centered design" OR "human-centered design" OR "inclusive design" OR "people centred design" OR "people-centred design" OR "people centered design" OR "people-centered design" OR "co-research" OR "coresearch" OR "co-research")) OR (TITLE-ABS-KEY("practice-led design" OR "practice led design" OR "practice-based design" OR "practice based design" OR "interactive design" OR "open design" OR "creative practice" OR "co-creation" OR "co creation" OR "cocreation")) OR (TITLE-ABS-KEY("critical artefact*" OR "critical artifact*" OR "experience-based co-design" OR "experience based co design" OR "experience-based co design" OR "experience based co-design" OR "experience-based codesign" OR "experience based codesign")) OR ((TITLE-ABS-KEY("co-design" OR "co design" OR codesign)) OR (TITLE-ABS-KEY("co-production" OR "co production" OR coproduction)) OR (TITLE-ABS-KEY("participatory design")) OR (TITLE-ABS-KEY("user involvement*" OR "user-involvement*")) OR (TITLE-ABS-KEY("evidence-based design" OR "evidence based design" OR "EBD" OR "EBCD")) OR (TITLE-ABS-KEY("experience based design" OR "experience-based design")) OR (TITLE-ABS-KEY("accelerated experience based co design" OR "accelerated experience-based co-design" OR "accelerated experience-based codesign" OR "accelerated experience-based co design" OR "accelerated experience based codesign" OR "accelerated experience based co-design" OR "AEBCD")) OR (TITLE-ABS-KEY("user-centred design" OR "user centred design" OR "user-centered design" OR "user centered design")))) AND (TITLE-ABS-KEY(design* OR patient* OR "healthcare professional*" OR "health care professional*" OR "health-care professional*" OR communit*)) AND ((TITLE-ABS-KEY(health W/6 quality) OR (health W/6 reform*) OR (health W/6 improve*) OR (health W/6 innovat*) OR (health W/6 enhance*)) OR ((TITLE-ABS-KEY("well being" W/6 quality) OR ("well being" W/6 reform*) OR ("well being" W/6 improve*) OR ("well being" W/6 innovat*) OR ("well being" W/6 enhance*)) OR (TITLE-ABS-KEY("wellbeing" W/6 quality) OR ("wellbeing" W/6 reform*) OR ("wellbeing" W/6 improve*) OR ("wellbeing" W/6 innovat*) OR ("wellbeing" W/6 enhance*)) OR (TITLE-ABS-KEY("well-being" W/6 quality) OR ("well-being" W/6 reform*) OR ("well-being" W/6 improve*) OR ("well-being" W/6 innovat*) OR ("well-being" W/6 enhance*)) OR (TITLE-ABS-KEY(health* W/6 redesign*) OR ("wellbeing" W/6 redesign*) OR ("well-being" W/6 redesign*) OR ("well being" W/6 redesign*)) OR (TITLE-ABS-KEY(health* W/6 develop*) OR ("wellbeing" W/6 develop*) OR ("well-being" W/6 develop*) OR ("well being" W/6 develop*)) OR (TITLE-ABS-KEY(health* W/6 inform) OR ("wellbeing" W/6 inform) OR ("well-being" W/6 inform) OR ("well being" W/6 inform)) OR (TITLE-ABS-KEY(health* W/6 creat*) OR ("wellbeing" W/6 creat*) OR ("well-being" W/6 creat*) OR ("well being" W/6 creat*))))))

Through the engagement of the expert network, and in recognition of the limitations and challenges of the search, all the partners were asked to submit a list of the outputs they felt were in scope from their own institutions knowledge base and activity. This developed a list of abstracts that were then reviewed for scope as per the method described above.

Coventry University submitted:	16
Glasgow School of Art submitted:	16
Royal College of Art submitted:	41
Sheffield Hallam University submitted:	29

Of these 102, **95** were in scope.

Grey Literature Review

Conference search

To try to ensure a comprehensive review we committed to undertake a Grey literature review, recognising the range of modes of dissemination and forms of outputs generated by a design process. With advice from the Librarian we manually searched all the abstracts from the two key conferences in the area of Design and Health. Design4Health (2011 and 2013) and Include (2001 – 2013) identifying 625 abstracts of which 149 were determined to be in scope.

Google Search

To complete the grey literature search and in collaboration with our librarian a protocol was developed to undertake a 'rigorous' Google Search [to mirror standard design student practice]. A reduced version of the database search terms, (Google is limited to a 32 words maximum per query) was led and developed by the librarian until the following search string was agreed.

“experience based design” OR “participatory design” OR “co-design” OR “co-creation” OR “people centred design” OR “inclusive design” OR “user centred design” OR “collaborative design” AND designer OR patient OR “healthcare professional” OR community AND “health * quality” OR “wellbeing * quality” OR “health * improve” OR “wellbeing * improve”

The Google search algorithm is sophisticated and searches different spellings, endings so no further wildcard symbols were required.

The top 120 results were imported manually into a spreadsheet and then reviewed as to whether they were in scope by the core team. This process led to a further **14** articles being added to the review.

Summary of full Review Process

At the end of this process we had identified 1912 articles, with 453 in scope. See Figure 4.

<i>Source</i>	<i>Articles</i>	<i>'In Scope'</i>
Database	1,185	195
Expert Network	102	95
Grey literature (<i>Conference search</i>)	625	149
(<i>Google search</i>)	120	14
<i>Total</i>	1,982	453

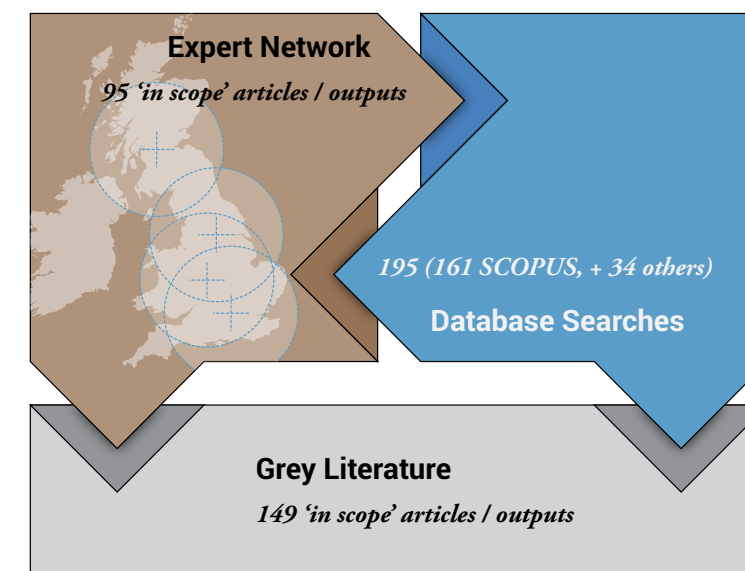


Figure 4 - Number of results, with number of 'in scope' articles.

Results

Coding process

As a core team we were keen to be able to describe the scope of practice described by the review. We wanted to be able to identify areas not being addressed. We had to devise a way to do this that was consistent with the creative approach espoused by design.

A subset of the 1912 articles were printed out as title and abstract.

The core team met and iteratively developed a framework to describe the papers. In turn each core team member took a paper and described it to the group trying to extract the key information. This discussion narrowed down to a core set of parameters; namely the methods, settings, populations, health conditions, and outputs of each project.

Subsequently the team member would describe the project and assign child codes (under these headings), until consensus and saturation was reached. Many decisions were straightforward, for example where a project worked in a hospital to redesign service, or in the community with a mental health team. Sometimes the quality of the abstract made it more challenging to assign codes, especially around methods or identifying specifically which populations had been engaged. If there had been more resource the team would have requested full papers to gain clarity, but pragmatically (and as acknowledged in the limitations) we had to make assumptions, or in some cases record a where available ‘not-specified’ response. Links to the full papers are all included (where available from the publisher) in the bibliography. The full list of codes is listed in Figure 5.

The coding process, once established was carried out by the core team using the Dedoose (SocioCultural Research Consultants LLC. 2012) software which allows the creation and application of such code trees to text based data, and can export data direct into Microsoft Excel to create the visualisations in the results section.

Codes

This section describes the codes to allow the reader to interpret the results. An outline of the parent and child codes is given in Figure 5, over the page.

Clinical Condition

The *Clinical Condition* code describes the medical or health specialism in which the design activity is focused. The variety highlights the large number of different scenarios where design has been incorporated into health projects. However, there were a significant number of abstracts that omitted to include information about the clinical condition. While this may seem to be a significant oversight on the part of the author, in practice this often was often due to the focus of the project and the subsequent publication notating the development of a methodology, or perhaps the development of an artefact spanning contexts. Hence, an abstract could discuss a *User-centred* design research project that included *Designers / Creative Disciplines*, *Healthcare Staff / Professionals* and *Older People* producing a methodology, and not require a clinical condition or methodology to be a valid piece of research.

Methods

The code for the *Method* describes the form of design (or related practice) used in the work described. This included some aggregation of methods into umbrella terms, as with the *User-centred Design* code.

Where an abstract overtly mentioned the use of ‘users’ as inextricably linked to the method, it was coded as *User-centred Design* in the absence of another stated method.

Quantitative Methods are perhaps surprising to find when discussing design in health projects, but the focus with the abstracts here was on the triangulation of research by incorporating different search methods. The methods outlined in the abstract were coded for their significance in the abstract, and this does not necessarily preclude the use of other user-centred approaches in the project work. An example of the use of qualitative methods in the design process is the use of ethnographic approaches, or other methods



Figure 5 - Code categories and sub categories applied to the search results

SocioCultural Research Consultants LLC. (2012). Dedoose, Version 4.5.91, web application for managing, analyzing, and presenting qualitative and mixed method data. Los Angeles, CA: SocioCultural Research Consultants, LLC.

of enquiry that come from the social sciences. The abstracts are coded by the author's decision to highlight methods used. An example of this is the MOMTech project for Maternal Obesity (Anon, MOMtech 2015), which used extensive interview and focus group techniques alongside design practice. Finally, the use of the code application *Critical Design* is applied to products involving Artists, or designer-makers employing methods that fall outside the boundaries of *User-centred Design*, or any of the other code applications here. For example, Zellweger (2013) in *Rituals of Self Design – creating artefacts in conjunction with Plastic Surgeons*.

The *Not Specified* code application can relate to projects that span multiple sites, such as the Better Services By Design (BOSOP) project (Anon, BOSOP Patient experience (2015), and the Health Design & Technology Institute (HDTI) (HDTI, Teggy) work referenced here.

Population

The Population code described the ‘types’ of people involved in the project, reassuringly this included all stakeholders including patients, carers, healthcare staff and the designers themselves. The child codes were applied for each type of participant mentioned in the abstract, meaning that generally more instances of this code appear in the abstracts than other codes. The code relates to the people who were involved with the research, not the intended audience or user group for the research output.

The code *Adult* refers to these people for whom another category is not appropriate. Patients are coded under this term when no other identifier is given, but also the code is used for people who live with a chronic condition but, in terms of the research, are not defined as patients of a healthcare system. As such, for projects that focus on a person's self-management or life in the community, their capacity as people (rather than patients) is recorded with the code *Adult*.

Setting

The code applied for *Setting* relates to the place that the activity took place. As with the *Population* code this does not necessarily reflect the intended setting for the users of the research output. As with the *Method* code the omission of this information could relate to an abstract that spans multiple contexts and projects.

Produced

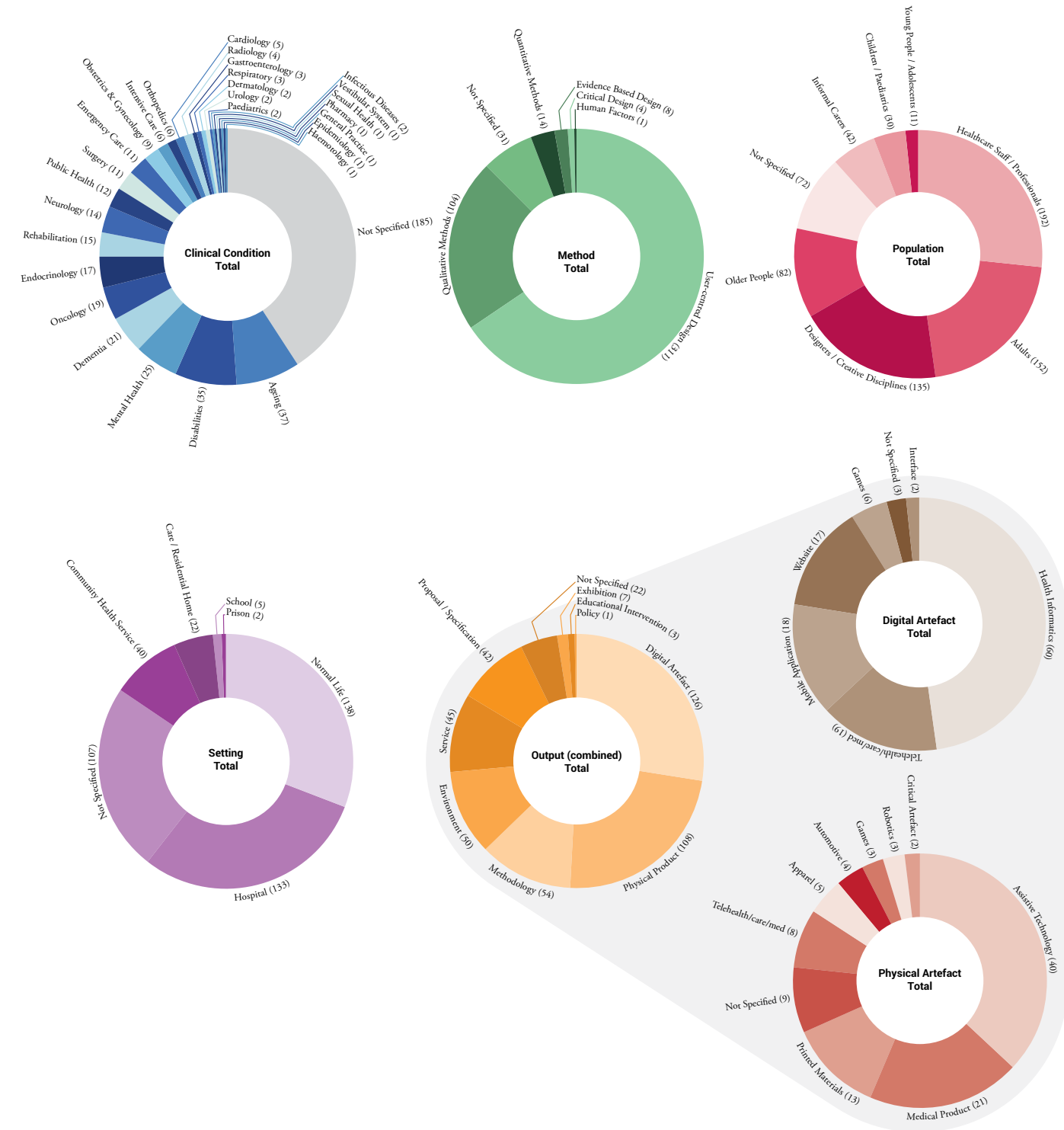
In order to describe the wealth of different outputs that were identified from the literature searches, we describe a broad overview of outputs, and then go on to breakdown specifically *Digital Outputs* and *Physical Outputs* in more detail.

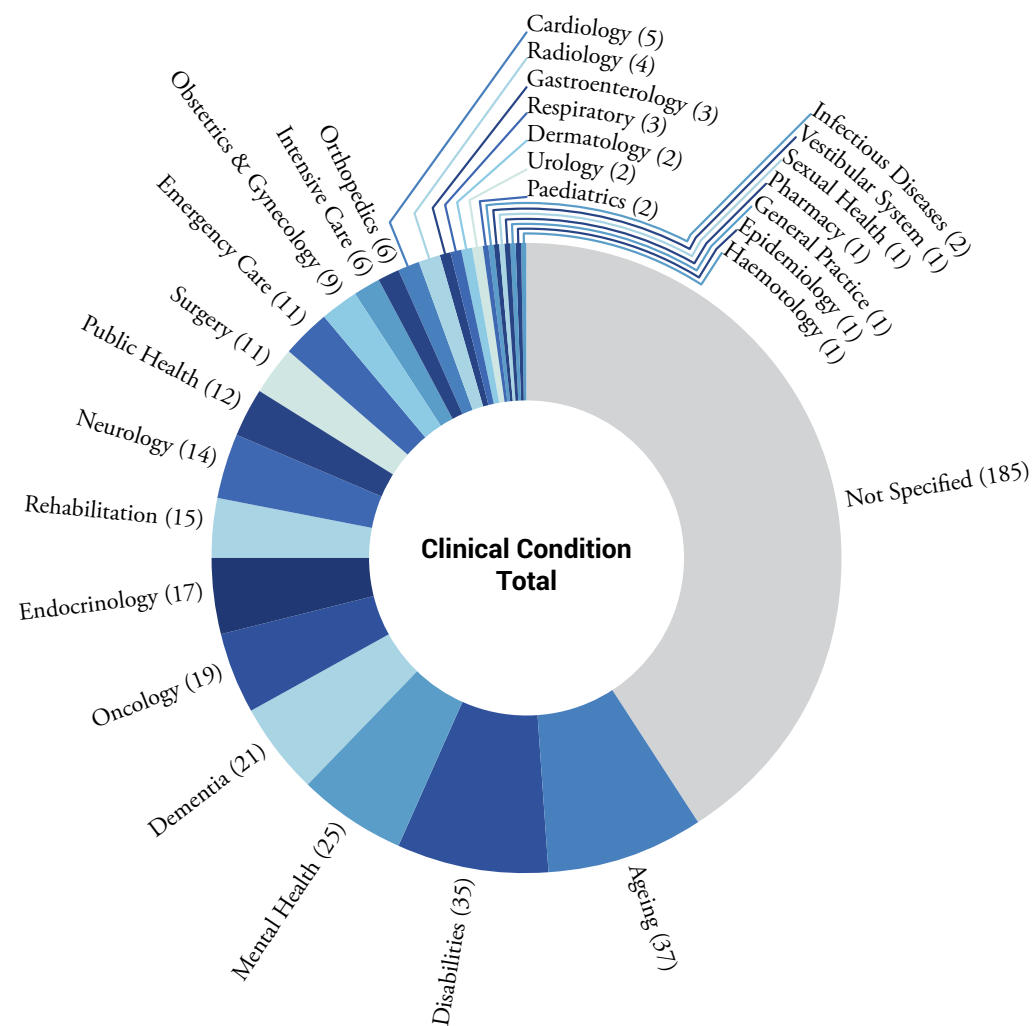
Results - Charts

This section details the code applications per review type and then combined. Three searches were conducted with each search represented graphically to allow comparison between subsets of the data.

We provide a brief narrative of the subsets of the reviews, and then focus our attention on the combined datasets.

Shown below are the totals from across the three searches—Library Database, Expert Network, and Grey Literature—according to the code application, as per Figure 5.





Clinical Condition

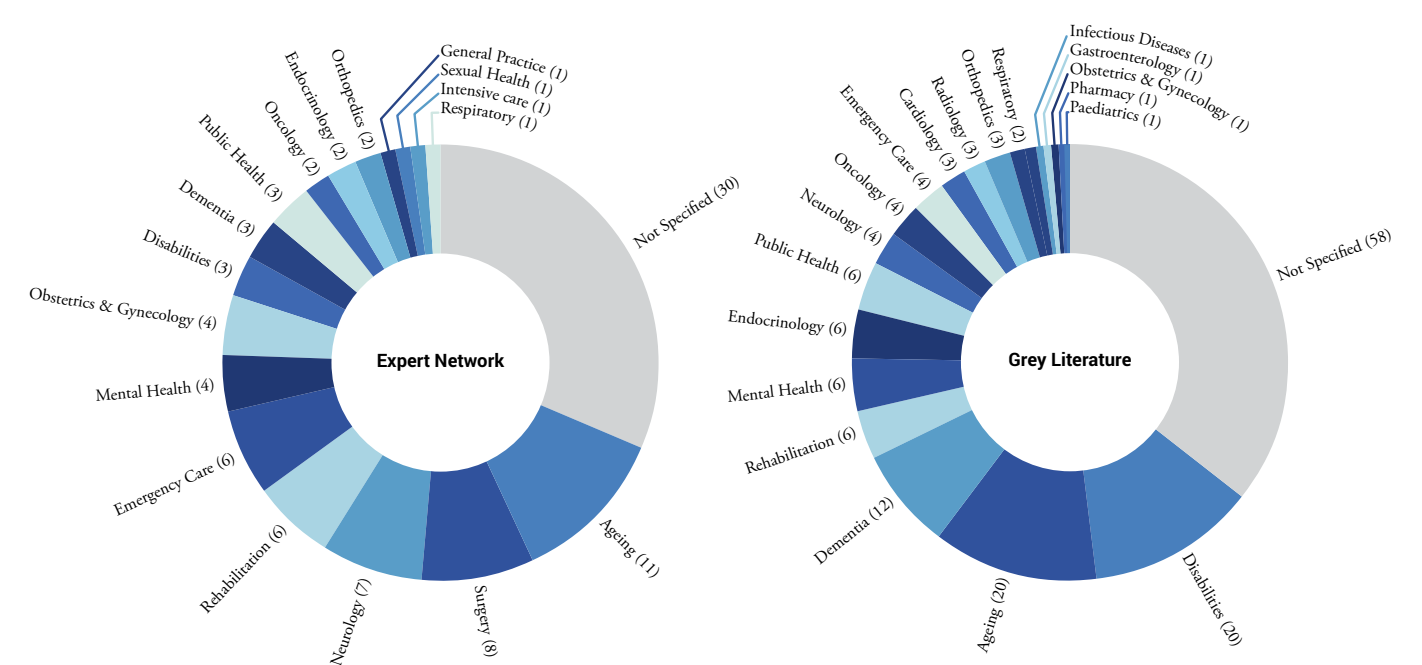
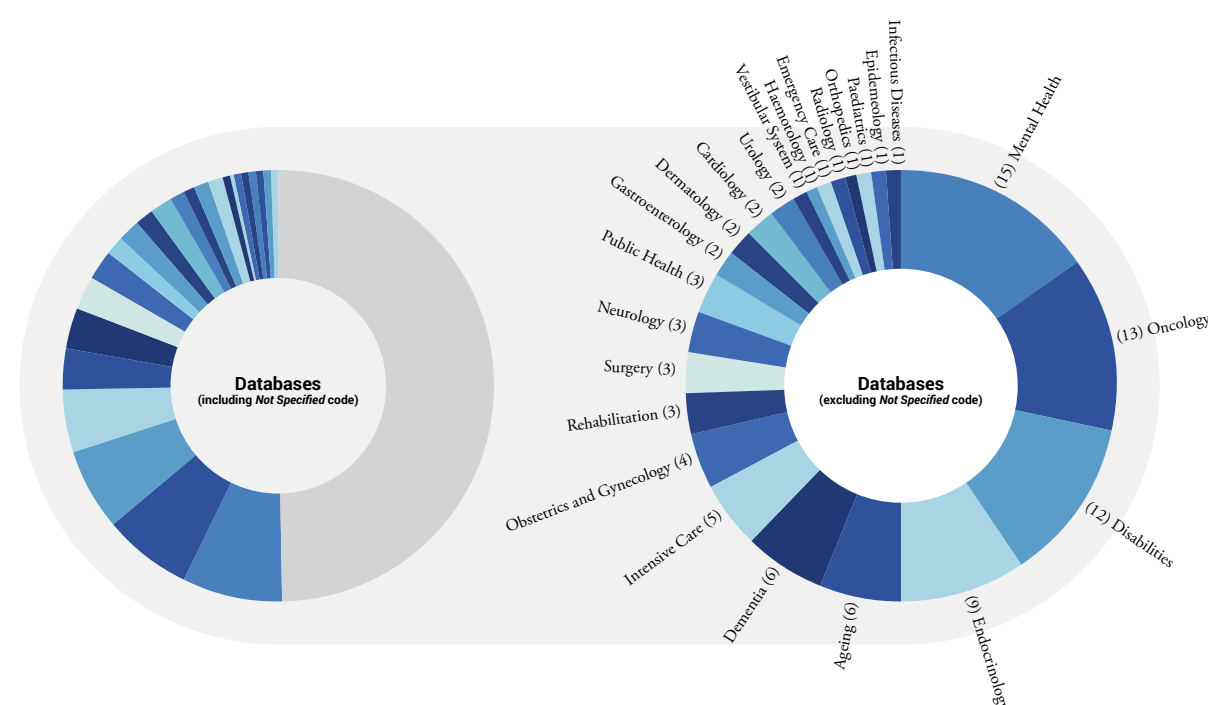
All the top coded clinical conditions are long term conditions, representing a potential design response to the key challenges to health and social care identified in the introduction to this report. *Mental Health* is well represented in the documentation from the Literature Review, with 15 articles spanning *Mental Health* Services (e.g. Davies, To & Hyde, 2004; Navarro, B, et al, 2013), Fear Therapy (Sa, M & Carriço, L, 2012), Autism (Carrol, M, 2010; Barracova, M, 2004), and Depression (Bae, J, 2009). After this comes *Oncology* with 13 papers spanning Breast Cancer (e.g. Skeels, M, 2011; Lindburg, S, 2013), artefacts supporting self-care (e.g. Klasnja, P, 2010; Wolpin, S, 2014), Cervical screening (Deffett-Leger, M 2011), Patient-Experience (e.g. Bate, P & Robert, G, 2007; Tsianakas, V, et al, 2012; Boyd, H, (2012), and Paediatrics (Ruland, M, 2006). *Disabilities* occupy the third place with 12 papers, covering Visually Impaired persons (Wai, K, Siu, M, Wong, M, 2013; Arcia, J & Poncella, J, 2011), Cerebral Palsy (Weightman, A, 2010), Personal Health Records (Lafky, D & Horan, T, 2008), Paediatrics (e.g. Holone, H & Herstad, J, 2012a; 2012b; 2013; Alsop, M & Holt, R, 2013), and Assistive Devices (De Couvreur, L & Goossens, R, 2010).

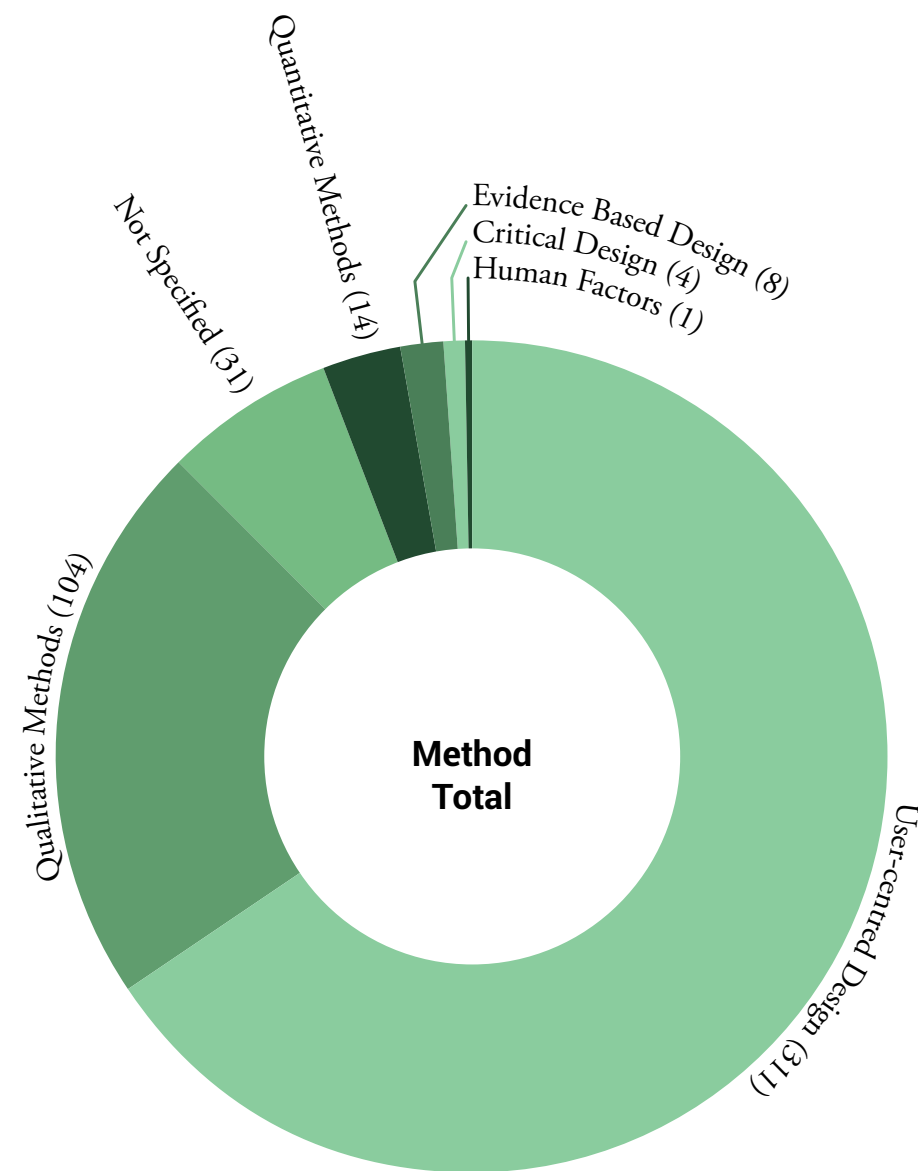
In line with the NHS outcome measures mentioned in the previous chapter (page 10) the instances of the 'Ageing' code are the largest specific patient group mentioned here. The potential of older people is a constant topic of discussion in the developed world where the proportion of adults who are classed as older is constantly increasing.

The results from the literature review highlighted a large proportion of papers that omitted the *Clinical Condition* covered by the research – with the papers instead focussing on general application across health and social care. As an example from the Expert Network: Chamberlain, P & Lawton, R (2008) describes the development of non-Luer medical connectors using a mix of design methods, and professional clinical input (output coded as: *Produced; Physical Product; Medical Product*). Gottlieb (2009) documents the use of design practice to inform the development of medical packaging guidelines (output coded as: *Produced; Physical Product; Proposal / Specification*). These are both clearly in scope of the project but do not reference clinical condition specifically.

The spread of conditions is quite striking, demonstrating designs ability to operate in many contexts in health and social care.

Figure 6 - Instances of the *Clinical Condition* code per search





Method

In accordance with the coding strategy outlined on page 16 of the Research Methods chapter, the code *User-centred Design* was taken to cover a variety of human-centred approaches. This ranged in degree of 'genuine participation' from consultation, through to collaboration.

In the abstracts from the database searches a much smaller portion of the papers omitted the *Method(s)* used. Arnstein (1969) - referenced below - and the different levels of power a participant holds in the collaborative process may play a role here, since as a network of design institutions operating within a healthcare context there is a common understanding of the meaning applied to terms such as 'collaboration', 'participation' and 'user-centred' in a design context, and one might expect the expert designers to be more explicit in their descriptions of methods.

Evidence Based Design was mentioned by Berger, L (2010), Becker, F (2011), Joseph, A & Hamilton, D (2008), Cole, T, Wright, C & Williams, A (2012) and Carr, V (2011), concerning an approach to: Healing Environments (Berger, L (2010); Becker, F (2011); Joseph, A & Hamilton, D (2008)), Medical Charts & Information (Cole, T, Wright, C & Williams, A (2012)) and Service innovation

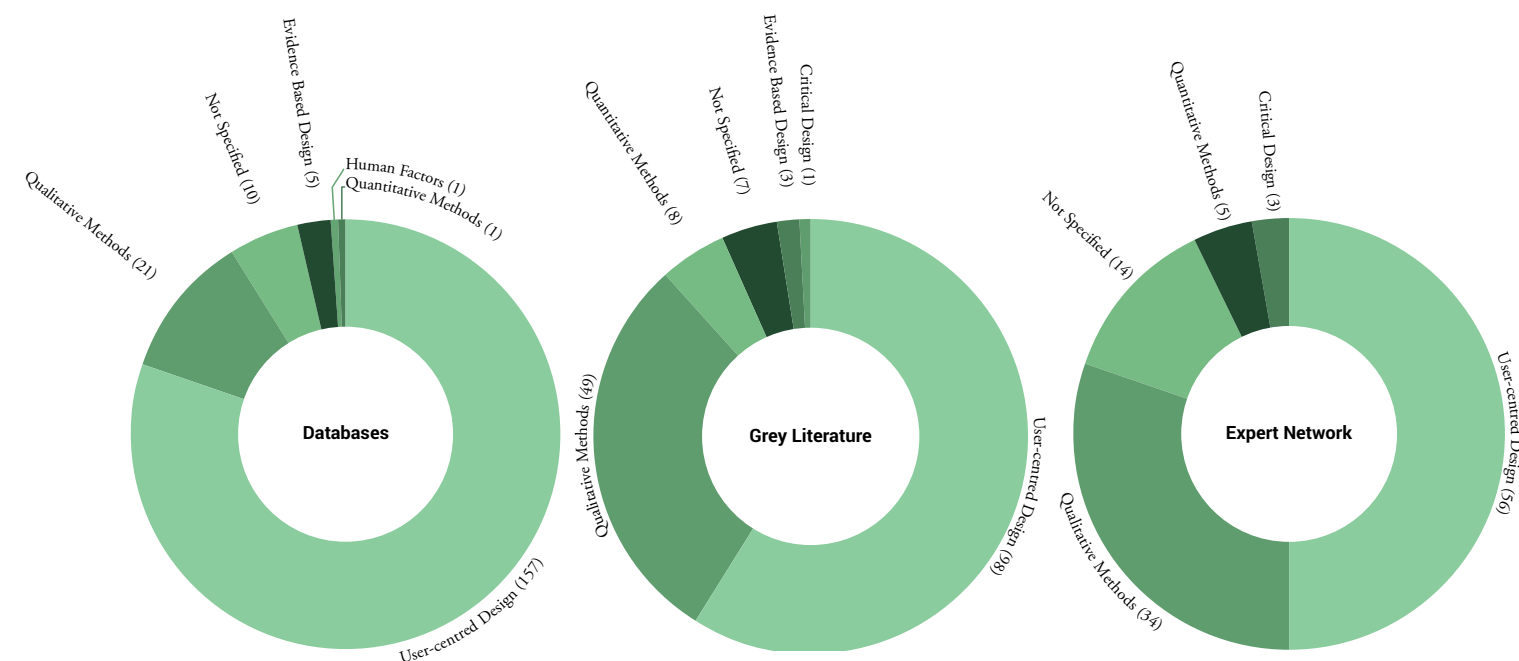
impacting environmental factors (Carr, V (2011)), and while there is debate about the nature of the evidence base with relation to design (with regard to the hierarchy and what is considered evidence in design) versus health, the projects listed above are all situated in domains that are closely aligned with Evidence-Based Medicine, or Evidence-Based Practice. Architecture and design for the built environment is a domain where *Evidence Based Design* is posited as a solution to the issues of standardisation associated with some design projects (Evans, 2010), and as such it is no surprise to see papers discussing the built environment mention the use of *Evidence Based Design*.

It is worth noting that while *Human Factors*, *Qualitative* and *Quantitative* (even *Evidence Based Design*) are not mutually exclusive to a user-centred approach (indeed, on some level they require it), the articles here were coded according to how the authors had described their work. Hence, Chan (2010) describes the project in terms of the use of *Human Factors* for the redesign of a clinical Radiotherapy environment, whilst also highlighting that the users were involved and ethnography incorporated into the research.

Arnstein, S., 1969. A Ladder Of Citizen Participation. Journal of the American Planning Association, 35(4), pp.216–224. Available at: <http://www.tandfonline.com/doi/abs/10.1080/01944366908977225> [Accessed June 25, 2010].

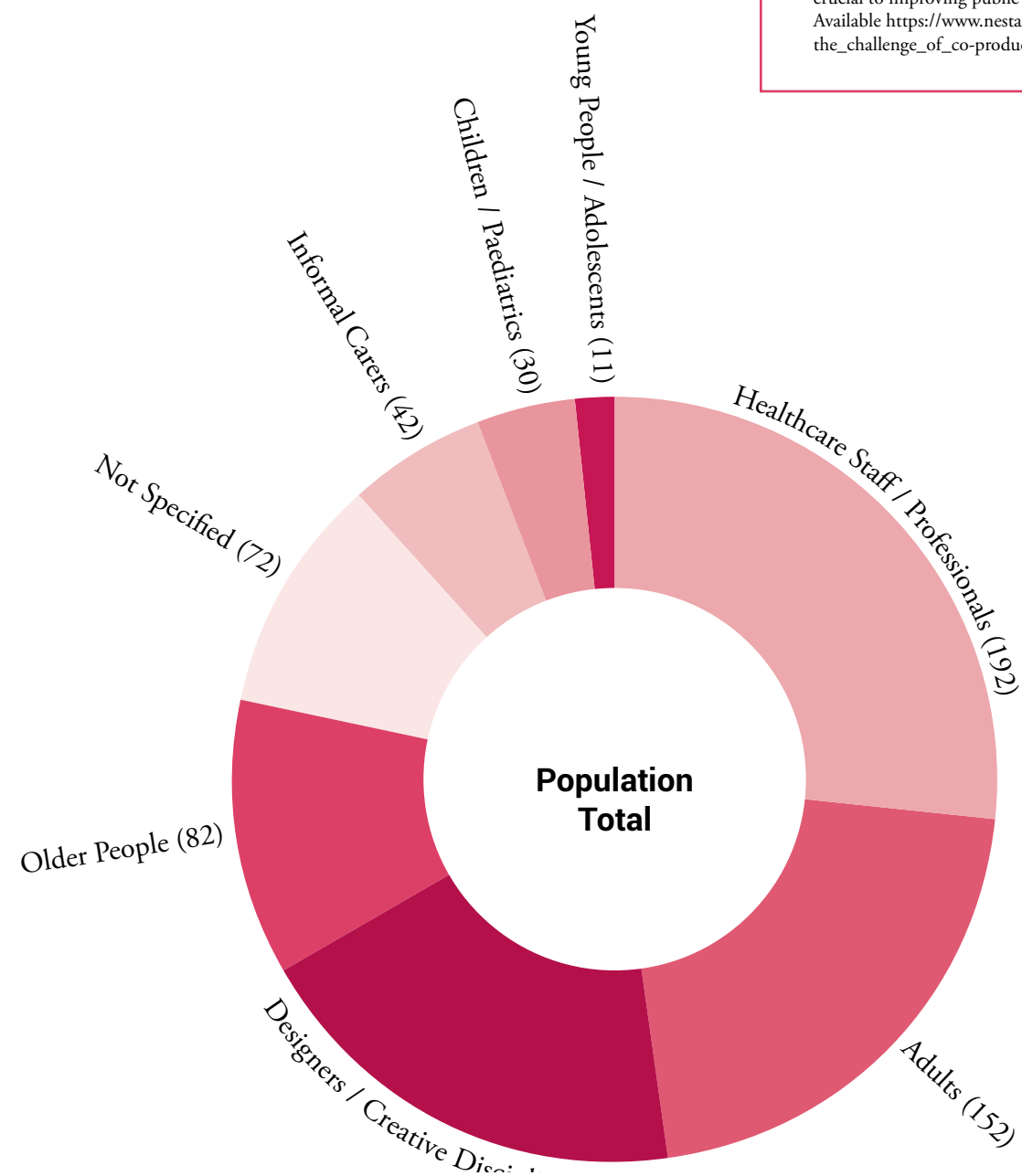
Evans, B., 2010. Evidence Based Design. In The World into Culture: Liber Amicorum Richard Focque (Comparative Methodologies). VUB University Press, pp. 226–421.

Figure 7 - Instances of the *Method* code per search



Boyle, D., Coote, A., Sherwood, C., & Slay, J. (2010). RIGHT HERE ,RIGHT NOW, Taking co-production into the mainstream. Retrieved from http://www.nesta.org.uk/sites/default/files/right_here_right_now.pdf

THE CHALLENGE OF CO-PRODUCTION How equal partnerships between professionals and the public are crucial to improving public services 2009, Nesta, London. Available https://www.nesta.org.uk/sites/default/files/the_challenge_of_co-production.pdf accessed June 2015



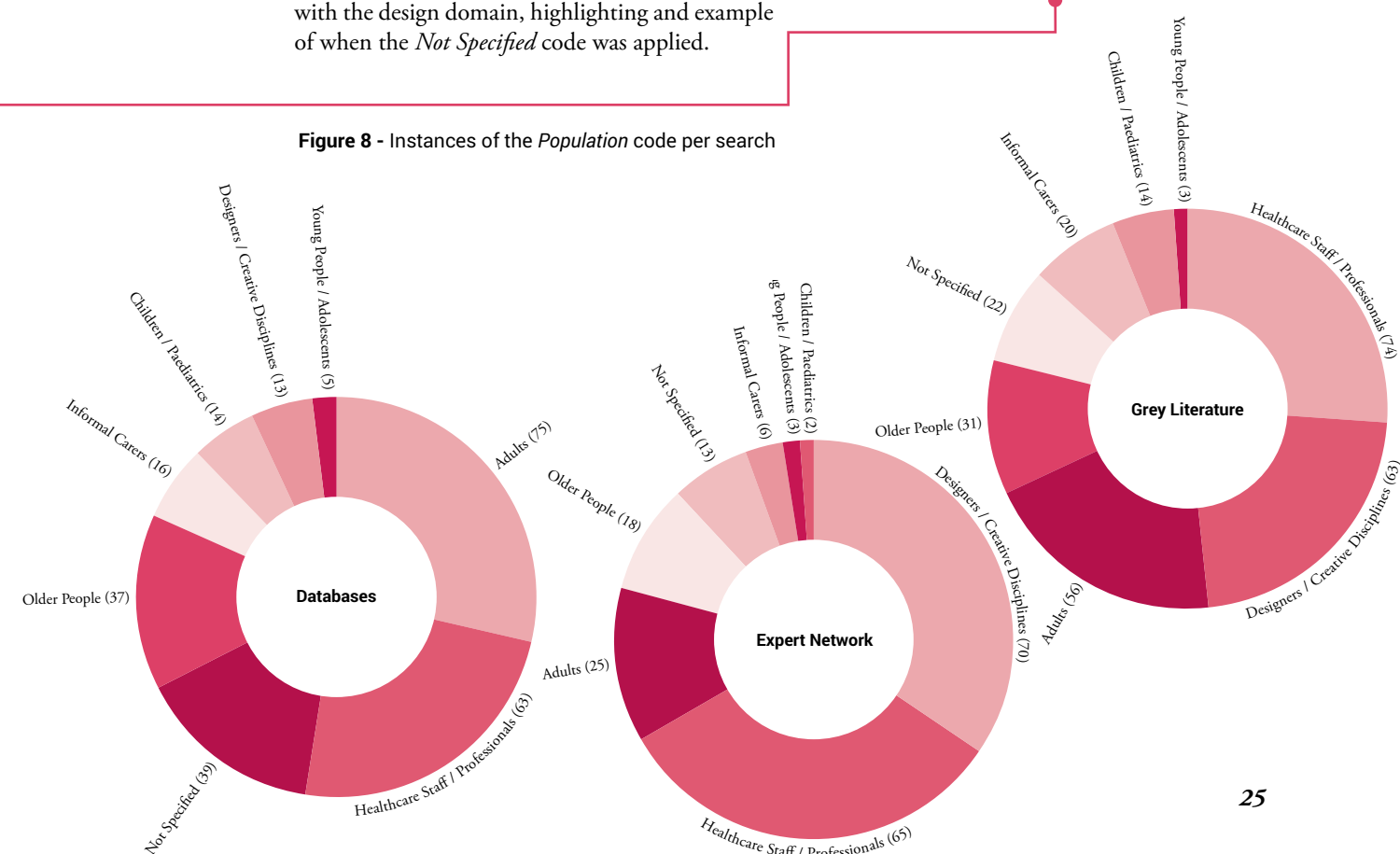
Population

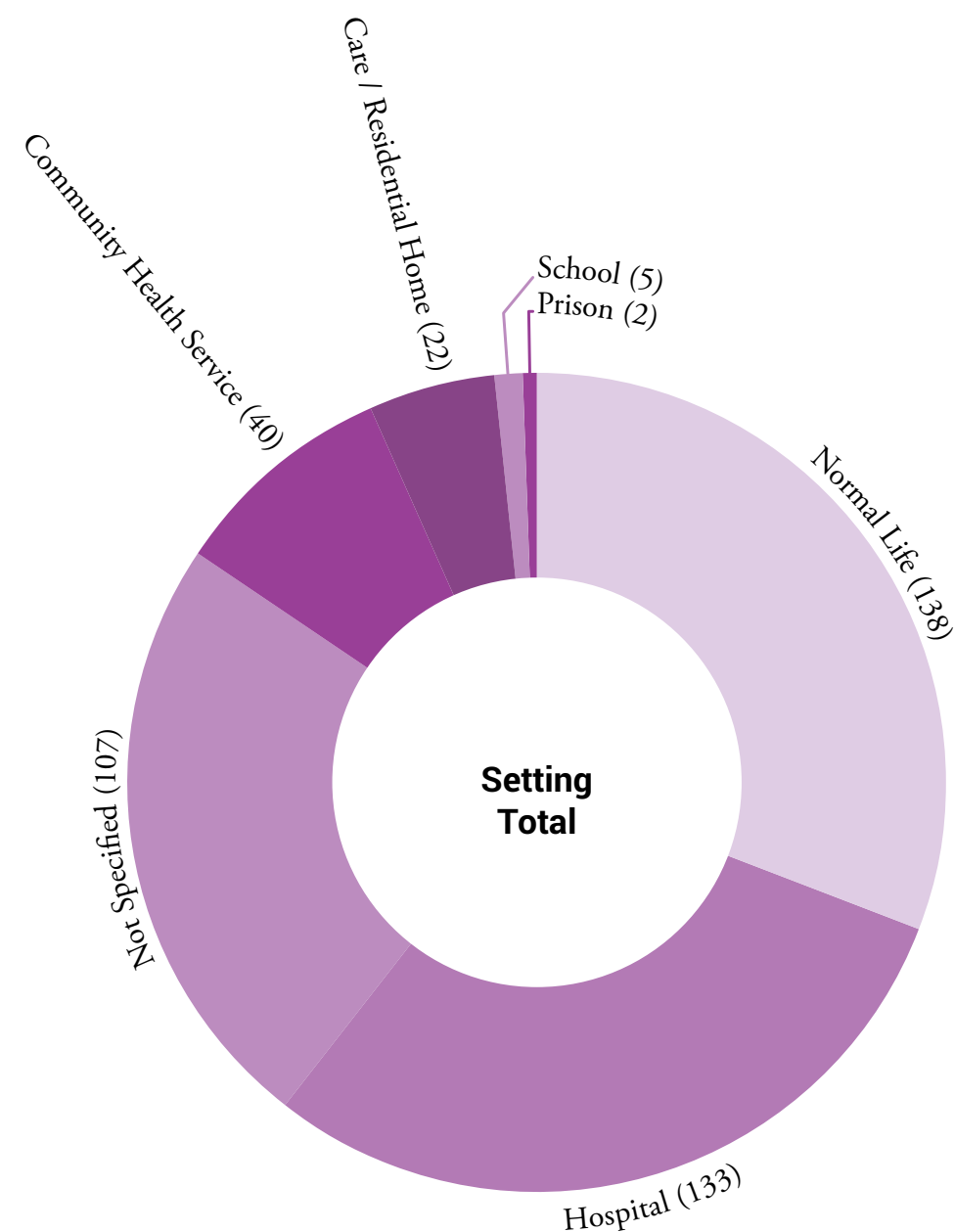
Immediately apparent with these results are the paucity of abstracts including designers, or other professionals from the creative disciplines from the Library Database Search. The number of articles describing *Designers / Creative Disciplines* amongst the *Population* is smaller, within these 13 articles including the *Designers / Creative Disciplines* code cover topics such as Assistive Technology (McCann, J and Bougourd, J (2008)), Health Service Design (Wolstenholme, D., et al. (2010); Lin, M, et al. (2011)), Health Informatics (Went, K, Gregor, P. and Ricketts, I. (2009); Korpela, M., et al. (1998); Hartwood, M, et al. (2003); Dwards, K., et al. (2012)), new methodologies of Design practice in health (Nykänen, E., et al. (2008); Mcdonagh, D. & Thomas, J. (2013); Horwitz, C. & Pentland, A. (2008)), Telehealth (Li, J., et al. (2006)), Medical Products (Grocott, P, Weir, H and Ram, M. (2007)), and Environments (Chan, P, Lai, T, and Wong, K. (2012)). This is perhaps reflected in the journals that are represented in the results, with a majority in the Human Computer Interaction (HCI) disciplines, an example of the application of the *Not Specified* code is Nixon, N (2013). In their article discuss how design thinking can be applied in health care, and while not specifically identifying a population within the abstract the work is still in scope for joining the health domain with the design domain, highlighting and example of when the *Not Specified* code was applied.

It is no surprise that the proportion of *Designers / Creative disciplines* is higher in the Expert Network review than the results from the Library Database searches. The proportion of *Healthcare Staff / Professionals* is similar to the designers, suggesting that the use of terms such as 'participation', 'collaboration' and 'user-centred design' align with Arnstein's (1969) definition. The use of the *Not Specified* code relates to projects that span multiple sites, and even abstracts that cover multiple projects. For instance, Partridge (2011) describes the design of a mobile infusion pump, with the abstract focussing on the artefact and the context, not the population.

It is extremely encouraging to see that the review supports the underlying principles of involvement and engagement in the abstracts identified. There are almost equal proportions of 'people' [*Adults, Older people, Carers*], healthcare professionals and designers engaged across the projects. This inclusion of expertise in the form of experience, professional 'know how' and design methodology and practice represents the best of what we know about mobilising knowledge into practice and demonstrates designs enabling role in the coproduction ideal espoused in many policy documents (Boyle et al 2010, Nesta 2009).

Figure 8 - Instances of the *Population* code per search





Setting

Immediately apparent from the results of the Library Database search is the high incidence of the *Not Specified* code (71 results). As an example of this, Wolpin, S, et al. (2014) describe the development of an Internet-based Cancer symptom and Quality-of-Life support system. The abstract for this work describes the *Population (Adults)*, *Methods (User-centred Design)*, *Clinical Condition (Oncology)*, and what is produced (*Digital Artefact; Website*). As such, the omission of the *Setting* does not necessarily belie a poorly constructed abstract.

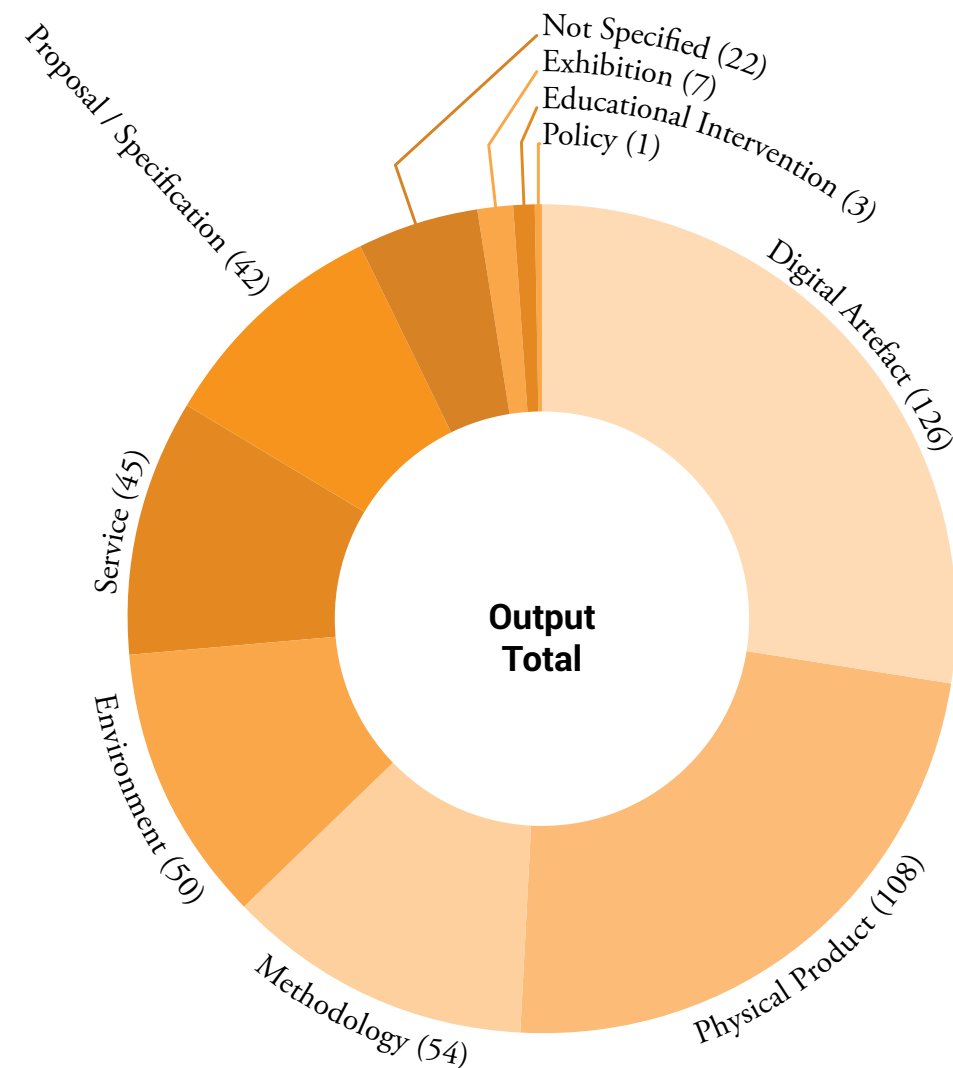
The totals for settings, discounting the 'not specified' articles tell an interesting story that

mirrors the challenges facing 21st century healthcare provision. The *Hospital* setting still is very dominant as a place where a large proportion of healthcare budget is spent. This is consistent across the three search strategies. Health and social care needs to move away from the bricks and mortar of hospitals and so it is encouraging to see a large proportion of the design projects here being undertaken in the community and *Normal Life* settings. Perhaps the user-centred focus of design is identifying that health will eventually have to be personalised and personal sooner than existing methods of enquiry.

Figure 9 - Instances of the *Setting* code per search



Sangiorgi, D, Prendiville, A, Ricketts A 2014 Mapping and developing Service Design Research in the UK retrieved from http://imagination.lancs.ac.uk/sites/default/files/outcome_downloads/mapping-and-developing-sdr-in-the-uk.pdf



Output

The Library Database results are dominated by a large portion of *Digital Artefacts*. These are detailed further below.

The number of types of outputs coded by the Expert Network is higher than from the literature review, with *Exhibition* (7) and *Policy* (1) applied to the abstracts. Some of the *Not Specified* applications for the produced relate to abstracts that are exploratory, or covering a multitude of projects that span contexts and therefore outputs – Torlei, K (2009) describes research into surgery at the Royal College of Art spanning a multitude of projects in the abstract, focusing on the methods, and overall methodology of the project.

There is a diverse range of outputs described, that illuminate the range of ways that design can produce an impact, and which serves as a useful counterpoint to assumptions that design is just about making ‘stuff’.

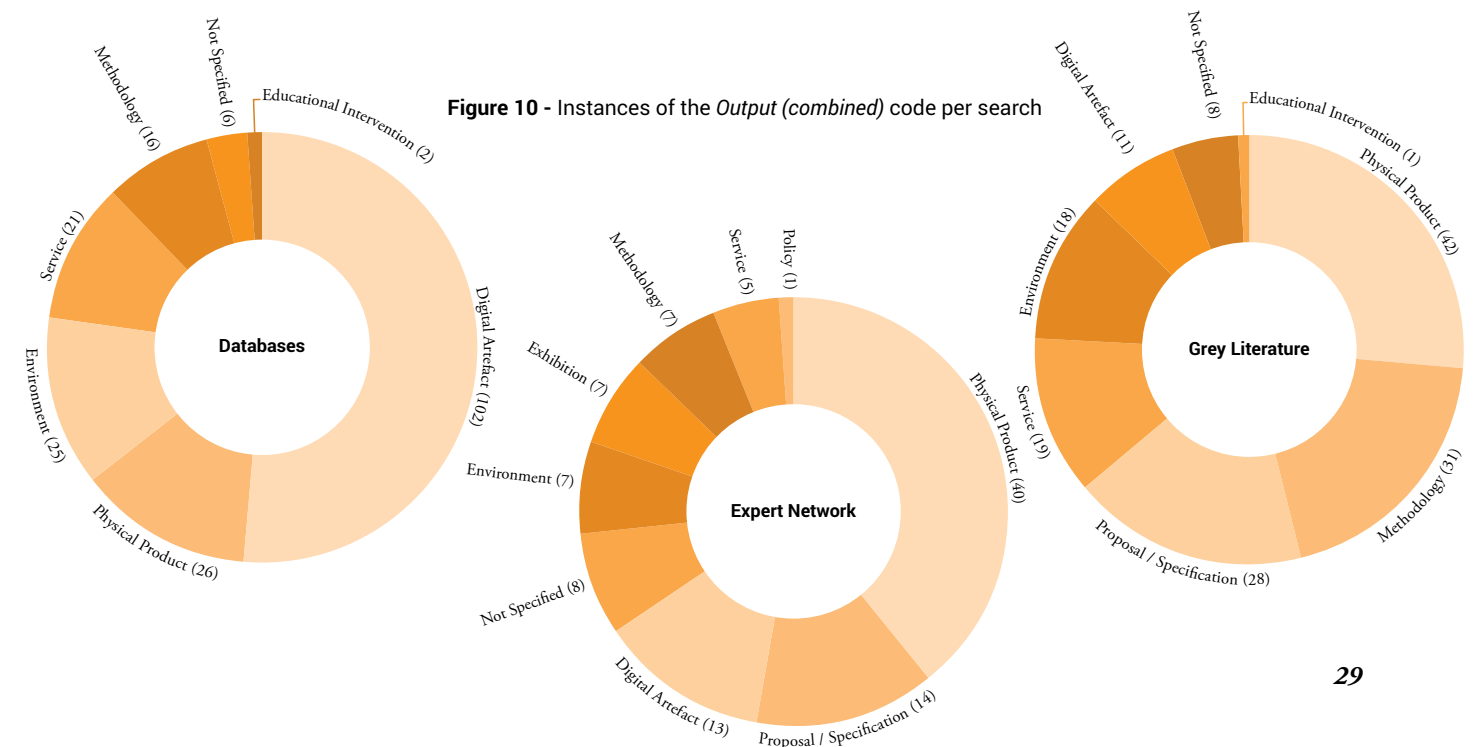
The *Environments* code covers a range from *Hospital* architecture and design (e.g. Chen B, & Wang G (2010); Biddiss, E, et al. (2013); Nedopil, C., Schaubert, C. and Glende, S. (2013)), living spaces for people with Dementia (Van Hoof, J., et al. (2013)), to specialist outdoor spaces for people living with specific medical conditions (Wagenfeld, A., Roy-Fisher, C. And Mitchell, C. (2013)).

Service design, which is the focus of considerable interest more generally in public services, (Sangiorgi

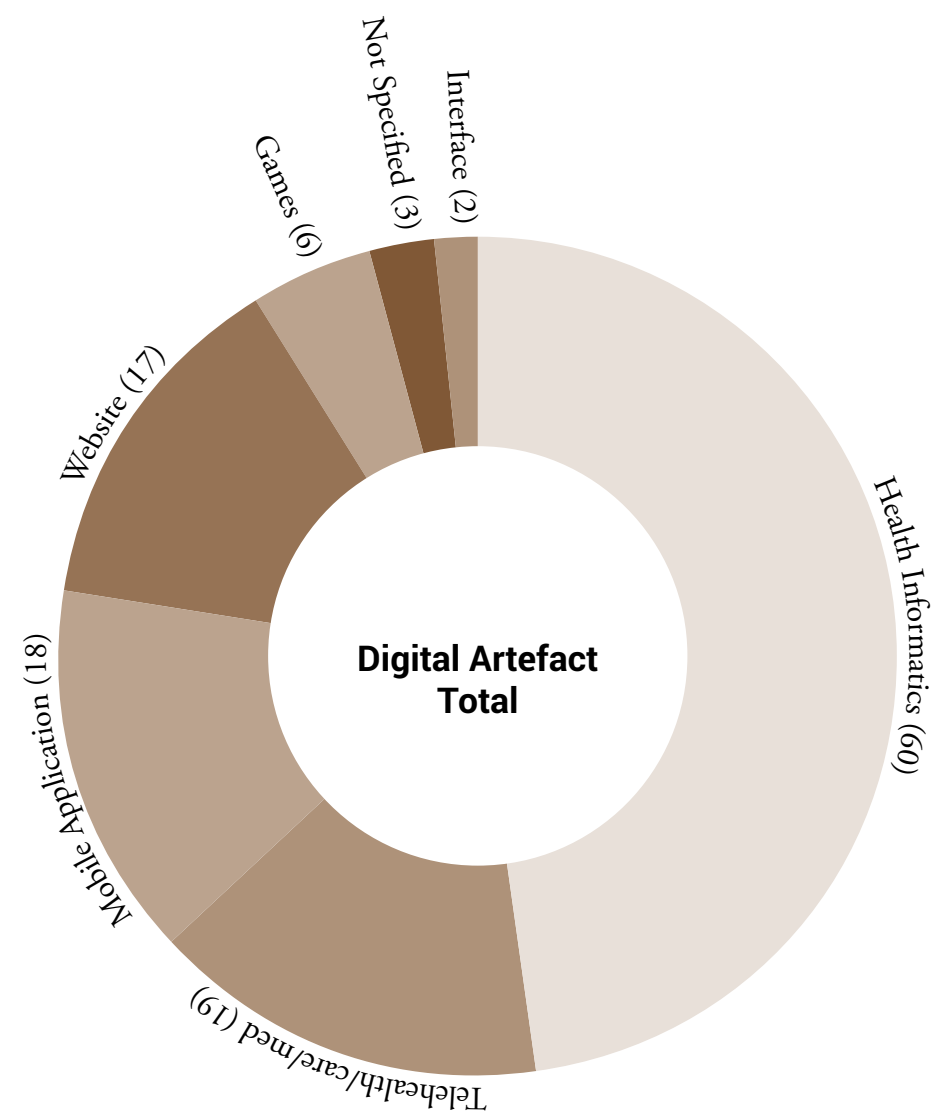
et al 2014) is well represented. From the Literature review, health services form a significant portion of the results with these outputs covering a range of *Clinical Conditions* – Dementia (Williams, R (2011)), *Mental Health* (Davies, H, & Hyde, P (2004)), *Oncology* (Tsianakas, V., et al. (2012); Boyd, H., et al. (2012); Bate, P. and Robert, G. (2007)), *Emergency Care* (Piper, D., et al. (2012)), or with no specific *Clinical Condition* applied but a focus instead on the process of designing a health service (e.g. Pickles, J. P., Hide, E. H. and Maher, L. M. (2008); Wolstenholme, D., et al. (2010)).

An example of a *Methodology* as an output can be taken from Bustamante Navarro, R., et al. (2013), with the description of the methodology for the ‘Participatory design guide for mental health promotion in prisons’. These outputs do not necessarily have a tangible output as the focus, rather they describe the methodology developed and the results. As with the *Methods* code, the focus of the abstract guides the application of the methodology code.

There were a small number of *Not Specified* applications of the code describing the artefacts that were produced (6 in total), with the smallest portion of results for *Educational Interventions*. These include Paediatric training (Klaber, R. & Roland, D. (2012)), and tool to improve Handover in care settings (Rachsler, H., et al. (2012)).



Royal College of Nursing. (2015). [online]. *Telehealth and telecare*. Last accessed 1 July 2015 at: http://www.rcn.org.uk/development/practice/e-health/telehealth_and_telecare



Digital Artefacts

By far the largest portion of the results are taken up by *Health Informatics*, which are not always elaborated upon or refined further in the abstracts. These range from designing virtual services for *Older People* (Mcloughlin, Ian, et al. (2008)), to the use of artificial intelligence to improve health communication (Neuhauser, L., et al. (2013)), as examples.

Second is the application of the *Telehealth/care/med* code. Telehealth, Telecare and Telemedicine have different focuses in their application. Telehealth and Telemedicine are counted as the same thing in the United Kingdom (RCN, 2015), and are concerned with the remote monitoring of physiological data for use by health professionals. Telecare technologies involve the use of alarms, sensors and other equipment to monitor domestic environments and provide local feedback of a person's condition, with the ability to reach others with pertinent information about the person's health condition. The application of this code under *Digital Artefacts* denotes research that had as it's primary focus the development of the intangible aspects of these systems. A sister code under the *Physical Products* outputs denotes articles chiefly concerned with the tangible aspects

of these technologies.

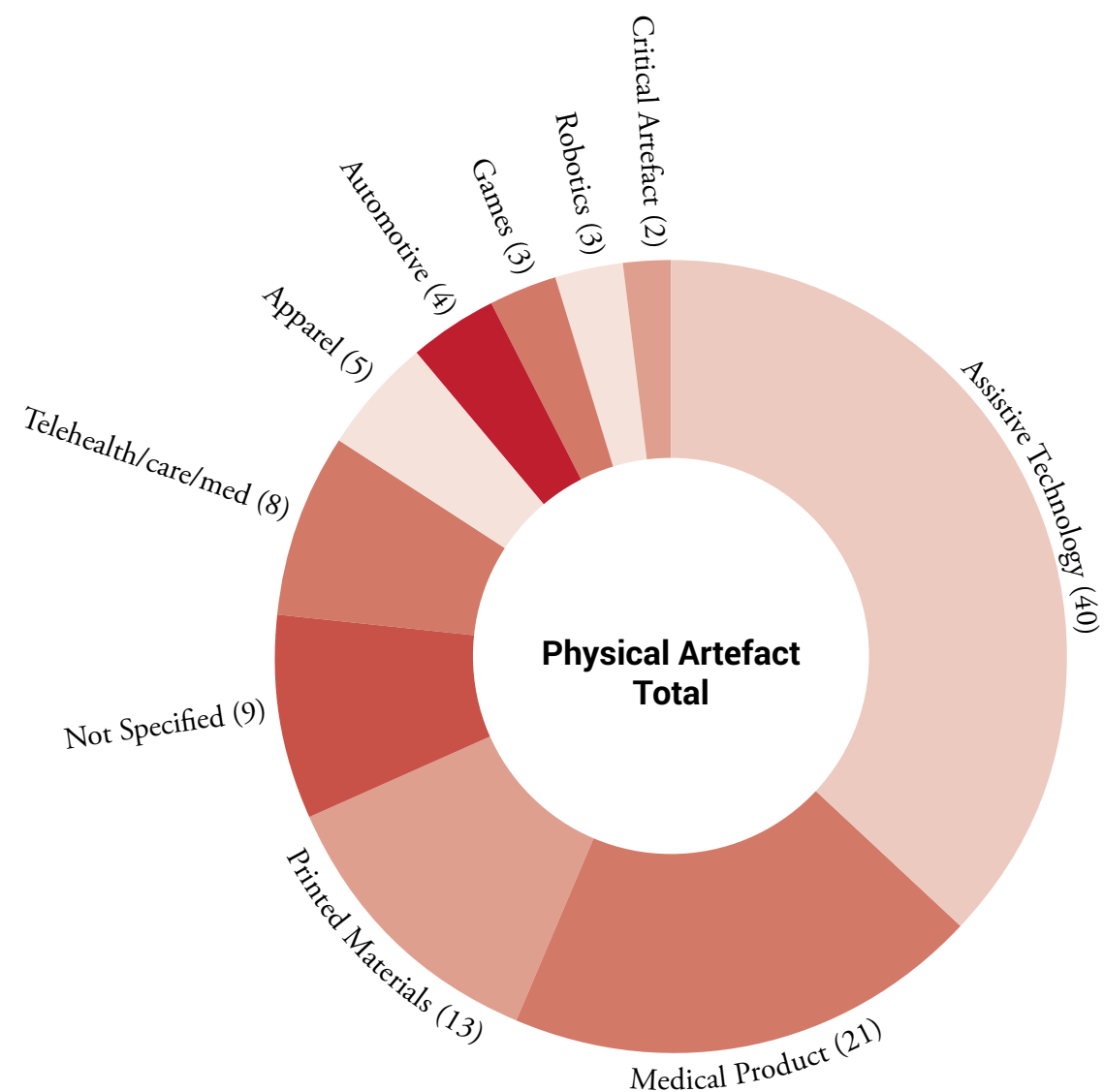
As with the code for *Telehealth/care/med*, the Games code has a sister code under Physical Products, with the same criteria defining it's application.

The abstracts that are coded as *Not Specified* include Macdonald A, Loudon D, (2011) & Storni, C (2013), with both of these abstracts having a focus more on the project methodology, setting and population than the specifics of the output.

There is a strong drive in health and social care to leverage the power offered by the digital revolution, and whilst health informatics is a long standing companion to health care provision, the use of design, and specifically user-centred design, offers the possibility of how informatics interacts with the multiple stakeholders in healthcare to deliver services that support clinical practice rather than dictate it. Telehealth is often seen as a panacea for delivering cost effective healthcare, but an argument might be that this ideal will only be released if it is well designed, with the necessary attention to the lived experience of those who might use it.

Figure 11 - Instances of the Digital Artefact code per search





Physical Outputs

There is a wider spread of physical products from the database searches, with *Medical Products* like Surgical Tools (e.g. Ming, C, (2012); Loring, B & Lemieux, E (2010); Cheung, M. (2012)), Ward-based medical equipment (Hao, Y., Gong, Y. and Choi, Y. M. (2013)), Wound Care (Grocott, P., et al. (2013)) as examples.

In contrast to the results from the Library Database searches that showed the main *Physical Artefact* to be *Medical Products*, the results from the Expert Network demonstrate a large number of abstracts relating to *Assistive Technology* - an example being the wearable technology from the Envisage Lab (Timmins, Macdonald, Maganaris, 2014). Also, new to the Expert Network results are the code categories of *Apparel*, and *Automotive*. The *Automotive* categories relate to the Ambulance redesign work of the RCA.

The range of *Physical Artefacts* is fascinating with topics spanning healthcare delivery in prisons (Canelli, N., et al. (2003)), activity alarms and health monitoring for *Older People* (Pratesi, A.,

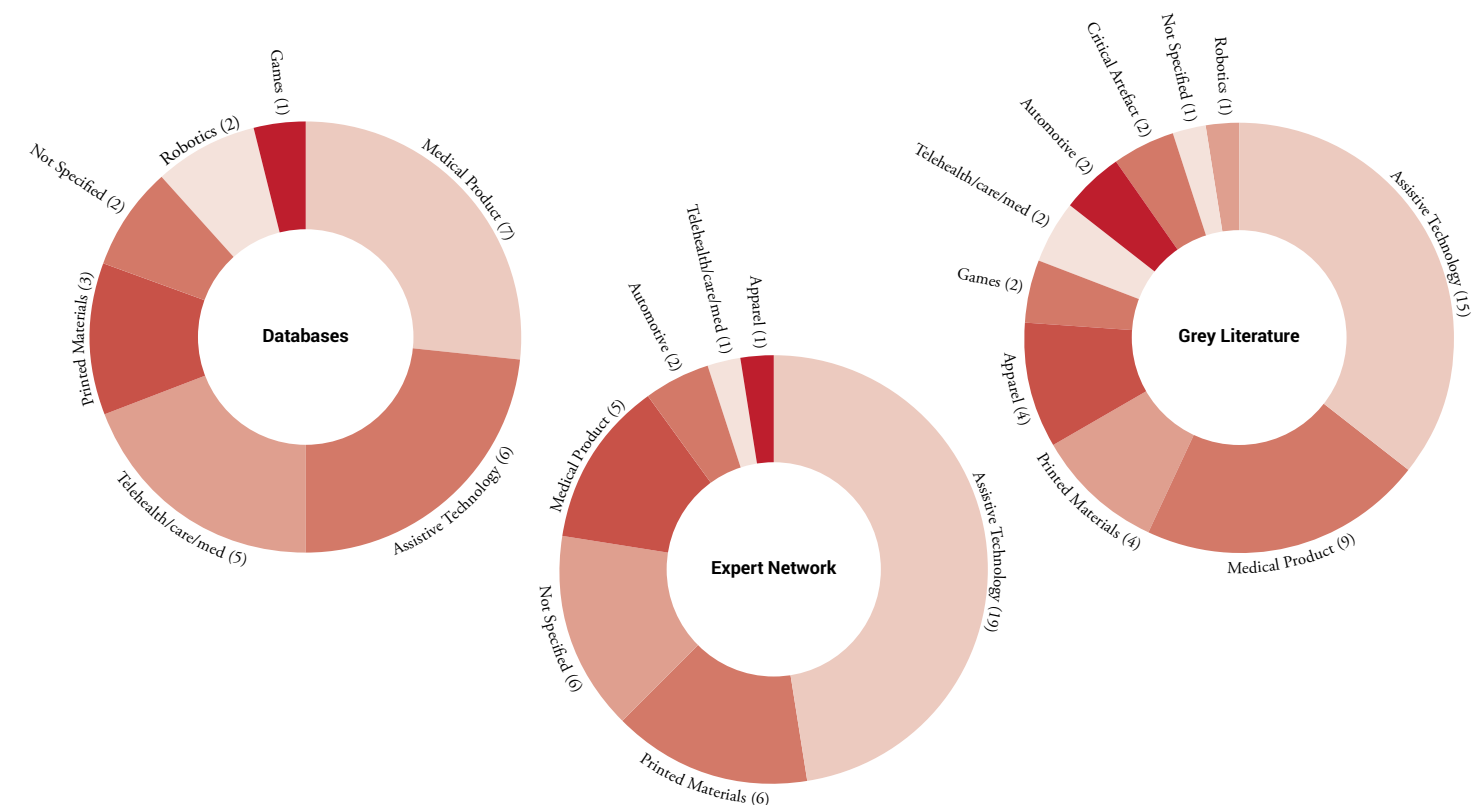
Sixsmith, J. and Woolrych, R. (2013); Jia, G., et al. (2013); Burns, W., et al. (2011)), and support systems for people with Dementia (Martin, S., et al. (2013)).

Only two articles do not specify the exact nature of the physical products that were produced as part of the research, and in both cases the articles document the production of multiple physical artefacts (Wilson, T (2010) & Eisermann, R (2005)).

Robotics in health are described in two arenas; Tiwari, P., Warren, J. and Day, K. (2011) document their research with regard to developing robotics to assist *Older People* with their lives, and Barakova, E. I. (2011) describes the development of robotic aids in the training of autistic children for social situations.

Finally, the remaining article is for the development of *Games*. Van Rijn, H., Van Hoof, J. & Stappers, P. (2010) describe the development of a game called “the chitchatters” for use in designing with people living with Dementia.

Figure 12 - Instances of the *Physical Artefact* code per search

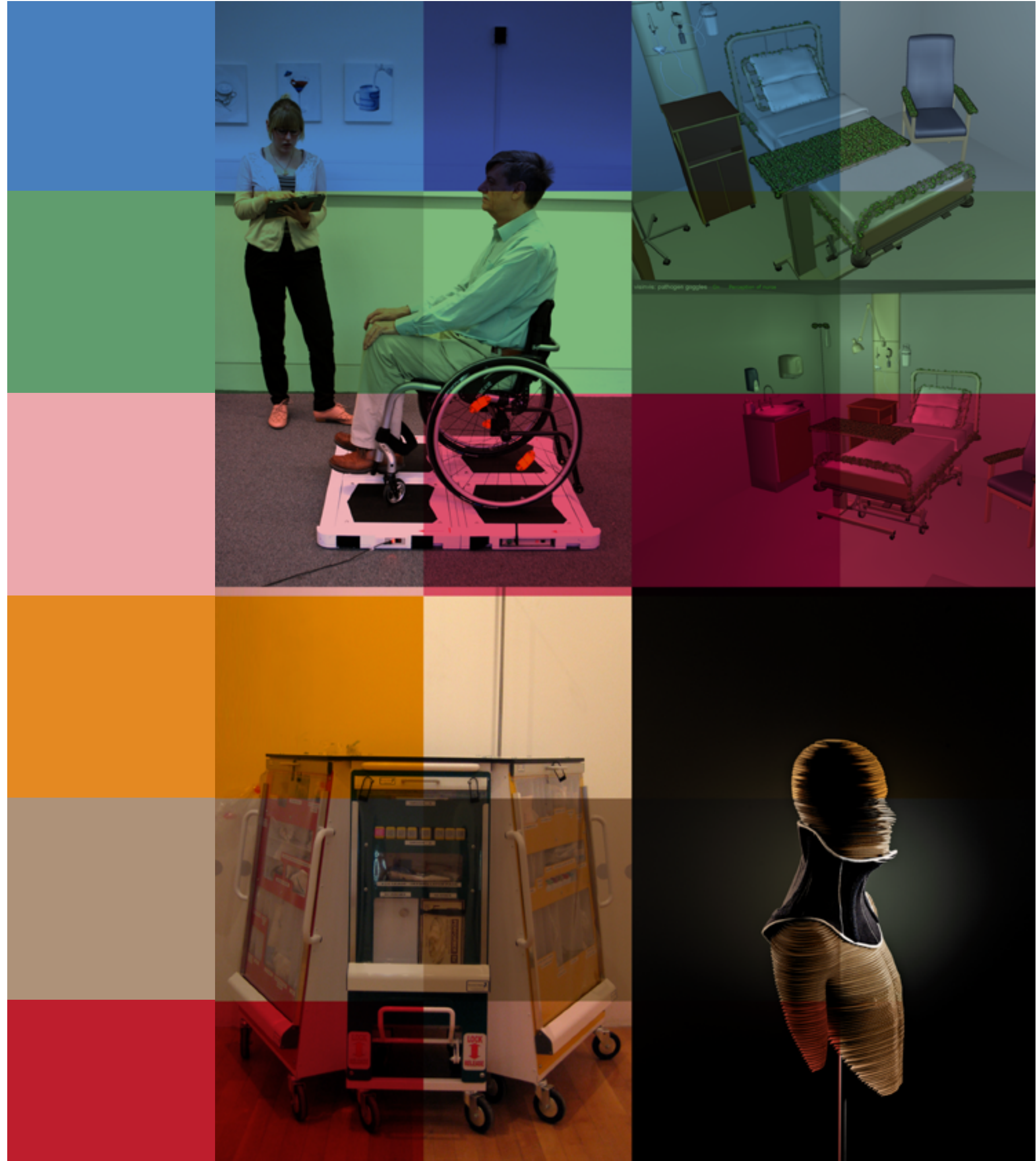


Expert Network Case Studies

As per the discussion on page 15, the network partners were asked to provide lists of references but also an example each of a project that acts as an exemplar of design in health.

Included here:

- Wheelsense® (*Coventry Univeristy*)
- VisionOn (*Glasgow School of Art*)
- Resus:Station (*Royal College of Art*)
- Head Up (*Sheffield Hallam University*)





Wheelsense® Case Study

The NIHR i4i funded WheelSense project was a collaborative project between Coventry University and 3 NHS Trusts: Birmingham Community Healthcare Trust, Kings College Hospitals Foundation NHS Trust, and Glan Clwyd Hospital.

The project aimed to design, develop and evaluate a system for assessing the stability and performance of wheelchairs before they are released to the client and used in the community.

The resulting system (Figure 13) measures the centre of gravity of the client / wheelchair system and maps the stability points. This information can then be used to inform the tuning of the wheelchair to meet client needs, and used predictively to model the effect of changes to the wheelchair on the performance and stability.

Background

With an increasing number of wheelchair users in the UK, ensuring stability, safety and performance is a growing concern. As a result of the ageing population there is likely to be a continued rise in wheelchair usage, alongside increasing need for specialist seating and condition-specific requirements such as bariatric chairs.

Research indicates an increase in wheelchair related injuries in the last decade; tips and falls were identified as the leading cause of injury accounting for more than 65% of wheelchair related injuries (Xiang et al 2006). Wheelchairs that are not appropriately modified to meet client requirements, lifestyle and environments can be prone to tipping, sliding and loss of traction. Incidents can occur on ramps, kerbs, cambers, soft ground, or when modifications have been made to the chair which alter the centre of gravity (such as the addition of medical or assistive equipment).

Wheelchair prescription and assessment in the UK is typically carried out by a health care professional such as a Rehabilitation Engineer or Occupational Therapist. The needs, abilities and preference of the wheelchair user/ client as well as the demands of the environment and lifestyle should be taken into account when prescribing and modifying a wheelchair.

Traditionally wheelchair stability in the UK is

tested through a ramp test. The wheelchair and client are positioned on a ramp to see whether the chair tips when positioned facing upwards, downwards, and sideways at an angle of 12° or 16°. Reports from patients suggest that they can feel vulnerable during the test and it requires significant physical effort from the prescriber. In order to improve stability assessment beyond these pass/fail tests, it was aimed to explore the use of load cell technology (widely used in vehicle stability testing) to measure the weight distribution of the wheelchair and occupant and use this to model and predict stability.

Wheelsense®

Wheelsense® (patent WO2015004454 (A1)) is a computer-based system incorporating force-measurement technology within a custom made rig. It calculates the centre of gravity, and maps the stability points of the user-wheelchair system. The design incorporates:

- A folding platform-based weighing system
- Underlying mathematical modelling and electronics
- Software and graphical user interface.

For portability, the platform was designed as a foldable four quadrant frame linked with suitable hinges so that it could be transported by car and used in a clinic, or out in the community.

The platform senses the wheelchair wheel and castor position and determines dimensional information. The assessment procedure involves 3 easy steps whereby the wheelchair is moved sequentially into position on the platform and sensor data collected.)

The resulting stability mapping is presented to the wheelchair prescriber on a Wi-Fi connected tablet computer to inform their tuning of the wheelchair. The data collected can also be used to predictively model the effect on stability of alterations to the wheelchair, for example adjustment of the wheel, castor, or seat position, or the additional of assistive technology. A visual image is presented that can be used to help educate the client on the limits of stability of their chair.

NHS
National Institute for
Health Research

Birmingham Community Healthcare **NHS**
NHS Trust

King's College Hospital **NHS**
NHS Foundation Trust

 **NHS**
WALES
GIG
CYMRU | Bwrdd Iechyd Prifysgol
Betsi Cadwaladr
University Health Board


Coventry
University

Figure 13 - The Wheelsense® System



Discussion and Conclusions

The development of Wheelsense® involved a multi-disciplinary design team including product design, software design, clinical expertise, human factors, engineering and mathematical modelling. The development was guided by a user-centred design process. The project was initially informed by interviews with 15 wheelchair prescribers and an online survey completed by 48 participants. The results led to the specification of user and system requirements that guided subsequent development.

Iterative design has ensured that the elements of the system have been effectively integrated and that the system meets the needs of the users and target market. From the initiation of the project, a stakeholder group was formed comprising of wheelchair users, a carer, and representatives from wheelchair services, manufacturers, and commercial providers. The group met every 6 months providing an opportunity for the research team to feed back progress and the stakeholders to inform the design of the system and future commercialisation plans. The active involvement of end-users (wheelchair prescribers, wheelchair users) and stakeholders in the design process has

been achieved through co-design workshops and design reviews of both hardware and software mock-ups and prototypes.

Towards the end of the project a fully functional prototype was tested within the 3 partner NHS Trusts for a 3 month period. The effectiveness and usability was considered through observations of the system in use; semi-structured interviews with engineers and occupational therapists; surveys of patient and carer experience and usability assessments. The results suggested that the system is regarded as a useful clinical tool and easy to use aside from some minor recommendations for improvement. The prescription process using Wheelsense® is efficient and the displayed results are useful for client and carer education. The positive evaluation results are a testament to the user-centred design process and effective interdisciplinary team working employed during this project.





THE GLASGOW
SCHOOL OF ART

VisionOn Case Study

Vis-invis and VisionOn form two consecutive projects. Vis-invis engaged in research leading to the development of dynamic visualisation approaches of use in the prevention and control of healthcare associated infections (HAIs). A set of three concept prototype visualisations was produced and evaluated, and were seen as ready for further development and application. VisionOn takes this initial work forward through a knowledge exchange project by developing a tablet-based training tool for healthcare staff using digital visualisations of data on pathogens: how they behave in the ward context and how to prevent their spread. Co-design methods are used to develop and evaluate the visualisations, developed from quantitative data on pathogens, through inputs from key hospital staff stakeholder groups – from two NHS Scotland regions doctors, nurses and cleaning staff, with support from GAMA Healthcare Ltd.

Context

The Vis-invis and VisionOn projects address an important environmental and social health issue, namely

Healthcare Associated Infections (HAIs) caused by pathogens such as MRSA, Norovirus, and Clostridium difficile which present a substantial global problem. In addition to the distress and potentially fatal consequences for patients who are infected, HAIs are costly – the cost to acute services in NHS Scotland was estimated in the 2007 national prevalence survey at £183 million. The 2014 World Health Organisation global surveillance report on antimicrobial resistance showed that “a post-antibiotic era – in which common infections and minor injuries can kill – far from being an apocalyptic fantasy, is instead a very real possibility for the 21st Century”. The prevention of the spread of HAIs in the first instance is therefore of crucial importance as the significant risk is that the pathogenic microorganisms, which cause these infections, can make designated healing places become harmful spaces.

Project details

The aim of Vis-invis was to engage in research that would lead to the development of dynamic visualisation approaches of value in the prevention and control of HAIs. A phased approach was used which involved: initial workshops with small groups of NHS staff and patient focused public representatives; developing prototype visualisations based on emergent and existing data; further workshops evaluating a suite of concept prototype visualisation options; refinement of visualisations / scoping of potential applications; and a structured feedback / next steps national seminar with key stakeholders at the project's end.

Vis-invis resulted in three concept prototype visualisations, centred on: 1) the idea of ‘place’ (i.e. the ward setting) and the spread of pathogens through touch; 2) the idea of ‘people’s perception of risk’, differentiating the highest risk areas of the ward for spread of infections; and 3) the idea of ‘pathogens in context’, exploring visualisations based on participant’s descriptions of the appearance and location of pathogens in the ward context. The following key deliverables and outcomes were achieved:

- A profile of ways of seeing pathogens in medical and surgical ward contexts. The data gathered during Workshop 1 achieved this. Workshop 2’s evaluation of the resultant prototype visualisations also illuminated staff perceptions in this regard.
- A profile of related clinical issues that may benefit from dynamic visualisation approaches. During the process of eliciting role, perceived risk, and conceptions of pathogens, and during evaluation of the prototypes, many clinical contexts and practice issues related to HAI were identified that could benefit from these applications.
- The development, evaluation and refinement of a suite of visualisation options. This was achieved in a way that involved research and knowledge exchange with a range of healthcare workers and some lay representatives. The resultant evaluated prototypes were seen as ready for further

development and application.

- A functioning knowledge exchange network for visualisations in healthcare. Throughout the project the team maintained professional engagement with a wide group of professionals (HAI Leads, healthcare professionals) and personal engagement with a smaller group of healthcare workers (nurses, healthcare assistants, estates, domestics).
- Further details can be found at <http://www.visinvis.org/>

VisionOn extends the Vis-invis achievements by developing a tablet-based training tool for healthcare staff using digital visualisations, exploring three themes supported by original quantitative data from research studies involving the microbiologist on the research team: transmission of infection and hand hygiene; the effect of cleaning on pathogen growth; and pathogen location and survival properties. The 12-month project is designed to elicit the experience of doctors, and nursing and cleaning staff, through a co-design process using visualisations, mock-ups and prototyping.

Discussion

Quantitative data from academic research studies on the microscopic pathogens responsible for HAIs are not commonly used in staff training information due to the difficulties in

communicating the findings in a meaningful way which relates to practice. In VisionOn, by presenting the data in a format appropriate for end-users, in relation to the context in which they are to be used, the possibilities for their application in training are being investigated.

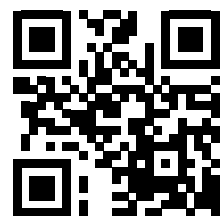
Currently available training materials for healthcare and cleaning staff largely focus on the procedural requirements of specific job roles, e.g., procedures to minimise the transmission of infection, hand hygiene protocols, guidelines on the use of personal protective equipment, and maintenance of a clean environment and clean equipment. The 'making visible' of data about (normally invisible) pathogens, through the use of visuals, mock-ups and digital prototypes as prompts during the iterative co-design process, provides a new and complementary approach to generating training information for the important issue of HAIs.

Conclusion

VisionOn brings a participatory co-design approach, involving key stakeholders, to inform the development of innovative visual training materials communicating important data on pathogens in an accessible manner for use in staff training for the first time.



visinvis: pathogen goggles On Perception of nurse



Vis-Invis (2015). [online]. Last accessed 19th June 2015 at: <http://www.visinvis.org>



Resus:Station Case Study

This case study details the redesign of a resuscitation trolley for in-hospital cardiac arrests by a multidisciplinary team involving industrial designers, clinicians and clinical psychologists.

The complex system of resuscitation and the demands placed by a resuscitation team on the trolley were investigated through interviews and workshops with experienced users and continued input from the clinical side of the collaborative team. Using a modified 'Failure Mode and Effects Analysis' tool, the resuscitation process was mapped, the problems identified and design opportunities developed.

Using co-design methods and critical clinical refinement of a breadth of ideas, a first stage prototype was produced. Subsequent rigorous testing in a simulated environment provided a large amount of user feedback. This led to further improvements in the design, and five second stage prototypes were produced for a more formal hospital trial, the results of which are published in clinical journals.

Background

This project was initiated by the initial research partner, the National Patient Safety Agency (NPSA) after figures showing that poorly stocked resuscitation (or 'crash') trolleys led directly to patient safety errors.

Crash trolleys are used to store all commonly used equipment for resuscitation attempts. They are wheeled to the scene of a cardiac arrest, and members of the team performing the resuscitation attempt access their equipment from the trolley.

Closed cardiac chest compressions were first described ten years after the first crash trolley. While the arrest protocol has evolved and technology such as the defibrillator has progressed immeasurably, the crash trolley has stagnated since their introduction to the hospital ward in the 1940s.

The brief was to research the resuscitation process and restocking procedure, and to design, construct and test a prototype that improved both the resuscitation and restocking processes. A multidisciplinary team of designers, clinicians and psychologists was assembled to tackle this brief.

The Project

The resuscitation procedure was initially researched through an extensive literature search, which was expanded upon through input from practising resuscitation personnel. The clinicians in the collaborative team were important at this stage, as relevant knowledgeable input was being given from people who fully understood the intent of the project and eventual design work. An Advanced Life Support (ALS) course was attended and documented through video to observe how clinicians learn resuscitation, and videos of actual arrests were also observed. Animations of resuscitations were produced from close observation of real life arrests.

Following the initial research it became clear that a tool was needed to focus design attention on specific areas. A hybrid form of task analysis and a more detailed Failure Mode and Effect Analysis (FMEA) proved to be useful. The tool involved breaking down the resuscitation process into



Figure 14 - Completed phase I prototype

smaller discrete tasks, each of which has potential errors, causes and effects. This focused input from the clinical side of the team to ensure the task list and errors were comprehensive, and helped to map the process as a cycle rather than a linear progression.

Each of the errors outlined using this tool provided a trigger for design work and concept generation. The clinicians were then involved in creative techniques to provide further design prompts.

The resulting breadth of initial concepts underwent successive revisions through an iterative critical process. The preferred design and features were detailed and made into a full size, fully functioning prototype (Figure 14) which was tested in numerous simulated resuscitation scenarios in different hospitals.

This design has an open layout to make access easier and identification of equipment clearer, as well as facilitating the restocking process. The trolley splits into three sub-sections, allowing the team to clearly identify individual roles, and configure the equipment around the patient as necessary.

Following the simulation testing of the phase one prototype, the project benefited from a Medical Futures Innovation Award, and a Wellcome Technology Transfer grant to fund further testing and development. A manufacturer partnered this further development, and design modifications were made (improved layout, materials and splitting mechanism) before five phase two prototypes (Figure 15) were produced for further trials. A number of simulation scenarios were run, and the trolleys were also used in real life cardiac arrests, with positive user feedback. The results were published in peer reviewed clinical journals.

Discussion & Conclusion

The main challenges of the project lay in gathering a consensus of opinion from such a broad user base. In addition to the collaborative clinical team members, Resuscitation Officers at other hospitals were also consulted (through bodies such as the Council for Professionals as Resuscitation Officers), and through attending and presenting at the International Congress of the European Resuscitation Council (see resources). Technological and manufacturing constraints were

identified from various trade technology shows, and from the manufacturing partner.

Finding a design to satisfy all of these needs is difficult but not impossible when the correct expertise is sought at each relevant stage. This process has been done iteratively to refine the ideas, and to ensure that the design remains relevant to the initial brief.



Figure 15 - Phase II prototype

The testing, increasing in its rigour, has done much to persuade the clinical team and colleagues about the benefits of the inclusive design process. Simulation and real life testing performed in isolation from any of the design team and collaborative clinicians meant that the feedback was free from bias.

In parallel with the more extensive trials, the project progressed through the commercialisation process, which included a competitor analysis, IP protection and the negotiation of a licensing agreement with a commercial partner. Many additional skills were called into play. An assessment of the size of the UK market for resuscitation trolleys was reliant upon company data, and was best performed by the manufacturing partner.

Next Steps

Despite being optimistic about sales, the market has since shown itself to be small for the R&D investment. The positive feedback from the front line, and the positive dissemination via the clinical journal papers, has led to a steady demand for the new design, though not enough for the UK manufacturers to continue manufacture. The project has attracted international interest, and the development team are pursuing active manufacturing interest in other countries.

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Resus-station (2007). [online]. Last accessed 19th June 2015 at: <http://www.rca.ac.uk/research-innovation/helen-hamlyn-centre/research-projects/2007-projects/resus-station/>



O travellers from
somewhere else to here,
Rising from Sheffield Station
and Sheaf Square
To wander through the
labyrinths of air,

Pause now, and let
the sight of this sheer cliff
Become a priming-place
which lifts you off
To speculate
What if..?
What if..?
What if..?

Cloud-shadows drag
their hands across
the white;
Rain prints the sudden
darkness of its weight;
Sun falls and leaves the
bleaching evidence of light.

Your thoughts are like
this too: as fixed as words
Set down to decorate
a blank façade
And yet, as words are too,
all soon transferred

To greet and understand
what lies ahead –
The city where your
dreaming is re-paid,
The lives which wait
Unseen a

WHAT IF?
Andrew Motion
Off The Shelf 2011

Sheffield
Hallam
University

Head Up Case Study

The Head-Up project produced an innovative head support to help improve posture, relieve pain and aid communication for people with motor neurone disease. The case study illustrates collaborative, interdisciplinary research and new product development underpinned by participatory design processes.

The study was initiated by a two-day stakeholder workshop followed by early proof-of-concept modelling, market analysis and patient need evidence building. The work subsequently led to a successful NIHR i4i application funding a 24-month iterative design process, patenting, CE marking and clinical evaluation by end users.

The evaluation has informed minor amendments to the proposed design we refer to here as the Sheffield Support Snood (SSS). The outcome positively demonstrates use and performance improvements over current neck orthosis provision and, we argue, the process of multidisciplinary and user engagement created a sense of ownership by MND participants, who have since acted as advocates for the product.

Background

Motor Neurone Disease (MND) is a rapidly progressive neurodegenerative disease with a relentless progression, a profile of complex disabilities and fatal consequences, to which there is currently no cure. It predominantly affects the motor neurones, the cells that control muscle activity including speaking, walking, breathing, swallowing and general movement of the body. As the disease is incurable, the efforts to support patients are heavily focused on sustaining a maximum quality of life.

The adult human head weighs approximately 5kg and is supported by a complex system of relatively small muscle groups that co-ordinate to support and control head movements. In very simplistic terms, the weight of the head is supported by muscles fibres that tie into back of the base of the skull at one end and attach to the back and sides of the lower neck. For people with MND, as these muscles begin to waste away, the head droops or flops, usually forwards and/or sideways in ways that can vary greatly depending on the individual.

‘Head drop’ exacerbates problems with swallowing, breathing, eating, communication and drinking. Ideally a neck collar should help alleviate these problems. However, during workshops conducted with MND patients and carers in the pre-proposal stages of this project, participants confirmed that currently available collars are of limited use for people with MND and are often rejected.

The participants in early workshops clearly expressed the unmet need as: “a neck and head support system for MND patients, and potentially those with other neck weakness conditions that provide sufficient support whilst allowing freedom for head movements, is comfortable to wear and is non-stigmatising in its cosmetic appearance”.

The Project

Devices 4 Dignity (D4D) and Knowledge Transfer - Extending Quality of Life of older and disabled people (KT-EQUAL) organised an innovation workshop, hosted by Lab4Living (a Design and Health collaboration initiative) at Sheffield Hallam University (SHU). This brought together people living with MND, teams of designers, engineers, MND clinicians and researchers, and people living with MND to explore unmet patient needs, validated by the user perspectives.

The event resulted in a range of early concepts in response, and followed by a health economics analysis articulating the current ‘cost’ in terms of quality of life and the potential gains from a product that met the user needs outlined above.

The project took 28 months. It had management and commercialisation work-packages running concurrently throughout the duration. The research and three dimensional design development followed a 12-month iterative and participatory design process involving repeated cycles of prototyping supported by experiential design components, a comfort assessment of existing collar designs and engineering virtual simulations.

In the background to these workshops, throughout the process, the design team was also producing a series of tools to assist them in the technical specification of the neck support. One such example of this is the development of ‘Edwood’.

Edwood was a life-size wooden mannequin designed to simulate the human head, neck and torso. Its head could be filled with a variety of weights to bring it up to average human head weight, of between 0 to 6 kg. Edwood's neck had been made out of a column of flexible polymer, simulating the top of the spine, and was the only connection between the head and the torso. Edwood's structure was such that it could not independently support the weight of its head, to the extent that the head would drop forward and to the side to contact the torso; either ear to shoulder or chin to chest.

Following this design process, the final output was patented, CE marked and subjected to a clinical evaluation with a sample population of 20 participants drawn from a population of people living with MND, different from those who had participated in the design process.

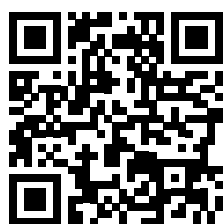
Discussion & Conclusion

The benefits of this participatory process included the emancipation of the patient users. A comment by the clinical lead, a specialist Neurologist but with only limited knowledge of new product development or participatory design process, clearly articulated this. His perception was that he hadn't realized how involved the patients and other project members would be in the design phase. He also commented on how it could have been possible to simply pay lip service to the suggestions from the patient and clinical users and pursue one's own design agenda. However, responsive action was the strongest possible affirmation that someone was being listened to. Prototypes being made that responded to suggestions from the patient users,

clearly demonstrated that this was more than lip service and he said that, when some sacrificial concept prototypes were tabled in a workshop and the patients could see how they connected to comments they had made, there was immediately a much stronger sense of engagement.

The challenges posed by such an extensive piece of Participatory Design were not insignificant – the use of domain-specific language by the different professionals presented a significant initial barrier to the collaborative design process. Other challenges included negotiating Intellectual Property rights; negotiating the sheer volume of work involved in developing a project from inception through to commercial viability within a single research-funding programme; time constraints arising from a participatory approach rather than a 'traditional' design / product development process; and finally the sheer complexity in commercialising a product concept.

The process can be described as an exemplar of a user involved design and innovation process with genuine user participation in the design. This has helped ensure that the novel head and neck support meets the needs of many of the target user group as well as functional requirements identified at project outset and those that emerged during the course of the enquiry. In the context of medical device development, there were direct benefits to participation, in particular, in regard to developing deep, qualitative understandings of the context of use, that enabled the team to mitigate. Although the neck support has only been evaluated by a relatively small sample, the results indicate a very positive response that validates the innovation model applied in this project, the user and clinician involvement and the design output.



Head-Up (2015). [online]. Last accessed 19th June 2015 at: <http://www.lab4living.org.uk/head-up>



Conclusions

Reflecting on the combined results from the Library Database, Expert network and Grey Literature reviews demonstrates the breadth of contexts and outputs where design and creative practice have demonstrated impact. Through the richness delivered by the case studies it can be seen how the methods and approaches of design can engage with the diverse stakeholders to deliver the innovative outcomes that health and social care needs to respond to the challenges that face society today and ongoing.

There is evidence of a significant and growing expertise within the design community around methods and techniques that engage with the traditionally difficult to reach - and work with groups that rely on and respond to participatory methods that are more democratic and not reliant on traditional forms of research. Using creative methods to engage people potentially allows the flattening of hierarchies that abound in the bureaucratic world of health and social care providing a voice to often marginalised stakeholders.

The conduct of this review has highlighted challenges for this emergent field of enquiry. The ubiquitous nature of the word 'design' makes it difficult to conduct literature reviews and designers' own propensity for 'journalistic' titles and abstracts makes identifying projects difficult. There are also different professional norms for dissemination, with the health paradigm concentrating efforts in the realm of peer reviewed publications, against a far more engaging and varied approach to exhibition, performance and making employed

by designers and creative practitioners. As a community we need to be more savvy in how we identify and reference our work to increase its visibility. This might be through collaboration or through actively curating our outputs.

Design in health might be establishing itself and becoming more visible just at the right time. Increasingly the challenge of getting research evidence into practice is engaging the collective consciousness of leading health service researchers. Knowledge mobilisation, transfer, utilisation is looking to different models that are quick to diverge from traditional linear ideas around how people use research. Co-production is being lauded as a means to creating meaningful knowledge, and design and creative practice have experience and expertise to deliver this.

The NHS Five Year Forward View (NHS England 2014) - referenced below - is a key document that seeks to describe both the need for and route to change that is required for the United Kingdom NHS. It describes the need for a new relationship with patients and communities and discourse about empowerment and engagement which have long been the preserve of design and creative practice. We should be very well positioned to respond to this challenge and this report may contribute to highlighting the breadth and depth of work being undertaken and provides a strong platform on which to build and influence health and social care and ultimately deliver better healthcare to the citizens of the UK and beyond.

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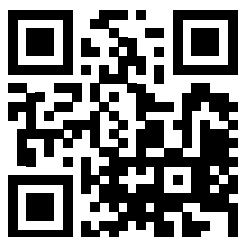
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Executive Summary

This report describes an investigation funded by the Arts and Humanities Research Council (AHRC) to establish greater understanding of the extent of Design theory and practice within the context of Health. Led by researchers from Lab4Living, based within the Art & Design Research Centre at Sheffield Hallam University, researchers from Coventry University, Glasgow School of Art and the Helen Hamlyn Centre at Royal College of Art, formed an Expert Network that bring together a critical mass of excellence in Design research for healthcare. An expert advisory group was appointed to provide an additional reference point for the network. The report presents background and rationale for the research, outlines the activities undertaken by the Expert Network, and describes the research methods adopted. The findings from the research are described and presented visually and exemplar case studies from each of the network partners articulate the valuable contribution of design in healthcare. The report draws some conclusions on the potential implications from the findings.



The state of the art of design theory and practice in health : an expert-led review of the extent of the art and design theory and practice in health and social care

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