Design Research for Change

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Foreword

The breadth of topics covered at this Symposium is proof, if proof were needed, of the enormous value of design research. In areas that range from the future of urban living to justice systems and neuroscience, design research is providing the frameworks and methodologies to answer questions which span disciplinary and conceptual boundaries; in an era of ever greater interdisciplinarity, design research is, once again, ahead of the curve. It is for this reason that the Arts and Humanities Research Council is delighted to support UK and international Design research, whether through the Priority Area Leadership Fellowship, to which we have just awarded follow-on funding, or through our open call research portfolios, or through other channels. Design has long been a discipline on which we collaborate with our sibling councils at UKRI, and it features strongly among the Knowledge Transfer Partnerships we sponsor.

What we mean by "design" and "design research" is ever-changing, however, and it is right that the AHRC, and UKRI at large, keeps a close eye on those changes and responds to them in a way that allows the very best of innovative and transformative research to flourish. The impacts of that research – academic, economic and social – are enormously significant not only in and of themselves, but also in demonstrating the value of the field, and therefore the importance of the robust and ongoing public funding it richly deserves.

Professor Edward Harcourt
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Introduction

A quick search of the word "design" on Google today (22 October 2019) returns over 25,000,000,000 results. These results include design organisations, design degrees, design news, ideas about design, design jobs, design media, and links to a variety of design tools and processes. Similarly, today there are many different designers working across different disciplines, with different attitudes, different goals, different agendas, different ways of working, different ways of doing research, producing different outputs that embody different values, engagement, and impact. Perhaps, however, the connection between all of these diverse design activities is the iterative development of products, services, systems, experiences, spaces, and other designed stuff in order to improve the human experience. In other words, using the power of human creativity to improve humanity.

Today, with its application across a wide range of different disciplines and fields, design is being used to help address significant, complex, and global issues ranging from antimicrobial resistance to mobility, from healthy ageing to migration, and the development of more sustainable materials and processes to creating policy and governance at local, regional and national levels. And with its inherent agility and applicability, design helps shape the scientific and technological advances which are transforming the world around us.

In recent years, design research has witnessed a clear "social turn" where researchers have looked to make change in more socially-focused contexts as opposed to wholly commercial realms. This "social turn" has encompassed a range of activities and interventions that constitute a more "socially-driven" form of design, which suggests that researchers and practitioners from non-design disciplines are working in close collaboration with design researchers with the ambition to realise change in social, cultural, economic, and environmental situations.

The twenty papers in this Design Research for Change (DR4C) book examine this "social turn" in design in detail and explore how contemporary forms of design research are increasingly involved in a range of social, cultural, economic, environmental and political action. The research included in this book highlights a variety of significant roles that design researchers play in some of the most challenging issues we face, both in the UK and globally.

Narvekar *et al's* paper "*Creative Interventions in the Juvenile Justice System of India: A Systemic Inquiry*" illustrates how design and gamification can be used to enact change in the juvenile justice system in India. Borin and Galluzzo in their paper, "*Over the Emptiness: Interpretations and Expression of the Term in the Spaces of Disused Cinemas in Milan*", analyse and investigate new possible forms and uses for empty cinema spaces in Milan.

Light's paper, "*Redesigning Design for Culture Change: Theory in the Anthropocene*", argues that design research needs to learn from cultural theory that positions culture as evolving and performative to ensure that design, which is low on theory of transformation, can be (re)designed to enact real culture change. In an educational context, Kerres and Getto's paper "Design Research for Educational Change: Methodologies for Exploring the Future of Learning" describes the development of a meta-project, based on a network of several university and national institutes, devoted to the development of a methodology of design-based research with a focus on change projects, design-based approaches and the analyses of success factors for change.

In "*Metaphors and Imaginaries in Design Research for Change*", Lockton *et al* discuss how design methods (metaphors, mental imagery, and other forms of imaginaries) can be used more effectively to influence how people act and make sense of the world and deal with large-scale challenges in health, environment, politics, and social contexts. Palomino and Defeo's paper "*Material Design Innovation: Fish Leather, a New Environmentally-Friendly Material*" reports on a collaborative project between the Icelandic tannery Atlantic Leather and the Italian analytical laboratory Ars Tinctoria connecting fashion designers, scientists and leather technicians from the UK, Italy, and Iceland to advance material innovation by using new technology (water-based ink digital printing methods) on fish leather as an alternative to conventional leather to encourage more sustainable fashion practices.

"*The Ripple Effects of Social Design - A Model to support New Cultures of Evaluation in Design Research*" by Eva Knutz and Thomas Markussen articulates a need for developing an evaluation culture that is primarily concerned with design outcomes. They use a social design case (a game-based intervention designed for family visits in maximum-security prisons) to identify ripple effects leading to three types of value - social value, demand value, and research value. Hackney et al present their work entitled "*Designing a Sensibility for Sustainable Clothing (S4S):*

Affective Activism" that combines arts with social science research methods to investigate how creative activities might shape a sensibility for sustainable clothing and promote pro-environmental behaviour change through making fibre, using waste fabric and modifying clothes.

Scott *et al's* paper "*Why Knitting Now? Textile Design Research as a Driver for Educational Change*" reports on work in collaboration with the Crafts Council (UK) and sixteen schools across Yorkshire that has used knitting as a tool for designing and making across a variety of scales to reposition textiles as a vehicle to respond to global challenges such as the environmental problems of textile colouration. Katharina Vones and Ian Lambert's paper "*Material Reality to Materiality: Ocean Plastic and Design Research*" brings together material exploration and designer-maker education methods to bear on a major environmental issue with huge public interest through a critically and scientifically engaged process, rooted in places and communities affected by complex and significant environmental issues.

In "S*trange Encounters: A Series of Posters Investigating the Hybrid Embodiment of Indo-Canadian Identity*", Krishna Balakrishnan's paper acknowledges the many forms of otherness that exist from differences in subjectivity, gender, race, class, temporal and spatial geographic location and dislocation to produce a series of visual artefacts that discuss hybrid embodiments of Indo-Canadian identity. Salisbury et al present ongoing research that explores how design, in the form of smart textiles, can aid upper limb rehabilitation and consider further the person's extended emotional needs through the considered implications of use of types of tools and approaches within the highly diverse lifestyles of individuals who have suffered a stroke in their paper entitled "*Wearing Your Recovery: 3.0*".

"T*he Fair Energy Mark in the Making: Framing a Citizen-led Campaign by Participatory Design*" by Laura Santamaria presents a design intervention that explored citizen empowerment in the context of the Fair Energy Mark campaign - a citizen-led action aimed to raise practice standards and address power imbalances in the energy supply sector. By integrating design and communicative action theories with participatory design and community organising methodologies the work highlights opportunities to amplify the impact of design research for social change. Lise Amy Hansen's paper "*So, What Do You Do? The Role of Design Research for Innovation towards Work-life Inclusion*" reports on the roles design research has played in a large innovation project in Norway – InnArbeid - where technology and services are developed for social change. In particular, the roles that design research has played in teasing out novel areas of opportunity for creating and in particular co-creating technology-supported services that support work-life inclusion of young people with developmental, intellectual disabilities (ID).

Ivanova and Flory in their paper entitled "*Design meets Neuroscience: Future Directions for Developing and Implementing Design Probes*" outline recent advances in neuro-technologies, and the pivotal role user experience design might play across a wide range of analogue and digital applications at individual, community, and global level ranging from learning and education interventions to innovation of large-scale healthcare options. Nneka Sobers' paper "*Intervention without Imperialism: An Equitable Approach to Design Research*" examines a hybridized and anti-exploitative design research methodology that is unpacked through a case study of a community in Accra, Ghana. Emphasising equity, self-determination, deep dialogue, and context-sensitivity, the design research presented in the paper resulted in the co-creation of a grassroots waste management system that illustrates notions of the role and mechanics of dismantling systems of oppression as a socially-conscious designer.

Endrejat et al's paper "*Advancing Sustainability at Universities through Design Thinking Education*", presents a case study describing how a team of students addressed the problem of disposable cups usage within a university (TU Braunschweig) using design thinking methods to reduce the usage of single-use cups. Rachel Kelly's paper "*The Voices of the Cordillera: Digitising an Oral Tradition*" describes a collaborative project between the Philippines-based CordiTex project and Manchester School of Art to support the future digitization of indigenous weaving traditions within the Cordillera region of the Northern Philippines. The paper includes the development of a Learning Framework and Toolkit to support the preservation of an oral-based weaving tradition and to develop interventions for creative practice and knowledge-based change. The paper highlights the voice of oral craft traditions and describes the relationships between different voices which can be heard within authored works such as hand-woven textiles.

In "*Tweaking Retirement-Living: Introducing Design Thinking & Coffee Bars to Shared Lounges*", Sam Clark describes research that aims to explore what the homes of older people could look like in the future. This research has been undertaken at a time when there exists a major societal challenge of housing a 'super-aged' UK population, and the particular needs and aspirations of active third-agers. Clark's research advances 'designerly' modes of inquiry, resulting in design-relevant feedback for those involved in the production of retirement-living environments and how housing providers can use this information to develop more appealing options. Simone Gumtau's paper "*The Future of Seafaring: What Can Design Add? Designing an On-board User-interface to Predict Engine faults on Marine Vessels, Lowering Fuel Costs and Emissions*" describes a collaborative project between a communication designer, data scientists, and engineers at the University of Portsmouth working with a consortium of companies in the marine industry around the Solent in the South East of England. The aims of the project is to add economic and environmental value to marine engineering services in order to retain market competitiveness,

to comply with international standards to reduce fuel consumption and emission through innovation, and also to provide a better user experience through design.

This rich set of papers are the end result of a lengthy process that began with an amazing response to the call-for-papers for the Design Research for Change (DR4C) symposium held at the Design Museum, London on Wednesday 11 and Thursday 12 December 2019. We received 62 papers from researchers based in countries all over the world including Australia, USA, India, China, Sweden, Germany, Italy, Norway, Denmark, Israel, Greece, Turkey and the UK. After a thorough review process, twenty papers were accepted for this book and presentation in a single-track session over the course of the two days at the Design Museum, London.

The Design Research for Change (DR4C) symposium and subsequent book are both much-needed, timely, and significant. The papers in this book address one or more broad and challenging themes highlighted in the original call-for-papers. We were interested to hear and see how design researchers working with others are making and contributing to change in areas such as energy and the environment, education, public services, health and social care. The call-for-papers was intended to be inclusive (not exhaustive) and contributions were encouraged that challenged these themes and others.

We invited authors to submit high-quality, previously unpublished, original contributions that explored one or more of the DR4C symposium themes. We asked authors to consider critically a number of questions including:

What they (as design researchers) are changing and why?
What difference(s) their design research is making?
Who decides what to change?
Who decides/evaluates if this change is "positive" or "good" or "enough"?

What impact has your change delivered and at what cost?
Also, we asked authors to consider how their design research addresses one or more of the following questions:

What have you tried to change through your design research?
Who has activated the change and who has been affected by that change?
What evidence do you have for the change that you claim?
When has your design research brought about positive change and when has it been detrimental?

Further, more broadly and looking to the future we asked authors to consider the following:

What should design research change now?
Can design research really change anything?
What will you do to make change?

In what ways do you envision the impact of such change to be evaluated?

Given the reach and interdisciplinary nature of many forms of contemporary design research it is anticipated that the rich mix of papers in this book that cross disciplinary, methodological, geographical and conceptual boundaries highlights the wide-ranging social, cultural and economic impact of emerging forms of design research. This book will be of interest to practitioners and researchers in a wide range of disciplines. This will not only include design researchers, design practitioners, and design academics but the book will be of significant interest to researchers and practitioners in other areas including (but not limited to) education, healthcare, government, biotechnology, engineering, management, computing, and business.

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Strange encounters: A series of posters investigating the hybrid embodiment of Indo-Canadian identity

Krishna Balakrishnan

Snow White and Sri Durga, digital collage, 44 x 62 in, February 2015.

Abstract

Acknowledging the many forms of "otherness" that emerge from differences in subjectivity, gender, race, class, temporal and spatial geographic location and dislocation has become greater interest in current time. This has also become a topic of interest among graphic designers as they explore design's relationship with culture. This thesis explores the use of graphic design to produce visual artefacts that discuss hybrid embodiment of Indo-Canadian identity. Cultural identities are represented as competing against one another, which results in recognizing one another as strangers. Multiculturalism and the migrant perspective are always constructed by proximity between strangers. Using hybridity, Homi Bhabha's (1994) concept of a "third space" identifies a metaphor for the space in which cultures meet. Where communication, negotiation, and translation bridge societies, a new space emerges. This thesis employs the interventions of "the third space" to negotiate a meeting space with strangers. The project prepared during this thesis (2015), The Avatars, digital montage of Hindu Gods, Goddesses, comic-book superheroes, Disney princesses, and hybrid prints produced at Belgium's Frans Masereel Centrum (2016), represents an alternative way of seeing migrant perceptions of displacement, temporality and belonging.

Introduction

"Strange Encounters," examines the relationship between graphic design and proximity between strangers. The concept of "strange encounters" denotes the relationship between strangers, embodiment and community (Ahmed, 2000). The purpose of this thesis is to explore graphic design in order to produce visual artefacts that discuss hybrid embodiment of Indo-Canadian identity (Navar, 2004). By articulating and enunciating cultural hybridity, this project aims to comprehend the rhetoric of the evolving cultural identities of multiculturalism and migrant experiences.

The politics of cultural identity is constantly debated, and cultural identification is a factor of representation. In his article "In and Around: Culture of Design and Design of Cultures Part I," Andrew Blauvelt cites French psychoanalyst Jacques Lacan who states that images and symbols for representational identification cannot be isolated from images and symbols of the represented identity (Blauvelt, 1994). The ways in which culture is represented conditions how it is perceived. This dilemma of cultural displacement is a result of contestation that happens between the predefined cultural identity and that of the new environment.

This work is an opportunity to engage critically with complex ideas of identity through the practice of graphic design. If cultural identity is a form of representation, how can graphic design contemplate its role in contributing to cultural identity? How can one recognize the importance of cultural motifs, patterns, images and icons of a particular

Winnie the Pooh and Lord Ganesha, digital collage, 44 x 62 in, February 2015.

culture within a multicultural society? In today's multicultural society, different heritages are adapted and borrowed. Indian images—of Hindu gods, patterns and Devanagari fonts—have been appropriated in western countries. Transferring visual vernaculars such as artifacts, styles and traditions across cultures requires adaptation to the new environment. How can a graphic designer translate cultural vernacular across many cultures as a way to negotiate representation of a meeting space between strangers?

Design's global engagement continues to focus largely on facilitating the flow of images and consumer goods across continents, without consideration of larger political and social effects. By communicating with different cultures and subcultures, designers and corporations expand their audience base by marketing messages to a specific regional or ethnic groups. How can graphic design contribute to different ethnic cultures in multiculturalism without being used solely for corporate exploitation? This thesis examines how design, as a medium, attempts to establish relationships with individuals with whom it seeks to collaborate—populations that are culturally others or strangers.

The posters series, The Avatars, created by Krishna Balakrishnan are a digital montage of Hindu gods and goddesses, comic-book superheroes and Disney princesses. They are metaphoric representations analogous to the embodiment of Indian-Canadian (Indo-Canadian) identity. The designer attempts to discuss complex ideas of migrant identity, difficulties in translating vernaculars—images and symbols across cultures, and negotiate the representation of a meeting space between strangers. All of these questions highlight postmodernism's concern for difference, difficulties in communication, and complexities and nuances of interests, cultures, and place.

The Concept of Hybridity: Proximity of Strangers

The concept of hybridity has been applied to biology, ethnicity, and culture. Hybrid denotes a fusion, a blending of two entities to produce a new original. In biology, the concept denotes an offspring of two animals or plants of different races, breeds, varieties, species, or genera. The extension of hybrid's definition for use in the social field can be "a person produced by blending of two diverse cultures or traditions." Canadian immigrants, or children born to immigrant parents may represent these hybrid selves. The mixing of peoples of different origins is as old as the history of humanity, but the term acquired recent relevance in connection to the imperialism and contemporary globalization. As theorist Jan Nederveen Pietrese says "… it is not mixing that is new but the scope and speed of mixing." (Pietrese, 2009).

Cultural hybridity stems from the notion that we must think of cultural identities as based on difference. Being different does not necessarily entail that one is better or superior to the other. Discriminatory and celebratory reactions to difference result from diverse conceptions of

Snow White and Sri Durga, digital collage, 44 x 62 in, February 2015.

identity (Brah, 1996). The sense of difference challenges notions of fixed binaries, which stabilizes meaning and representation, and shows how meaning is never finished (Hall, 1990). Without relations of difference, no representation could occur. The essentialist position of identity and culture attempts to preserve a homogeneous essence. A non-essentialist attitude is, however, a conception of culture as a continued process and as a heterogeneous combination of discursive practices. An essentialist concept of culture leads to the creation of social, cultural and racial barriers, while the non-essentialist concept allows for blending and crossings. If cultures have stable, discrete identities, then the division between cultures can always become agonistic. Such barriers are arbitrary ideological formations: metaphors, discursively constructed. Avtar Brah defines such borders as:

> *Arbitrary dividing lines, that are simultaneously social, cultural and psychic; territories to be patrolled against those whom they construct as outsiders, aliens, the Others: forms of demarcation where the very act of prohibition inscribes transgression; zones where fear of the Other is fear of the self: places where claims to ownership—claims to "mine," "yours" and "theirs"—are staked out, contested, defined and fought over. (Brah, 1996: 198)*

Hybridity problematizes boundaries (Bhabha, 1994). The borderline subverts the concept of an essential purity. Hybridity implies "openness, adaptiveness, flexibility, contradiction and irony." (Stoddard and Cornwell, 1996). Hybridity thus relates to postmodernism, which also employs concepts of "difference, repetition, the simulacrum, and hyper-reality" to destabilize other concepts such as "presence, identity, historical progress, epistemic certainty and the univocity of meaning." (Aylesworth, 2013). In The Location of Culture, Homi Bhabha's introduction begins with Heidegger's definition of a boundary: A boundary is not that at which something stops but, as the Greek recognized, the boundary is that from which something begins its presenting (Bhabha, 1994). A boundary stresses the idea that what exists between settled cultural forms or identities—identities like self and other, stranger and friend—is central to the creation of new cultural meaning. It suggests that the proper location of culture is in-between the overly familiar forms of official culture.

Homi Bhabha's 'Third Space': Negotiating the In-between

In most of his works, Bhabha considers the interrelations and interdependence between colonizers and colonized. In "The Other Question," Bhabha proposes the colonial discourse as an apparatus that turns on the recognition and denial of racial/cultural differences (Bhabha, 1994). The objective of colonial discourse, says Bhabha, is to view the colonized as a population of degenerate types on the basis of racial origin, in order to justify conquest and to establish systems of administration and instruction. The social categories exerted on the colonized imprints imaginary conditions that collide with their own,

Captain America and Lord Krishna, digital collage, 44 x 62 in, February 2015.

and displaces the disjunction. This encounter eventually creates a new "hybrid" expression of cultures and of belonging, which in turn challenges the beliefs and experience of the colonizers (Bhabha, 1999).

Whereas one theory would give the colonizer dominant power, Bhabha proposes an alternative context to the interaction between colonized and colonizer. Bhabha argues that colonial and postcolonial cultural systems and statements are constructed in a "liminal space," the "Third Space of Enunciation":

> *The intervention of the Third Space of enunciation, which makes the structure of meaning and reference an ambivalent process, destroys this mirror of representation in which cultural knowledge is customarily revealed as an integrated, open, expanding code. Such an intervention quite properly challenges our sense of the historical identity of culture as a homogenizing unifying force, authenticated by the originally Past, kept alive in the national tradition of the people. (Bhabha, 1994: 54)*

In an interview titled "The Third Space," Bhabha explains that "this third space displaces the histories that constitute it, and sets up new structures of authority, new political initiatives, which are inadequately understood through received wisdom." (Bhabha, 1990). The notion of hybridity concerns the idea that in any particular political struggle, new sites are always opened up. Referring new sites to old principles limits participation of the newness fully, productively, and creatively.

Bhabha strongly urges negotiation, for negotiation is what politics entails. Bhabha further states that we negotiate even when we don't know we are negotiating. We are always negotiating in any situation of political opposition or antagonism. Subversion and transgression are negations. Negotiation is not only a form of compromise or "selling out." All forms of political activity, especially progressive or radical activity, involve reformations and reformulations. In history, these changes are called "revolutions": critical moments of reforms and reformulations. Subversion refers to a process by which the values and principles of a system in place, are contradicted or reversed.

Visualizing Hybrid Forms of Indo-Canadian Culture

The Avatars are a series of hybrid creatures, mongrels, mutations, or combination of strangers, which depict negotiation of their prescribed representation. Their visual representations suggest a sense of transitioning and morphing into singular entities. Though they appear autonomous, they are in fact an amalgamation of what are two or more former entities. What is important in hybridity is not the original moments, but rather amalgam, which emerges from the previous. These avatars are visually recognized as single-bodied creatures yet the visual system of overlapping images suggest translucency when one perceives independent forms in the same place. The use of translucency

The Little Mermaid and Sri Saraswari, digital collage, 44 x 62 in, February 2015.

invites the viewer to read the collaged images; the embodiment of an in-between space. The images' composition and arrangement also aid in recognizing The Avatars as single-bodied creatures. Images of the former characters are purposely selected in similar dynamic posture and gesture, thus enabling them to become recognized as a single entity.
At first glance, the iconic characteristics of The Avatars' former "original" form are identifiable. The representation of Spiderman's webs, his hand gestures as he projects his webs are visible. On the same avatar is a shirtless blue body, adorned with brown beads, and long locks of messy hair that extend below the shoulder. In place of a head, where one expects to see the masked face, with curved and repeated lines that represent a spider web, is a visible blue face. In the areas where the two bodies overlap, translucent fragments of another character are visible. On this avatar's chest and shoulder, one sees the translucent forms of Spiderman's costume. On another avatar, the viewer sees Superman's iconic "S" in the diamond shape on his chest; his red cape, and blue and red costume suggest it is the "man of steel." On top of Superman's costume are pearl necklaces, jewels and green silk fabric wrapped around his waist. He has animalistic features—a long tail with a bell attached at the end, and the facial representation of a monkey. These different features are reflective of Hindu God Hanuman's representation.

On one hand, The Avatars make use of comic-book vernacular and children's cartoon characters from Western pop culture while on the other hand, The Avatars depict Indian Hindu gods and goddesses. These juxtaposing vernaculars from distinct cultural contexts meet in their hybrid embodiment. In this embodiment, the boundaries that contain static identities are dissolved. Attempting to visually read The Avatars forces one to negotiate these juxtaposed identities. The Avatars' construction asks questions of their configuration: Why are they in this mongrel mutated form? What is their relationship to one another? Cultural identities are represented as competing against one another, and as a result the hybrids are recognized as either contesting or harmonious in their embodiment. Bhabha notes that differences in writing or écriture contribute to the difficulty in cultural enunciation of cultural texts, or systems of meaning (Bhabha, 2006). This difficulty has less to do with what anthropologists describe as varying attitudes to symbolic systems within different cultures than with the structure of symbolic representation. The difficulty in reading the content of the symbol or its "social function," is due to the structure of symbolization. Bhabha further states that the difference in language is crucial to the production of meaning, and ensures that meaning is never simply formal, technical, and transparent. The difference of cultural symbolism makes the images' meaning difficult to read if one is not receptive to differences of cultural enunciation.

To understand The Avatars, one needs to forgo traditional representations of being an Indian and a Canadian. The Avatars' bodies are never complete; they are in the process of "becoming" their new embodiment, and "destructing" their former selves. In "Creation of

Spiderman and Lord Shiva, digital collage, 44 x 62 in, February 2015.

the Sacred Image: Apotheosis and Destruction in Hinduism," James J. Preston claims that sacred images in Hinduism are temporal, incomplete, and inadequate as a full expression. The sacred images of Hindu gods are constructed according to systematic rules, and then are infused with sacrality and kept "alive" by highly controlled behaviours intended to retain the "spirit in matter." (Preston, 1985). The process of constructing sacred images, and the process of their destruction, reveals something intriguing about human religion. The destruction of the sacred image is as important as its creation; it is a powerful act of imagination that challenges us to ask why humans must insist that the invisible must be made visible. In Darsan: Seeing the Divine Image in India, Diana L. Eck states that Hinduism is an imaginative, "image-making" religious tradition in which the sacred is seen as present in the visible world—the world we see in multiple images and deities, in sacred places, in people, in every locus of Indian life (Eck, 1998). The behaviour Indians exhibit towards sacred images is brought to their immigrant land and changes accordingly upon interactions with new experiences.

The superheroes are representations of "godlike" presence in American "material" popular culture. Their images are produced in similar quantity as those of the Hindu gods—in product packaging, films, posters and whatever corporations can exploit in their trademark. Though the superheroes of The Avatars can be perceived as American, they have roots in every country, where, around the turn of the twentieth century, the comic industry expanded from publication newspaper and strips to circulation in collections and serials. Canadian culture, so close in proximity to the United States, is heavily influenced by American superheroes. Today, comic studies have been integrated into many university programs of world literature, and represent a form of storytelling art rooted in trans-cultural imaginations. Superheroes and comic books have become synonymous with the experience of westernization.

Flesh of Gods, Flesh of Superheroes: Embodiment of Avatars

The graphic narrative of The Avatars present bodies moving through time and "space" (Ryan, 2012) - gods and superheroes, Indian and Western, sacred and popular, high and low, past and present. Considering how the bodies of The Avatars relate to and interact with each other and the world around them shapes the viewer's perception of time, space and causality. In "Space, Time and Causality in Graphic Narratives: An Embodied Approach," Karin Kukkonen notes that to some extent, the embodied approach inverts the Kantian perspective that time and space structure human experience, and proposes that these concepts arise as a consequence of readers' experience (Kukkonen, 2013). The narrative of The Avatars needs to be examined not as objective. Rather, they need to be examined as properties related to the physical resonance of mixing two former bodies into one self. To a large extent, perception is formed by how we view the space around us. Kukkonen points to Alva Noe's statement that perceiving is an activity of exploring

Superman and Lord Hanuman, digital collage, 44 x 62 in, February 2015.

the image to understand the ways in which composition affects one's sensory relations to things.

Considering the composition of The Avatars' bodies in relation to one another, readers get a sense of how to perceive the story around them. When the "original" images of represented bodies overlap, The Avatars appear to be harmonious with their two former selves. In contrast, some of The Avatars hint at a contested interaction of former "original" images. Though The Avatars are still images, they evoke a sense of movement. Motion seems to be transferred from one body to another because of the movement's spatio-temporal unity, perceiving a causal relationship being established. Spiderman's legs seem to exert forces of balance, and Lord Shiva (even though sitting crossed-legged) appears to respond to the balancing on one foot. This perception, Kukkonen describes, is part of our "body schema," that is, the ways in which our bodies shapes our perceptual field, integrates sensory information about our bodies moving through an environment, and information about our posture and movement. Image schemata, like "balance" relates to our immediate bodily experience of the world. When we see a perpendicular composition in an image, with clear horizontal and vertical lines, it relates to our bodily experience of being perpendicular (due to gravity), and we view the body of The Avatars as "balanced."

The medium of collage is also intrinsic to the depiction of hybridity, and represents an alternative way of seeing the Indo-Canadian identity. The Avatars' incorporate image reproduction of characters that are familiar and different. The gods and superheroes are products of mass printing. One does not need to travel far to encounter Indian gods. Their adoption by global culture has seen Krishna and Kali appear on CD covers, diaries, websites, clothing, and fashion accessories. The superheroes and princess are part of the Hollywood popular material cultures and thus their images are mass reproduced. In this way, the Hindu gods can be seen as popular images that represent India or Indian-ness. The mass consumption and presence of superheroes gives them the power to be seen as gods of Hollywood material culture. Through juxtaposing one element to another, the images make us rethink the significance of all familiar images. The Avatars appear estranged, otherworldly, in-between the possible and the impossible or unlikely, and in a space between real and simulated. By its nature, the collage becomes an interpretation—an expression of opinion. In "Collage Now: The Seamier Side," Laura Hoptman argues that collages' interpretative qualities make them "uniquely suited to the job of bringing the world and its cultural efflorescence into close proximity, with no burden to mimic reality or impart truths." (Hoptman, 2007). The Avatars, in expressing the duality of Indian and Indian-Canadian identity, become a form of strategy, resistance to the world they confront. Difference and similarities of images asks us to imagine them in an alternative way.

Translucency of Bastard-ization 1 – The Little Mermaid and Sri Saraswati, Kasterlee Belgium, Intaglio and Chine-col-le print (Hahnemühle paper + Awagami Paper for Chine-colle), 39cm x 53cm.

Avatars as an alternative way of seeing Indo-Canadian identity

The Avatars have a sense of originality. The meaning of the original work no longer exists in what it says uniquely, but rather in what it is uniquely. An image's meaning changes according to what one sees immediately beside it, or what comes immediately after (Berger, 1972). Images reconstruct meaning against each other's symbolism through comparative analysis. Comparative analysis of symbolism, such as Jungian theory, help explain the symbolic mechanisms by which images work in the mind (Leuthold, 2011). Using comparative analysis of symbolism, The Avatars become an alternative way to view the interaction between Hindu gods, comic-book superheroes, and Disney Princesses as a metaphor of Indo-Canadian identity.

While one recognizes the positive contribution of multiculturalism in producing cultural diversity, theorists and writers such as Stuart Hall, Homi Bhabha, Salman Rushdie, bell hooks, and Sara Ahmed emphasize the importance of cultural differences for notions of hybridity. Multiculturalism is an attempt to both respond to and control the dynamic process of articulating cultural difference, demanding a consensus based on a norm that cultivates cultural diversity. For Bhabha, the liberal relativist perspective of cultural diversity is inadequate, and does not recognize the universality and normative stance from which it constructs cultural and political judgments. Ahmed (2000) describes multiculturalism as the proximity of strangers. The strangers are not simply those already recognized as out of place; rather, in a multicultural nation, strangers have a place. Ahmed argues further that multiculturalism can involve a double and contradictory process of incorporation and expulsion: it may seek to differentiate between strangers whose appearance of difference can be claimed by the nation, and those whose differences may be dangerous to the well-being of even heterogeneous nations. The proximity of strangers requires constant adjustment and transformation. With the notion of cultural difference, Bhabha positions himself within liminality—the in-between, productive space in the construction of culture as difference or otherness. However rational one is, it is very difficult, and even counterproductive to try and fit together different forms of culture, and to pretend they can easily coexist. The Avatars' embodiment creates a sense of uneasiness and contestation: some appear as though they are tearing from one another's opposing strangers—as if they are in forced embodiment.

The Avatars are not about seeing the Western or the Indian selves, but rather seeing a unique in-between space of negotiation—a Third Space. Bhabha notes that this Third Space intervention makes the structure of meaning and reference an ambivalent process; it destroys mirrored representation, and reveals cultural knowledge as continuous, integrated, open, and expanding code. Such intervention challenges our sense of "the historical identity of culture as a homogenizing, unifying force, authenticated by the original Past, and kept alive in the

Transition of Becoming Mongrel 3 – The Little Mermaid and Sri Saraswati, Kasterlee Belgium, Intaglio and Chine-colle print (Hahnemühle paper + Awagami Paper for Chine-colle), 39cm x 53cm.

national tradition of the People." The Avatars' enunciation displaces the narrative of Western's perception, which Bhabha—pointing to Benedict Anderson—so perceptively describes as being written in homogeneous, serial time. The Avatar as a metaphor of Indo-Canadian identity asks one to re-examine their own perception of the migrant stranger.

Through the use of space, time, and causality in The Avatars, the images depict what Lawrence Barsalou calls "situated conceptualization." Kukkonen references psychologist and cognitive scientist Lawrence Barsalou in pointing out that we process concepts not as abstract, detached combinations of features, but rather as "agent-dependent instruction manuals" to run an embodied simulation. These embodied simulations are tied to the context of particular situations, which include the objects and agents involved, actions and bodily states, motivations, emotions, and cognitive operations, and often settings. In "situated conceptualization," thinking about concepts like "dog," "truth," or "chair" (Barsalou's examples) means placing ourselves in a situation with them. The embodied situations evoked by The Avatars places the images in the situation of the Indo-Canadian self, whereby the migrant experience is understood as a perception. Migrant individuals perceive notions of "difference" in the new environment, but are those "differences" analogous to the Canadian experience? Seeing and reading images in the migrant's perspective, one can experience a sense of double embodiment. Reading the images of The Avatars in terms of a situated conceptualization brings the formerly individual (gods and pop characters) together in analysis; embodiment and composition contribute to creating an embodied simulation of the migrant experience. Indo-Canadian identity is continuously changing and The Avatars, as a metaphor of migrant experience, represent such interaction of time, space, and causality.

Conclusions

Articulating and enunciating concepts of cultural hybridity in graphic design not only helps to comprehend the evolving cultural identities of multiculturalism and migrant experience, but also promotes alternative ways of representing in-between cultural spaces. How can visuals discuss complex ideas of identity, difficulties in translating vernaculars—images, patterns and symbols across cultures, and negotiate representation of a meeting space between strangers? All of these questions highlight postmodernism's concern for difference, difficulties in communication, and complexities and nuances of interests, cultures, and place.

The enunciation of cultural difference problematizes the division of past and present, tradition and modernity, at the level of cultural representation and its authoritative address.96 In signifying the present, something comes to be repeated, relocated, and translated in the name of tradition; it is draped in the guise of a pastness that is not a truthful sign of historical memory, but rather a strategy in representing

authority over certain cultural groups. This conception undermines the homogenizing effects of cultural symbols and icons by questioning the sense of authority in culture, demanding that we rethink our perspective on the identity of culture. The concept of cultural hybridity employs postcolonial theories to alternatively view the past to represent a new perception of the present. Bhabha refers to Mikhail Bakhtin who states:

Hybrid is not only double-voiced and double-accented... But is also double-languages; for in it there are not only two individual consciousness, two voices, two accents, as there are [doublings of] socio- linguistic, consciousness, two epochs... That come together and consciously fight it out on the territory of the utterance... It is the collision between differing points of view on the world that are embedded in these forms... Such unconscious hybrids have been at the same time profoundly productive historically: they are pregnant with potential for new world views, with new "internal forms" for perceiving the world in words. (Bhabha, 2006: 156)

In The World, the Text and the Critic, Edward Said states that it is in culture that we seek out the range of meanings and ideas conveyed by the phrases belonging to, or in, a place—being at home in a place (Said, 1983). Said further states that culture is something that one possesses, and, along with that proprietary process, culture designates the boundary in which concepts of what is culturally extrinsic or intrinsic come into forceful play. Discussing "culture in graphic design" and "graphic design in culture" allows design to encompass multiple ways to engage in the production of discourse in formal development.

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Over the emptiness: Interpretations and expression of the term in the spaces of disused cinemas in Milan

Ambra Borin and Laura Galluzzo

Abstract
The concept of emptiness, since ancient times, has often been associated with a negative connotation. The following paper analyses and investigates new possible forms to cross this meaning towards a new added value. Emptiness is everything, it is a center, it is space and a place, it is lightness, it is immateriality but at the same time it is also fullness. This paper talks about a research, starting from the first term definitions to a design opportunity, where the concept of Emptiness is not only synonymous with "nothing", but becomes above all a physical manifestation of images and sounds.

To interpret the Void as a physical and a spiritual reality, as it shows itself through culture and art, as a built reality, and above all as an urban effect through the figures of the greatest philosophers, critics, artists, architects and directors, who have always designed their definition of Void. To transform this research subsequently into a spatial experimentation to enhance the urban value of Emptiness, as the leitmotif of an exhibition system that aims to redevelop the disused cinemas of the Milanese territory. After a research in terms of abandoned buildings, which for years have become 'empty-urbans', have been selected some abandoned cinemas in Milan with the opportunity to give new life to their spaces, staging the declinations and interpretations of the Emptiness previously composed.

The project that follows the research, consists of a scenario with the aim of combining the concept of living the Void as a visual and spatial experience and a curatorial setting of case studies selected. The result is a system of relations between empty interpretations and the various abandoned theatres in the territory, with a specific in-depth study of the project in the spaces of a historic cinema in the center of the city of Milan: Manzoni cinema.

Introduction
The goal of this paper is to overcome every negative meaning of the term and to go beyond the prejudices that are based on a collective thought where the void is conceived as nothing.

In oriental cultures, emptiness is not an aspect to be afraid of at all, to be looked at with suspicion, it does not bring with it negative aspects as western thought does; on the contrary, it is a generating element of order and purity, meditation and the sacral. In parallel to these topics, an observation of an architectural and artistic nature is introduced, dealing with people who have dealt with this subject in the past and then carry out the greatest works recognized worldwide. However, it is interesting to note that by examining different protagonists we have different visual manifestations and results, and that each of them has a personal vision that is not identical to that of the others.

These topics are supported by new concepts that deal with the most constructed part of the Void, which shows the form of this term and how it makes itself visible in its immateriality. The Void is defined as a multifaceted, open and collective space; in short, a public space in which movements, dynamics and variations can follow one another, making explicit the power of time and the importance of human action. The vacuum is conceptually the opposite of full, it is then contour, delimitation and spatial frame and finally excavation, hole and cut.
Apparently, the Void may seem imperceptible, but it is present, exists and manifests itself in multiple declinations. This work invites to not stop at the appearance of things, and, to be able to give meaning to everything even if it has already been given before, to add a new value and thus provide new forms of a hidden reality. Emptiness is power, exploited in different artistic and humanistic fields, and it is at the basis of architecture since each project always starts from a void in which to lay the foundations. Emptiness is space, penetrable, immersive, built, habitable, superfluous space and space to be able to reinvent. Emptiness is therefore a possibility, that element available to be transformed and reused. Emptiness is full, it is matter, it is concretely abstract. Vacuum is pure and ethereal, a sensitive and impalpable world, magnetic and attractive. Emptiness is order and totality.

Emptiness is a silence, moments of stillness, of mute sounds that create harmony and balance. Emptiness is everything, a physical reality and a significant value of things.

Shapes of emptiness
The Void is defined by the matter that surrounds it and that gives it tactility, to be a haptic space, able to build a mutual contact between us and the environment, emotional and phenomenal, in which the matter interacts with the light and with the body; it can accommodate man and on the basis of this relationship acquire meaning, being therefore a space that connects subject and object, the object to its context, internal and external. The interest in this type of space lies in these properties that lead to a modification of contemporary architecture, to the overcoming of singular objects, to a new relationship between inhabitant and space, between architecture and city, from a closed and self-referential space to a relational space. In fact, it is "the quality of emptiness that determines the peculiarities of our perceptible surroundings" (Zennaro, 2001). In architecture, the void is not an abstract space, absolute, devoid of matter as it is defined in the mathematical physical field. It can also be an element, the contour, that delimits an open space - as we have already seen in past eras where it was the generating centre of the context - that defines the perfect envelope of a 'room' of the city. In fact, the building does not define the form of the void, but shatters into different architectural nuclei, opening up these contours and multiple units of planes, surfaces and volumes, creating a Modern scenic perspective. Emptiness, by definition, should be a place

where there is nothing, inverse to full, neither object nor substance, a place without a body, a non-place without space.

Emptiness, by definition, should be a place where there is nothing, inverse to full, neither object nor substance, a place without a body, a non-place without space. For a discipline like architecture, emptiness and absence have a paradoxical role because they are traditionally in antithesis to any physicality and yet maintain an undoubted generative value; Rem Koolhaas, in several critical contributions, underlined the enormous potential of absence as a proliferative factor and emptiness as a strategy to trigger innovation: "where there is nothing, nothing is impossible. Where there is architecture, nothing is possible" (Koolhaas, 1985). Architecture is directly connected to its ability to interpret and arrange relationships for the definition of spaces that are characterized as the most authentic expression of an era. It finds a response to a new experiential dimension of the "perception of space capable of involving geometry and proportion, matter and light, tangible and immaterial, understood as pairs of prerogatives necessary to recognize the status of architecture as an art form" (Russo, 2018).

Emptiness is a creative condition and the best support for life. Bernard Tschumi (1996), argues that the architectural void is, first and foremost, a kind of open space, available to the project as "unplanned": this is the location of the events. It is necessary to think about the necessity and the difficulties to "give rise with a new project to the complex interweaving of social relationships and that "make" the city (Tschumi, 1996). The part without matter, in a certain the fact that the subject matter itself is the subject matter is not as useful as it is the subject matter itself, but is the generating part of it, the part without which "the object would have no meaning in terms of utility. Everything draws its existence and functionality from the presence of what does not exist, i.e. from emptiness, from the absence of space occupied by material' (Zennaro, 2001).

The Void is never something neutral, but rather a dynamic field of attractive and repulsive forces in interaction, which triggers distance relations between the parts that make up and delimit the space. As in the case of magnetic and gravitational fields, these forces are linked to the masses and their respective distances, so composing spaces essentially means creating links between the parts, defining the ways and distances with which they will be arranged. In this sense, building an architecture does not mean putting a stone on another or placing objects in a space; architecture is the construction of the void, of the immaterial form of space, which in many ways refers to what Heidegger means by Raum (Heiddeger, 1969). This german word literally refers to space and in its ancient meaning is intended to indicate a free-space for a settlement of colonists and suggests the need for a relationship between emptiness and fullness. This is how a precise function of architecture is defined, which in this way is configured in a work of intersections between things, in a definition of relationships at a distance, in a work of expansion and

compression. In this way, comparing oneself with space in architecture means intuiting and therefore governing the relations between the parts of the composition, which are often hidden behind the overall image of a work; it is the configuration of a limit that confers form and identity to the space. The city is a meeting place, in which the dynamic social transformations which affect human life in its history are more evident. The city is the scene of new lifestyles, manufacturing, work and the use of the spaces of which it is composed (Espuelas, 1999). Urban voids can be described as those spaces that have been deteriorated or are not intended for use, places where it is possible for those activities of social innovation to manifest themselves. If cities are the moments of encounter with time, memory and people, it becomes interesting to analyse them starting from the physical place where this happens, in other words the public space: the matrix of the city's voids (Espuelas, 1999).

The Void in the city is the shared space, already seen in the previous paragraphs when the Greek polis was explored, where people express themselves and where architecture has the possibility of rooting its own meaning. It is usual to think of cities from their buildings and to imagine the urban form from the full. By reversing this vision, it is possible to understand what it means to look at an urban landscape by studying the form and meaning of the spaces between the architectures, thus considering the void with the same importance that is given to the full. "What seems to be of interest is no longer architecture as such, nor, after all, its relationship if it remains only on an architectural level, but the connective tissue that binds them. In this way, the idea of emptiness is very close to that of the environment, understood as a unifying fluid of relations, rather than objects" (Purini, 2008). The intention is to look at those voids of the city full of forms, trades, relationships and meanings, as the primary field of investigation of architectural research, observing the space 'between things' no longer as that which separates two full spaces, pause, absence, but as an architecture in all respects, which separates and relates the built, people, and places, "the space that is left is as important as the space that is filled" (Távora, 1996).

The urban void is therefore understood as an inhabited-place with a high density of events, forms, meanings and, above all, a main source of urban identity. In urban planning, the void represents an organizational element, an instrument of measurement and dynamic stability, and the empty space between the buildings, as a place of putting into relation between the parts, acquires a central role so strong as to overshadow the singularity of the architectural objects themselves in support of a unitary system that unites the full and the empty. Therefore, interpreting the urban space as a system of places that welcome the dialogue between buildings means thinking about the topology of the urban system as a whole, regardless of its specific forms. From this initial definition of void, it can be affirmed that it is, within the urban structure, the sphere of mediation and relationship, the scenario of urban facts and therefore the place of the city in which the collective structure is reflected and

therefore its own identity. Cities were born when not buildings, but unbuilt spaces have taken on meaning, or rather, when this meaning has begun to prevail over the meanings of individual buildings [...] cities have their strengths especially in open spaces, those that can be defined as 'unbuilt'). From these considerations we can construct a reflection on the empty urban issue, investigated in its various implications, which seeks to trace a new path attentive to the quality of space between things, given that for years architects have not only not spoken about spaces, but they have not even known how to imagine and build.

The Void, "by its very nature not directly objective, seems something difficult to understand, not easily comprehensible, like the smoke that passes between the fingers, and therefore destined to escape reflection. For this reason, while on one side the theme of emptiness has an undeniable conceptual and practical interest, on the other side it entails an evident difficulty in defining clear and defined fields of action" (Zucchi, 2016). The system of these urban voids includes not only those spaces of the city where the city's public life is being staged, but also those places where temporality and stratifications of elements that can be perceived through streets, courtyards, galleries or squares come into relation. They are spaces that tell the story of a place and communicate with an immediate hierarchy a given urban area. Russo (2018) declares that "the void of the square is defined by the buildings that make up the adjacent urban nature. It lives and multiplies its presence thanks to its recognizable shape in the fabric, to the amount of volume given by its size, to the pressure defined by its margin and by the density linked to the quality of light that characterizes it".

In the contemporary urban context, it is now evident how much the urban emptiness that is generally identified in a square or in a free or open space, is no longer a unique relationship and thus opens up to new scenarios not yet fully investigated and tested by the architectural project. In this sense it seems very useful to wonder about the possible declinations of the theme of open space, deepening the fundamental concepts of emptiness, space and place. There is a precise intention to trace a unitary path between art and architecture, which starting from the most conceptual and abstract declinations of emptiness, formally materializes in the theme of space and in particular of urban space, and finally sees its point of arrival in the concept of place that represents an attribute of quality and meaning in the relationship between space and man. Empty spaces can be understood as urban reserves for the experimentation of collective dreams.

In conclusion, the voids can be not only residual spaces but also places of connections, large areas that structure and regulate the discipline of the islands, preventing their reunification through building activity; a giant infrastructure called upon to hold the exploded city together. The role of open space, of a non-internal open space, appears more difficult to recognize where it can be considered, in reverse order to what happened in the city of ancient regime, pervasive element that gives

contained space is transformed into space containing: from occupied space to defined space. The Void, from contained space between full spaces, becomes space containing the multitude of situations of the dispersed city. In this way, it is possible to overturn the argument and transform the negative scenario of empty space as an unoccupied and uncharacterized place into a place that is available, flexible, adaptable and transformable.

In a parallelism with spoken language, and as it has already been dealt with previously, this void can be traced back to an ordered silence, as a necessary suspension, an essential interval, which becomes a dimension between the stillness of the gaze and the tension of knowledge, and goes to distance itself and move away from a 'nothing' and to confirm itself in that 'everything' capable of tracing a fence of references and arranging an open field of relationships. "For me there is a beautiful silence in relation to a building, which I connect to notions such as calm, naturalness, durability, presence and integrity, but also warmth and sensuality; to be oneself, to be a building, not to represent something, but to be something" (Zumthor, 1991).

Emptiness in Milan

The term emptiness when referring to cities, is used to indicate residual spaces without any use, urban voids, the system of squares and streets of compact cities, places that have lost their meaning as disused areas, disused buildings, former agricultural areas, open spaces of the suburbs conceived only as detachments or urban standards.

Milan is a dense and structured city, but also a fragmented city. In the transition out of Fordist industrialism, the city broke up. Not only in its urban geometry, but also in the multiplication of internal boundaries between the splinters of its social composition. There is a synchrony between the urban centrifugation of the city and the creation of internal barriers of an almost anthropological type between the different fragments of its social body; a coexistence between pieces of a naked city, lost and left on the margins. It has been possible to trace five fragments of the social composition of Milan from the beginning of the twentieth century to the present day, using the metaphor of circles that converge in the same urban centre. "The first circle, the inner one, reveals a Milan of the neo-bourgeoisie of flows and networks, where power is managed by mobility on a global scale. The second circle encloses the Milanese trade and how the areas of the city are divided by area and commercial purpose. The third circle, on the other hand, sees as its protagonist a multitude of workers employed in the tertiary sector of maintenance, distribution, collective catering, etc.. This circle also includes all the disused areas, those occupied, with temporary settlements and nomad camps that describe Milan as the city of the invisible. Continuing, the fourth describes the social component of entertainment and creativity, communication and the artistic professions. Finally, the fifth circle is that of the city outside the walls, where there is a very large portion of industrial enterprises, from the smallest to the

largest" (Bonomi, 2008). This account of Milan's main fragmentations anticipates the fact that it is an Italian city whose role is to be the node of the global network. With the emergence of new global flows, in fact, the city increases its centrality and becomes a privileged place for social and global economic development. This image of a great generating machine, Milan is transformed from a place to a flow: passing from the valorization of culture and interpersonal relationships, to have the sole purpose of creating as many connections as possible outside the walls of the same generating city. Bringing losses to the starting territorial level. The city-flow is praised by eroding the city-location. Milan yesterday. Milan today. Milan as it was and as it is now. Two stories but that make it one, but certainly two different worlds. In the middle of time, the evolution of society, changes in customs, changes in language. The city, industry, but above all the human landscape, that system of relationships that define the sense of space animating it with intentions.

The change in terms of economic and social development has been the main cause of a great transformation at the Milanese territorial level. As if it were a second city, a virtual city with forgotten pieces of Milan. An urban reality takes shape, assembled with places out of time, which seemed to have fulfilled their mission, but also with buildings that would still be able to live and serve the citizens. It seems like a dormant city, huddled between skyscrapers and great works of art of a hungry metropolis of success. Uncertainty, bankruptcies, economic reasons, political reasons, projects aborted even before their completion. There are many causes that have made buildings invisible and, often, a refuge for the invisible; these are not the peripheries of a retreating city, but places scattered throughout the urban fabric of a metropolis that proceeds with the construction of new towers. An absent Milan, distracted by cementing every void, to listen to the silences of buildings waiting for ideas and courage. These are places that do not want to remain the same as themselves, but that are ready to transform by adapting to new functions, fighting against the deterioration that gradually breaks their foundations and nature that, quiet, takes back the spaces that have been taken away.

Documenting this dual identity of Milan was possible thanks to authors who share a love for photography and for the city in which they live: Gabriele Basilico, Cesare Colombo and Giovanni Hänninen in an exhibition in 2013 at the Galleria Bel Vedere in Milan entitled Una città per due. One of Basilico's most interesting works is Milan. Portraits of factories, a mapping of the still active or already disused factories in Milan that he himself led at the end of the seventies and that significantly marks the beginning of his long work on the contemporary urban landscape in its modifications. These are images of the Milanese suburbs that present a visual recomposition of a little-known, marginal landscape. The work is the result of a long investigation that takes industrial architecture as its emblem. Basilico, incessantly tackles the

theme of the urban landscape in his works. He has produced several series that deal with these topics, but with Dentro la città Basilico he tackles the theme of the representation of space and architecture in different ways. He affirms that the void in architecture is much more than a lack of matter, it is an integral part of architecture, a structural part of its being. The presence of a man is enough to restore the void to its dramatic sense of absence.

Likewise, there are two parallel stories for a single city, those of Colombo and Hänninen, two visions that integrate masterfully telling not only what happened and did not happen in Milan but also two different declinations of language in images. Colombo began his journey in the fifties, telling a city full of poetry that in a few years will become the scene of hope and then tensions, practices a street photography attentive to faces, small events, relationships between people and spaces. In 2010 Giovanni Hänninen turned his attention not to the inevitable changes but to the transformations that had not taken place, to the immobile finds of a city waiting for something to happen, he used documentary language, an architectural vision and carried out an almost catalogical investigation of the places that the development of the city has left to themselves. Hänninen does not intend to make a work of denunciation and in fact does not like the concept of abandonment, preferring to define Milan as a waiting city that is also the title of this research. His photographs, all made in elegant prints with delicate colours, are a continuous and surprising revelation: "I have never entered these places illegally and, to overcome the hardest obstacles, some places are hidden behind high walls. I define them as empty spaces inhabited by those who sleep here, live or enter only to browse or play, a humanity that many do not want to see".

Città in attesa is a proposal for analysis, a strong suggestion addressed to the city that must critically address the limits of the past to better plan the future and, of course, the present. Over four million cubic metres. This is the figure for abandoned buildings in the city of Milan. These are public and private offices no longer used, former factories and railway stations, farmsteads surrounded by green parks, etc..

An immense heritage of abandoned buildings in Milan that, thanks to the census started in 2014 by the municipality, you can document and understand the situation through the current photograph of the existing city, reporting all those situations that are perceived as a state of decay and inactivity. The census is divided into macro-areas to better understand the buildings: buildings, large built areas and free areas. Empty, abandoned, are many buildings of the sixties and seventies that marked the development of the city. Others, on the other hand, are simply the result of building speculation. Today, in a city that is experiencing a growth in inequalities, a growth in illegal occupations, urban planning is changing and must also deal with these realities. Various associations and educational experiments have also considered the revaluation and restoration of these empty and abandoned areas to

be an excellent subject for design and analysis.
The projects suggest different scales of intervention and different disciplinary connotations: architectural and urban planning, urban planning, technology, restoration and conservation, aimed at outlining scenarios, often alternative, of functional reuse, reconversion, even for temporary uses, and technological adaptation of a heritage relevant for size and diffusion in the city. The temporary use of space is configured in this sense as an opportunity for the city, as a laboratory for the inhabitants to become actors and re-interpret continuously parts of the city and city; practices of temporary use such as interactive construction, dynamic products unstable and not predetermined.

> *"A strategy to consider effectively open, indeterminate the interaction during which - and not before - are defined the actors, materials and interests at stake, and the relationships and rules of interaction, between them" (Crosta, 2011).*

Temporary urbanism is a potential lever to encourage the re-appropriation of urban spaces in the time of the ephemeral; a way to trigger the awareness and knowledge of citizenship towards the city, and a form of living in the city, able to combine pervasiveness of the information system and response to the alienation produced by the coldness of technological mediation, also attributing new meanings to the tiles that make up the city. "Contrary to the more traditional forms of urban planning, (re-)temporary use projects define areas where prototypes of a new urbanity can be tested, and allow the processes of development to be wrong and reoriented. The knowledge and experience of places are the result of crossing and losing oneself; walks, events and performances then become a humble method to look at the territories of abandonment, which before being redesigned and remeaned, can be experienced as repositories of stories" (Inti, 2014). The premises listed above, through various examples, have the task of providing clarity through a quick analysis of the situation of the buildings and areas of Milan that express vacuity and abandonment, but at the same time are an example of a possible rebirth and revitalization through a social commitment and design of re-use of spaces. Giving a second life to spaces that are no longer interesting, but at the same time maintain their identity and remain faithful to their city-place. In the following paragraphs the attention of this sense of abandonment within Milan and a possible revenge of these spaces, will focus on the sensitive and critical character of the abandoned rooms in the area.

Cinemas and Emptiness

It is interesting to make a historical excursus and analyze what were the causes and effects of what is called the Italian film crisis. It was in the 1980s that a profound transformation of the economic, social and cultural life of the city was outlined in Milan. In recent years, cinema has also become a means of relaunching the image of the city and the city of Milan promotes numerous exhibitions and initiatives. The 1980 festival was a great success, when the films in competition at the Venice

Film Festival were presented at the Teatro Lirico. An initiative that has been very popular since 1984 is the exhibition of films in their original language. At the beginning, screenings were held at the Dal Verme and Paris cinemas.

All these initiatives, in any case, are not enough to stem an increasingly pressing crisis, which affects above all the city's film exhibition, both in terms of structures and consumption. In the 1980s, increasingly advanced technologies made it possible to watch films on television, record them, rent them and even buy them at newsstands. The phenomenon of the transition to red light cinemas also continues.
Therefore, the crisis of the cinema does not consist in a productive collapse but in the crisis of the cinemas. Many Milanese theatres began to close in the 1980s, while the rest were concentrated in the centre, whose success was associated with the possibility of combining shopping, catering and entertainment.

The multiplex is yet another attempt to respond to the crisis by diversifying the supply and creating smaller cinemas than the original, which were difficult to fill in their entirety. The decline of the city's theatres continues inexorably from the second half of the 1990s to the present day. In addition to the factors already mentioned, there are three other causes: the development of multiplexes, the spread of the Internet and the advent of the digital age.

The first multiplex opened in Italy dates back to 1997 and immediately imposed itself as an alternative model. Located in the suburbs of the city, often close to the main road junctions, the multiplex offers the customer, no longer just a spectator, a series of attractive comforts. Another competitive factor for the cinema has been the recent development of the internet and the consequent possibility to download films, even as soon as they have been released, to be seen at home without any expense. The real innovation of the last few years is the transition to digital cinema which, involving the production and distribution sectors, sees the abandonment of the film. The advantages of this change are the quality of the support, which does not deteriorate over time, the low costs for interventions on the copies, the lightness and low cost of the equipment for shooting, which allows even small independent productions to shoot quality films.

However, the adoption of the new technology entails significant changes in the field of instrumentation, where the film projector is replaced by the digital projector. The management of the cinema and the creation of an archive become two determined factors that must be organized and this operation is not always simple, given the relative costs. Once again, it is especially the small exhibitors of small city cinemas who, despite public funding, are struggling to bear the costs of digital.

It is in this perspective that in Milan, as in many other Italian cities, the problem of the role of disused cinemas within the city's fabric is

beginning to arise more and more, and like many declining stars, they are waiting for the spotlight to be focused on them again. If the question of abandoned areas in a city like Milan is a widely visited field of research. It is outlined in this way the city's historical centre, its blocks and radio-centric expansions are inserted like tiles in a constellation of fragments. The heterogeneity of these places, which includes empty lots, abandoned buildings and incomplete or crumbling structures, opens up to a different vision of the city, made up of small portions that fit into the different spaces of which the urban fabric is composed. The investigation as a vision is metaphorically linked to a recurring typology within the decommissioning: the cinemas. In their nature as parts and as a whole, cinemas are guiding elements for investigating changes in the city. This is a widespread condition which, in line with the morphological development of the typology, takes on different but recognizable structures, capable of describing urbanity in different ways each time. These two developments are accompanied by different relational possibilities, linked to the way in which the cinema faces the city and the internal structure of the cinema. If on the one hand lights and posters are recurrent elements, the spatial development of the accesses to cinemas calibrates in different ways the relationship between the space of the street and the interiority of the cinemas.
In their fragmentary nature, disused cinemas are silent witnesses of social and cultural changes that, at the end of the last century, have led to the failure of a large number of cinemas, involving both the most central ones and those in the suburbs. However, despite attempts to survive, a large part of the city's cinemas closed by the end of the 1990s. The former cinemas, like the tiles of a mosaic, give a complex image, made up of spaces and uses that have changed over time; the old buildings today house the most disparate functions, also thanks to

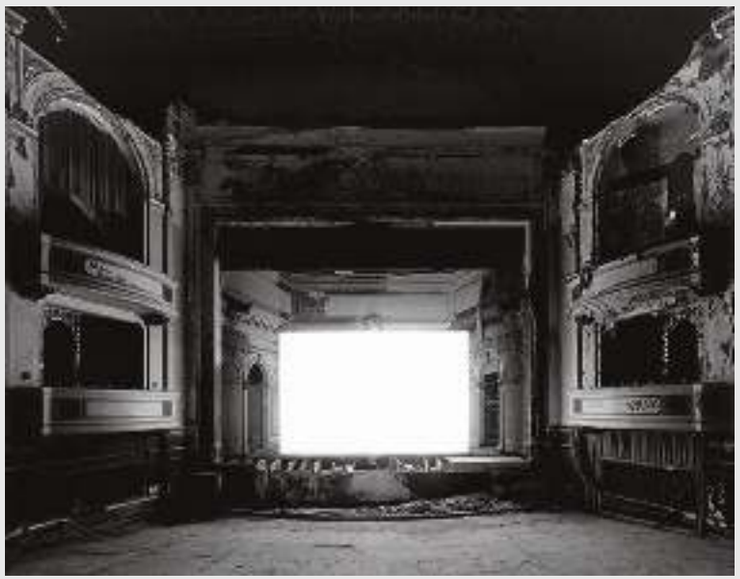

Figure 2. Theatres by Hiroshi Sugimoto, 2015. https://www.sugimotohiroshi.com/abandoned-theater

the many possibilities offered by a large empty space such as that of a projection room.

"The ideal cinema is the hall of silence. The viewer must be able to get lost in an imaginary infinite space" (Holl, 1991). By portraying the architecture of the cinema hall, we can learn a lot about film space. The cinema images taken by contemporary photographer Hiroshi Sugimoto provide a condensed historical view. It portrays the hybrid spatial archaeology of cinema. In his work one has the feeling of 'living' in the pure space of the cinema, which becomes the essential experience of cinema. It is an emotional topography that takes place within the architectural transport of the 'home' of cinema. The cinema is in fact a house: place of origin of travel, interior architecture, is a map of cultural movements.

The fourteen portraits that will be analyzed are cinemas that have remained abandoned and disused to this day, and represent suspensions within the urban fabric. With this analytical and later design narrative, the aim is to investigate the symbolic value of these places, where space and time are fundamental elements in the typological and morphological making of the parts. In this sense, following the development of these cinemas allows us to glimpse the contemporary possibilities of a spatial renewal. A design that takes care of these abandoned places, spaces denied to the city, in an attempt to reactivate them as a weak and widespread urban infrastructure starting from an internal void, bringing new meanings and ways of use.

From this analytical and literary premise comes the need to temporarily restore a new look to these empty spaces, and to stage their essence

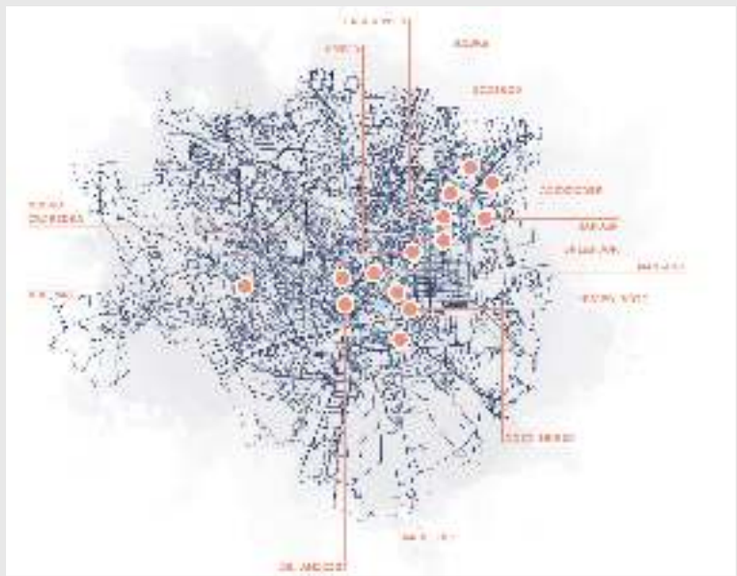

Figure 2. Map of the fourteen disused cinemas in Milan

ex novo through the Void in its infinite interpretations. It was decided to analyse which were the abandoned Milanese cinemas, to take an interest in their history, their success and what were the causes of their failure. Emphasizing their most salient aspects, it was planned to create a system that would connect the fourteen selected cinemas with the fifteen categories that are respective to the theme of Emptiness.

Empty. Milan. Abandoned cinemas and again the Void. A closer look at one of the selected cinemas, the Cinema Manzoni, which is the oldest and most central among the others, and already a location for cultural events and exhibitions, has determined the design aspect of the thesis, which has allowed us to create the basis for this paper.

The Manzoni cinema, located in via Manzoni 40 in Milan, in a complex of commercial buildings began its activity as a cinema in 1950. The structural and static part was designed by the architect Mario Cavallè, while the decorative part was designed by the architects Bergonzo, Fratino and Tedeschi. The group of architects built the entire building complex: an underground theatre with 1000 seats, a 1600-seat cinema at the stadium, located at an altitude of 7 metres above the road surface, an 800-square-metre atrium, an all-store gallery at street level, a restaurant and an office building. From the atrium depart the large stairs that disengage the theater and the cinema, located respectively under and above the atrium itself. The volumetric organism is therefore made up of three large superimposed vases: the first consists of the underground theatre, the second of the covered square, the third of the large stadium cinema, whose plan resembles the shape of a violin. There are numerous previews at the Manzoni cinema, invitational evenings, parties, conventions and presentations. The last two years have been managed by Cinecittà (Istituto Luce), which tries to relaunch cinema with events, seminars and conferences for companies, morning screenings for schools, but this is not enough to save Manzoni from an

Figure 3.
The Manzoni Cinema, Milan. http://www.giuseppperausa.it/cinema_manzoni_-_milano.html

irreversible crisis. The cinema ended its activity in July 2006. Artistic constraints prevent the transformation into a multiplex. In the following years, while the theatre continues its successful activity until today, the spaces of the cinema are sold and used for rent only occasionally for some fashion shows, exhibitions and various events.

A system of diffuse exhibitions in disused cinemas in Milan

The project consists of an exhibition scenario with the aim of combining the concept of living the void as a visual and spatial experience and a curatorial setting of the case studies previously examined. The result is a system of relations between the fifteen empty interpretations and the fourteen abandoned theatres of the territory, with a specific in-depth study of design in the spaces of a historic cinema in the centre of the city of Milan: the Manzoni cinema.

Being mainly a thesis project, what follows this multidisciplinary analysis is a hypothesis of transformation and change, underlining the cultural and spatial importance of these disused and abandoned cinemas. The thesis project is a means of communication and a tool to give voice to the void, which shows its most interesting features and thus develop a new meaning with added values. The path taken for the realization of this project is divided into several phases that see the void as the protagonist. In the foreground, as an initial phase there is an in-depth research of the theme, dealing with historical, physical and scientific topics, and then move on to a cultural vision, an observation of an architectural and artistic nature, as was discussed in the previous paragraphs. This research phase is accompanied by a further investigation that ends with a series of interpretations of the void divided into categories, showing the most similar case studies that can return a visual and concrete idea, opening more possibilities of events touching different fields of reference. Emptiness as everything.

Figure 4.
Pensieri by Edoardo Tresoldi, 2015. https://www.artwave.it/arte/artisti/cupole-daria/

The interpretations, which have been created specifically for this purpose, are as follows:

- Spatial Flexibility: the attention to the theme of flexibility is apparently produced in a void, which hides inside an entire fact of several parts. Through gestures, design or dynamic by the user, it is possible to transform this space into a multifunctional and habitable space according to unpredictable laws.
- Spatial Delimitation: boundary or limit, it is presented as a two-dimensional and sometimes three-dimensional geometric meaning, it consists mostly of a demarcation of a space that apparently isolates itself from the context, leaving something outside and incorporating something inside.
- Spatial Immersivity: an experience of blurred vision and loss, a total immersion of the body in an enveloping space.
- Passage: a passage, banally a corridor, is configured as a real element that can project the observer in an unlimited perspective, open, or forced.
- intheMiddle: different ways of filling a void, adding value and completely changing the vision of space.
- Framework: the act of describing a part of a large component within a pre-established boundary frame, delimiting a celestial void, that is, the sky that interposes itself between the architectures.
- Bubbles: able to remain in spherical formation for a few seconds, and then burst. So the 'architectural bubbles' are made of emptiness, air and free space that add value to the urban scenario.
- Suspension: the only material from which this suspension is made is air.
- Pure White: clean, ethereal and almost empty white is often the object of the greatest works of art that seem to cancel out the entire canvas. It is the non-color that par excellence directs the rules of emptiness.
- Presence/Absence: "But this is the very condition of existence. Making oneself spring means accepting the risk of winter. To be a presence means to accept the risk of absence" (de Saint-Exupéry, 1943). For this category it is interesting to mention the artist Edoardo Tresoldi, who through his sculptures tells the dialogue that is established between an empty net figure and the surrounding space. To cite one of his most important Pensieri (2013), which represents an absence of thought, a moment frozen in time.
- Trace: The track express reality by means of an external element, in this case absent.
- Memory: The purpose of these case studies is to transfigure a concept such as absence and memory, translating it into a feeling experienced in the intimacy of the individual through sensory perceptions.
- inVisible: not seeing things allows us to imagine new worlds, new stories and new spaces, stimulates our imagination, everything that was not there before, takes shape.
- Silent Noise: Without noise and discover that what you are not listening to is emptiness. A silent and moving dialogue that never leaves you indifferent, is the one interpreted by Marina Abromović (The artist is present, 2010). During the whole time the artist stood still, in silence, sitting in front of a table for many hours a day, meeting the eyes of the public, who, almost like in a solemn pagan ritual, approached her slowly and sat in front of her, for as long as they thought it necessary.
- More is More: one of the most serious diseases we suffer from is that of the Full: the illness of those who live in a continuous mental state occupied by a whirlwind of demolished words, stolidly recurrent images, useless and unfounded certainties, fears formulated in sentences before emotions.

Figure 5. The Artist is Present by Marina Abramovič, 2010. https://commons.wikimedia.org/wiki/File:Marina_Abramović,_The_Artist_is_Present,_2010_(2).jpg

The second of the research is based on the concept of interpreting the void on an urban scale, what are the relationships and whether they exist between the void, always as a protagonist and the urban territory, between the most hidden corners and the ghosts of cement that lie behind the tallest skyscrapers Milanese. It was decided to analyze which were the abandoned Milanese cinemas, to take an interest in their history, their success and what were the causes of their failure. Emphasizing their most salient aspects, it was planned to create a system that would relate the fourteen cinemas selected with the fifteen categories respective to the theme of Emptiness. A closer look at one of the selected cinemas, the Cinema Manzoni, which is the oldest and most central among the others, and already a location for cultural events and exhibitions, has determined the design aspect of the thesis. Emptiness as a manifestation of Presence/Absence and Silent Noise, thus succeeds in giving a new image to the spaces of the structure, transforming its function into another while maintaining a contemporary artistic imprint. The atmosphere that has been created inside the spaces of the Manzoni cinema, can be traced back to a large mysterious cloud that enters the atrium overwhelmingly disorienting anyone. This cloud,

haze, becomes more and more rarefied as it rises in level. The more the space of the cinema comes alive and therefore Presence is created, the more the blurred cloud diminishes. The void is filled with the experience of those who enter this space. The intent of the project, as already mentioned several times, is to be able to give concreteness to this void, through different manifestations. For the communication and the graphic elements to complete the visual picture of the exhibition system, it has been thought to realize everything through the technique of the survey. Having the possibility to orient oneself through texts and graphics in relief is a point in favor for the entire space and those who live it for the right time of the event. Basically, the Manzoni cinema will be the central pivot from which a system is triggered that will see the other theatres turn on every day at thematic intervals. The opening and closing day will be entirely dedicated to the Manzoni cinema and its spaces, while from the second day on, the others will also come alive. In parallel with these openings, the Manzoni cinema will always be open, also in the evening, thanks to an evening programme of screenings of eight films selected from among Ozu's greatest successes. Through this hypothesis of cultural and artistic event at the same time, it reveals itself to the true essence of Void. Living through a few but effective elements an ethereal and sublime experience.

The installation develops throughout the empty space of the Cinema Manzoni: the atrium, the foyer on the first and second floors, and finally the internal projection room. The concept of void is expressed in these spaces through a vaporous cloud conductor with different levels of intensity for the entire cinema.

To represent the two interpretations of emptiness chosen for the Manzoni cinema, namely Presence / Absence and Silent Noise, during the exhibition you can interact with some works, as well as case studies examined during the analysis, which strengthen the concept of emptiness and experience. In these spaces, one feels immersed and captured by a white and suspended atmosphere of emptiness, sometimes interrupted by silences or absent images. Giving shape to the void, giving a materiality to this concept. The design intent, as already mentioned several times, is to be able to give concreteness to this void, through different manifestations. For the communication and the graphic elements to complete the visual picture of the exhibition system, it was decided to realize everything through the technique of relief. Having the possibility to orient oneself through texts and graphics in relief is a point in favor for the entire space and those who live it for the right time of the event.

This system of spatial and experiential relationships, consists of an exhibition scenario with the aim of combining the concept of living the void as a visual and spatial experience and a curatorial setting of case studies previously examined. It is always necessary to start from a void, to demonstrate the true essence of things. The most interesting part of the whole project is to have hypothesized a network of connections between cinemas, which turn on and off during a precise and pre-established period of time, referring to the Manzoni cinema as the central hub and generator of the interpretations of emptiness. The void exists and through the void there is something else.

Conclusions

The objective set at the beginning of this work was to overcome every negative meaning of the term and to go beyond, to go beyond, the prejudices that are based on a collective thought where the void is conceived as the 'nothing'.

Apparently, the void may seem imperceptible. But the void exists, exists and manifests itself in multiple declinations. The work presented is a search for months in which the term has been treated with care and deep investigation, maintaining an interpretative approach critical to its final composition. This work invites us not to stop at the appearance of things, and to succeed in giving meaning to everything, even if it has already been given before, in order to add a new value and provide new forms of a hidden reality. The idea of undertaking research work on the void is born from a personal curiosity, to reveal what is not always considered and brought to light. Emptiness is power, exploited in different artistic and humanistic fields, and it is at the base of architecture since every project always starts from a void in which to lay the foundations. Emptiness is space, penetrable, immersive, built, habitable, superfluous space and space to be able to reinvent.

Emptiness is therefore a possibility, that element available to be transformed and reused.
Emptiness is a possibility of change.
Emptiness is full, it is matter, it is concretely abstract.
Emptiness is pure and ethereal, a sensitive and impalpable world, magnetic and attractive.
Emptiness is order and totality.
Emptiness is a silence, moments of flat calm, of mute sounds that create harmony and balance. Emptiness is everything, a physical reality and a significant value of things.
From Emptiness everything is created and everything returns.

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Tweaking retirement-living: Introducing design thinking and coffee bars to shared lounges

Sam Clark

Abstract

The research presented in this paper stems from doctoral work that was undertaken between 2014 and 2018, with the aim of exploring what the homes of older people could look like in the future. The underlying research context is the major societal challenge of housing a 'superaged' UK population, and the particular needs and aspirations of active third-agers. The research project foregrounds 'designerly' modes of inquiry, resulting in design-relevant feedback for those involved in the production of retirement-living environments. At the core of this work is a deep inquiry into what older people consider when making choices about their housing and how housing providers can use this information to develop more appealing options. The study acknowledges that in the last decade there has been a considerable expansion in the range of choices available and, while there is a growing demand and requirement for specialist housing, it remains true that many older people do not move until they reach crisis point. It is important therefore to gain insight into not just what retirement

housing of the future might look like, but also how good design can encourage people to plan earlier in order to make more proactive decisions about their housing. Aspects of the doctoral research were commissioned by an industry sponsor, referred to here as Pink & Knight, as part of a bespoke studentship arrangement, which had the qualities of contracted research while involving a close, yet critical collaboration in the spirit of a Knowledge Transfer Partnership (KTP). The author is grateful to the sponsor organisation for the opportunity afforded by the PhD studentship, and its enlightened board of directors, which was open to a reflective and reflexive research process. Elements of the research were only possible through full access to the company's staff and customers, as well as its portfolio of retirement developments. A special thank you is extended to the company's Group Land & Planning Director, who championed the research, through commissioning and facilitating introductions within the company, and bravely supporting research by Creative Practice. As an architect, the author is particularly grateful for the opportunity to have pursued applied research within the construction industry and thanks all those that participated in open and candid discussions within the board room, and other business environments.

Research Context

The research presented in this paper stems from doctoral work that was undertaken between 2014 and 2018, with the aim of exploring what the homes of older people could look like in the future. The underlying research context is the major societal challenge of housing a 'super-aged' UK population, and the particular needs and aspirations of active third-agers. The research project foregrounds 'designerly' modes of inquiry, resulting in design-relevant feedback for those involved in the production of retirement-living environments. At the core of this work is a deep inquiry into what older people consider when making choices about their housing and how housing providers can use this information to develop more appealing options. The study acknowledges that in the last decade there has been a considerable expansion in the range of choices available and, while there is a growing demand and requirement for specialist housing, it remains true that many older people do not move until they reach crisis point. It is important therefore to gain insight into not just what retirement housing of the future might look like, but also how good design can encourage people to plan earlier in order to make more proactive decisions about their housing.

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From the outset, the research sponsor was keen to structure the project, anticipating a process based on defined work packages, milestone reports and accompanying presentations, as well as regular 'placements' within its offices. Indeed, an indicative 'plan of study' was written into the research agreement, which was further defined within the research proposal. Five work packages were determined, though in practice packages were scoped in turn. A significant aspect of the contracted research involved 'designerly' forms of post-occupancy evaluation of the sponsor's 'retirement-living' product; a product that is marketed to customers "driven by need rather than aspiration". Pink & Knight's age-exclusive developments are made up of privately owned one- and two-bedroom apartments grouped around communal facilities and services. A typical development consists of 40 apartments in one building, or 'Chalet', with the following features:

- Concierge reception (staffed by a Chalet Manager)
- Shared Lounge, coffee bar and accessible toilet
- Guest suite (for use by friends and family)
- Intruder alarm and CCTV entry system
- A central lift serving all floors
- 24-hour care and support system

- Landscaped gardens (with raised planters and potting sheds)
- Free parking (including electric vehicles, cycles and mobility scooters)

All chalets are managed by an independent company, referred to here as Chalet Management Services (CMS), which is owned by Pink & Knight. The management company collects the monthly service charge and is responsible for all maintenance, service and ongoing management of the chalets. This accommodation model has developed over decades and is now becoming more widely recognised as a 'lifestyle' offer. Examples can be found on the websites of the three market leaders in the UK: Churchill Retirement Living, McCarthy & Stone and PegasusLife.

Scope

For the purposes of the Design Research for Change Symposium, this paper reflects on the theme of design research for health and wellbeing change, and seeks to answer three questions:

(i) who decided what to change,
(ii) who activated the change, and
(iii) who has been affected by the change?

In the context of this paper 'change' is defined as revised or 'tweaked' design patterns/templates for an established product. Here change has a positive effect on the lived experiences of residents and their visitors, as well as staff, occupying communal spaces within age-restricted residential developments. In this context design change adds value to an environment that promotes an independent retirement lifestyle, in which residents can age in place, supported by a social architecture and communal space that helps to mitigate loneliness through chances for meaningful and natural interaction over coffee.

This paper represents something of the researcher's story. In part it is an autoethnographic account of myself as an actor in the research field; an acknowledgement that I have played a part in the research, having developed and performed multiple personas – research student, associate, architect, lecturer – throughout the project, and sustained relations with various stakeholders. It is also part sense-making of an inquiry framed as 'creative practice' and involving elements of design research. Autoethnographic writing is by nature self-reflective – placing emphasis on the ways in which I have interacted and been immersed with the culture being researched (Holt, 2003; Méndez, 2013) – and so this story has something of a 'confessional' quality; it refers to regrets, paths not followed, and mistakes made, as well as some positive experiences and surprises, and connects these to wider cultural meanings and understandings.

Introduction

I have come to know a developer's standard product for private, independent retirement-living and gained insights into its design, production and consumption. I now appreciate the retirement chalet's qualities, particularly its social architecture, as well as the sustainable benefits to individuals, communities and society as a whole. Nonetheless, through design review, I have questioned the quality of the architectural environments the product offers, and promoted specific design 'tweaks' that could enhance residents' everyday experiences. I have also come to question the very idea of so-called 'specialist' housing, especially products targeted at 'older people', given the inherent diversity and populous nature of this group.

In 2014 I conducted an interview with a teaching colleague with a background in housing, and specific project experience designing ExtraCare facilities, during which we exchanged some candid views on the long-term presence and marketability of Pink & Knight's product. The following extracts from the interview transcript capture my thoughts, as the interviewer, reflecting on my research experience at the time:

> *"There are some things that are good about it [the Retirement Chalet; particularly its social architecture], but on the whole I think it falls short of what I would expect of decent ['Lifetime'] housing, let alone specialist housing. Actually, that term ['specialist housing'] I am not entirely comfortable with. I don't know if we should be looking for specialist housing offers, or whether there just ought to be good housing that anyone can live in for as long as they like".*

> *"It must be an incredibly niche market. This product [retirement chalet] is not for me, it's not for you, it's not for my parents. It's not for [my partner's] parents. It's not for their [Pink & Knight director's] parents… It's a very particular demographic that buys into this. And, if you are [re-]selling it through an estate agent, your chances of success are fairly limited. I think also there must be psychological barriers for someone not coming through the sales office of [Pink & Knight] but coming from an estate agent, and thinking, 'What is this? This isn't an apartment, this is something else. What is this community? Who are these people? Are they all "old codgers"? Are they all about to pass away? Where do I fit into this cohort? And is it performing like a cohort; are they all ageing together or is there a diversity in this?'…I think it would be a hard sell [the resale of a retirement apartment]".*

I continue to feel at a distance from the developer and the consumers it supplies. As an architect I am particularly saddened by the low level of consumer knowledge in relation to housing in the UK. I am particularly concerned for those older people who are moving from familiar housing typologies – private houses – to forms of communal apartment living, and not knowing what to look for in their new their home.

"That's my biggest concern in all of this. You ask people about the architecture and they say nothing. Then you ask them, 'Well, what do you think about your apartment in terms of layout? What is the bathroom like?' Then you get pages of feedback. You think, 'You didn't have this knowledge prior to the purchase'. That's what concerns me. I do wonder… The question about the range of offers on the market for older people. I think in part the range isn't there because of the [lack of] knowledge; the discerning consumer doesn't really exist".

Of course, this is not an isolated problem, but symptomatic of a wider UK cultural unknowing or unthinking when it comes to housing design and respective property searches and purchases. Much has been written about this topic elsewhere. For me, the following remark from an architectural researcher describes the phenomenon rather well; a problem of consuming with the eyes, rather than taking into consideration issues of comfort and accommodating the whole body.

Figure 1.
Lounge
Interiors

"Research has shown that after location, external appearance – and in particular a period style – is cited as an important priority to the vast majority of [UK] homeowners, with more respondents rating the importance of these aspects of their homes than the size, décor and quality of the rooms. Newly built homes in the UK are also the smallest in Europe. Why do we value looking-at over being-in?" (Horn, 2015)

I am now familiar with the retirement housing sector, and a cast of older person informants that presented a wide spectrum of aspirations and needs with regard to their homes. I also have knowledge on the retirement chalet and understand its attractiveness and relative advantages to residents, as well as areas where it could be improved. I am also aware that I carry design knowledge – in part gathered from resident informants – that prospective customers do not possess, though they will likely come to know, tacitly, post-purchase.

Design Case Study

The case study presents design work that was prepared for the sponsor, based on the findings at one of its built developments, and later ratified by studying other settings. Design was used as a method for synthesising and testing emerging ideas, gathered through mixed research methods and field tactics (including residency and design review). A close examination of the chalet product led to the identification of 'opportunity areas' for design review and enhancement, including the shared lounge. Designs sought to work within existing frameworks – grids, layouts, unit mixes, strategies, etc. – and are therefore posited as potential enhancements to the standard product. Here two proposals are presented, based on a case study chalet. The first proposal comprises a simple remodelling or 'tweaking' of the existing lounge, reflecting resident feedback and aspirations. The second proposal involves more substantial structural alterations, albeit respects the established space allocation for shared lounges.

The atmosphere of the typical lounge is somewhere between that of a hotel lobby and a TV or day room within a nursing institution, but without the nurses (Figure 1). Within the case study location the lounge is one open plan space, articulated on one side by a bay window with integral door leading onto a south-facing terrace. At one end the room is open to the main entrance, which includes a concierge style reception desk. There is a small kitchen, separated by a door at the opposite end, which is primarily intended for preparing tea and coffee. Appliances include a fridge, glasswasher and microwave. The lounge itself has an ornamental fireplace, flat screen television, a number of soft armchairs, three coffee tables and two dining tables with upright chairs. The ways in which residents have appropriated the space were documented through a photographic survey (Figure 2). Key features are a small table by the entrance for out-going post, a folding table near the reception for displaying shared books, and a puzzle table close to

Figure 2.
Shared
Lounge
Photographic
Survey

the kitchen. It's also worth noting that there is insufficient space for all members to attend a function at one time.

The shared lounge is a kind of default space, typically resulting from the 'omission' of two residential units on plan. My studies of schematic drawings reveal traces of a 'plan logic' associated with the apartments above – the same compartment and external walls, often with a bay projection occupied by apartment kitchens elsewhere. In these terms the typical lounge is a kind of 'geometrical' or 'empty space' that might be regarded representative of Henri Lefebvre's perceived shift in philosophical considerations of space (Lefebvre, 1991). Arguably this way of thinking "decouples space from time, and thus also from considerations of social life as unfolding in space" (Coleman, 2015). Lefebvre points to an apparent gap that separates the products of professionals from their intended inhabitants (Lefebvre, 1991). Likewise I question to what extent the architects working for Pink & Knight are considering future lived-experiences of the lounge spaces they propose. It appears that design energy and budget is expended on interior finishing – the objects that fill the 'empty space' as opposed

to inherent architectural qualities of space and light. Chalet managers have confirmed that the same furniture and finishes can be found in all the developer's lounges, acknowledging that "they all look the same".

The first design proposal – 'remodelled lounge' (Figure 3) – shows the concierge desk relocated in-between the lounge and the main entrance. This would improve thermal comfort within the lounge as well as reduce unwanted distractions e.g. deliveries. Some residents also felt strongly about having to walk through the lounge in order to reach their apartment, sensing that it was an erosion of their privacy. The proposal recognises the entrance as an important public-private threshold and makes provision for display space within the lobby as well as seating around the reception. This area could be closed off by means of a sliding door. Similarly, the chalet manager would have dedicated office space that communicates with the lounge and overlooking the entrance, both internally and externally. The lounge would be

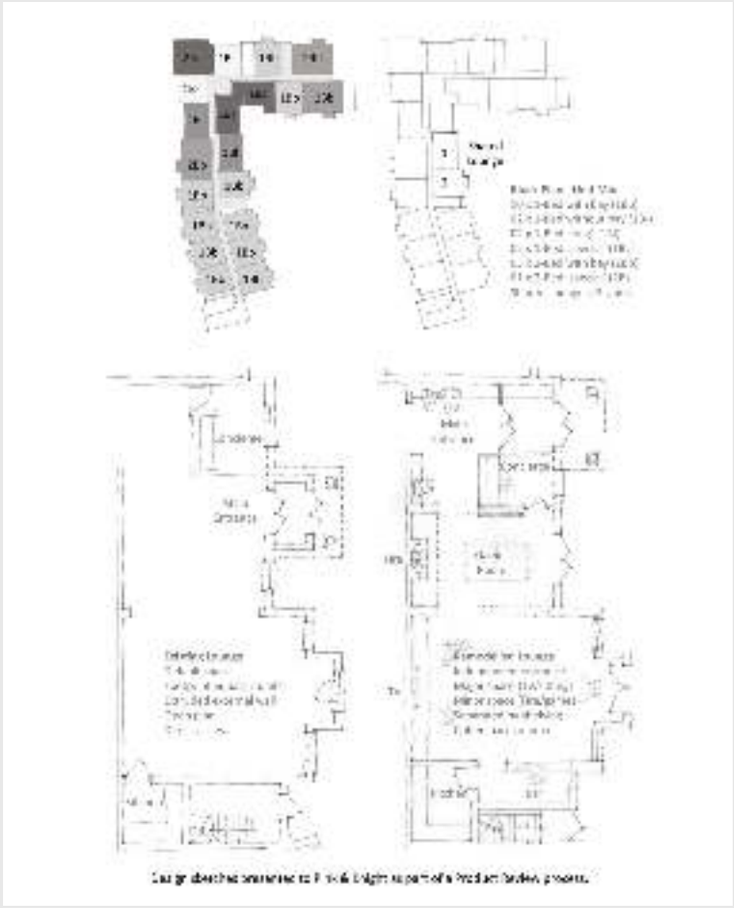


Figure 3.
Lounge Logic

articulated on two sides and moveable furniture used to subdivide into a games room with fireplace, and a sitting room with the television. The division could be formed by book shelving, thus accommodating the library that is currently laid out on a folding table by the reception. Both sides of the lounge would have direct communication with the outside by means of double doors leading onto the terrace. The sitting room features a coffee bar, which would better facilitate coffee mornings and parties. There is still a separate room proposed for the kitchen, recognising that there are times when residents would want to shut the door on the noise of appliances.

Figure 4. Through Lounge

The second design proposal – 'through lounge' (Figure 4) – presents a lounge that extends the full depth of the building block, though is no bigger in real terms. This has the benefits of more than one aspect and improved access to and from both sides of the development – street and garden court. The primary entrance would be associated with the garden and parking, while a secondary entrance offers more direct and/or discreet access to and from the street (the latter is referred to as the

"shoppers' entrance" on other Pink & Knight schemes). The proposal also seeks to make better storage provision for furniture, allowing for greater flexibility of use and multiple functions within the lounge. Pink & Knight are now thinking about the identity of the lounge and the potential benefits of it looking and feeling more like a coffee lounge or public-facing shop. In some respects this would be a more natural or better understood venue in terms of its programme, since people have been 'meeting for coffee' for a greater part of their lives. Whereas how and when to use a shared lounge is less clear. There is also a risk that current participation depends upon the direction of the chalet manager and therefore limited to office hours. In this way existing lounges share the 'day room' image of care settings.

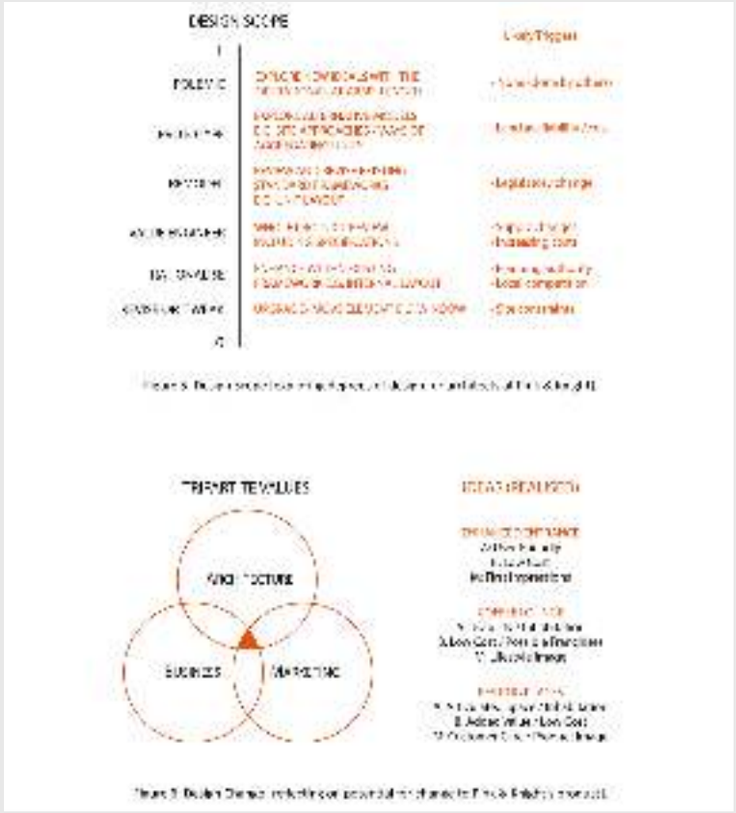
Analysis

Working with an industrial sponsor has brought many advantages in terms of ease of access to a research/practice context, including a portfolio of developments and population of potential informants (staff and customers). Equally, the sponsor had a genuine stake in the research and helped shape its scope and direction; implicitly, explicitly and through latent or subliminal affect, influencing me and the research informants. I can recall questions not raised or discussions unentered, due to self-censorship or more general need for professional tact. For instance, during my first meeting at Pink & Knight, when empathy was sought from directors faced with a refused planning application and appeal case, due to design challenges from the local authority which appeared justified (to me). The presence of a sponsor had an immeasurable impact on what could be facilitated for the research, and what could be imagined for it, as well as what could be discussed openly, be it in the boardroom or in public. The following extract from research notes illustrates some of this tension:

> *"I've been to [Pink & Knight] and met various board members. All appear supportive of design research, albeit 'design' defined differently. Design scope ranges somewhat across the organisation, from moving windows through to alternative forms/formula for retirement housing. There is an apparent tension with respect to meeting their current client profile (characterised as a 79-year-old widower…) and developing up-to-date 'products' for baby boomers and subsequent generations with aspiration... Imagine… a profit-orientated MD, alongside resident architect-directors looking to evolve a product that has remained more or less the same for 20 [plus] years..."*

Perhaps my greatest struggle was reaching an influential audience within the sponsor organisation, with regards to 'design'. Within Pink & Knight it appears that company architects have limited voice; their agency being limited to project-specific challenges, as opposed to evolving the design of the standard product and its governing patterns/templates. Indeed, I would go so far as to say they have limited license

to hear critique, with individual enquiries from staff suggesting that dissemination of research findings occurred on a need-to-know basis. My experience is that information was filtered before travelling up and down management lines. This is to be expected, since the organisation and its respective communication channels exist to efficiently and productively serve business objectives. Within this culture continuity and certainty rule. There is little tolerance for unpredictable, resource-consuming exploration and innovation. Furthermore, external comment is regarded as potentially disruptive, unnecessarily challenging business intelligence ('what we know') and prescribed processes ('what we do') and tested products ('what sells'). In this environment, design operates at the level of the development site and making the standard template fit. Product review, or what I regard 'real' design, occurs at committee level.



Figures. 5 and 6 Design Diagrams

I will refer to Figures 5 and 6 to describe the design culture and activity observed at Pink & Knight. Regarding design scope (Figure 5), low-level design involves 'tweaks', such as moving elements (e.g. windows) or revising non-material details. Larger design changes, such as revising internal layouts, may be argued on grounds of 'rationalising' or 'enhancing' existing templates, though robust evidence and cost analysis is required. Material changes, such as reviewing product specifications, are more likely to come about as a matter of reflex, resulting from 'value engineering' or changes to the supply chain. Whereas re-modelling will only occur in response to new fixed constraints, such as legislative changes to building regulations or nationally described space standards. Similarly, prototyping and exploring alternative models – for instance different types of sites or development strategies – is led by economic pressures, such as land availability and return on investment. Pink & Knight does not engage in polemic or speculative design that disregards its established operational frameworks. In these terms the organisation is observed to be conservative in its attitude towards design.

In my limited experience of presenting 'real' design ideas to Pink & Knight, I have observed that design change can only advance if sanctioned at the highest levels of management. Even then, an idea cannot survive on architectural merit alone. For an idea to translate into material change it must satisfy a business or financial case as well as offer a marketable benefit (Figure 6). For instance, the introduction of the coffee bar into the shared lounge represents a low-cost material and spatial change, and may offer possibilities for franchising in the future. The coffee bar is visually impactful and gives prospective buyers an easy to digest manifestation of the lifestyle offer. It is also easy to photograph and include within marketing material. Architecturally, it brings the 'tea station' into an open plan environment, making it more accessible/user-friendly, and offers new possibilities for interior design. The coffee bar also supports a design narrative for 'inhabiting' space. Of course, the biggest impact is a social one; the coffee bar offers the shared lounge a familiar programme – meeting for a coffee – and goes some way to 'defeminise' the space and make it more flexible for large groups. In any case, design change is contingent on business thinking and the support of directors without design training. In this respect my role as 'external architect' involved some amount of design teaching or advocacy, as well as an openness to other ways of thinking. Plus, some amount of tact.

Within the sponsor organisation, evidence has been collated that demonstrates how the research project – involving a reflective and reflexive process – has affected the design evolution of the developer's standard product in a few key areas, as highlighted by a director cited in a trade magazine:

> *"It's good to have a critical look and to challenge what we do…There were suggestions as to how we could improve, for example in circulation improvements... [the research associate] came up with the idea of creating a 'man shed' where male residents can just potter, which is a great idea". (Vedrickas, 2017)*

A testimony (Figure 7) provided by a member of the sponsor's architectural team corroborates a change in design approach to circulation, through consideration of 'resting areas', as well as general improvements in the common spaces, with alternative layout arrangements being explored for the shared lounge. The testimony confirms that future developments will have an alternative entrance sequence, separate from the shared lounge, and that shared lounges will feature an open plan coffee bar, with an accessible toilet nearby. The coffee bar has been found to be especially popular with resident owners and their visitors. Figures 8 and 9 show the physical impact of the coffee bar in terms of the spatial and material differences it has made to the chalet product. In older developments (Figure 8) small kitchens or 'tea stations' were placed in bays/rooms adjacent to the shared lounge. Whereas, today coffee bars are installed within lounges (Figure 9), making a positive contribution to the look and feel of this key space.


Dear [research associate],

I confirm that your research, disseminated through three Product Review reports ([illegible] Chalet], February 2015; [Weather Chalet], May 2015; [illegible] July 2015) has had an impact on the design approach to the communal spaces within the retirement [chalets] developed by [sponsor organisation]. This can be evidenced through the following documents:

Planning Application drawings for [named development 1] (May 2015) indicating:

Main entrance [illegible] separated from the [shared lounge] by the reception desk and supporting office (as opposed to entering directly into the lounge proper); an open plan Coffee Bar in place of the tea station, [illegible] [shared lounge] [illegible] and a nearby accessible toilet, within easy reach of the main entrance and [shared lounge]. (Drawing Ref.*)

Construction Drawings and As Built Photos for [named development 2] (Oct 2015), indicating:

[illegible] 'through lounge' with secondary entrance (Drawing Ref.*); separate activity spaces designated 'Resting Area' and '[shared lounge]' (Drawing Ref.*); an enlarged, open plan Coffee Bar in place of the tea station (Drawing Ref.*); nearby accessible toilet within easy reach of the [shared lounge]; additional storage cupboards within the 'Keep-Fit/Meditation' room and a separate store off the corridor (Drawing Ref.*). On the upper floors the corridors on the first and second floors have a 2.5 x 3.0 metre bay with a [illegible] smoke vent window to vent the corridor outside of Stair 2 (Building Regulations, Part B requirement). These may be furnished/utilised as 'Resting Places' overlooking the street/Western garden [illegible]. (Drawing Ref.*)

The open plan Coffee Bar was well received and following its success in [named development 2], the new design will be implemented on all new schemes.

Kind regards,
[company architect]

Email Testimony from Pink & Knight architect, [illegible] December 2015.

Figure 7.
Evidencing
Impact

Figure 8.
Tea Station
(Before)

Limitations

I suppose the defining characteristic of the design work is one of contingency; a practice that responds to or 'depends' on the real world, a problem articulated by Jeremy Till in his writing about the gap between what architecture actually is and what architects want it to be (Till, 2009). If I am honest with myself, as a student I sought an opportunity to design cart blanche and enjoy the production of architectural artefacts for a small audience – myself and some professional peers. Whereas Pink & Knight had sponsored the research, from which they expected specific answers and to collect a good public relations story and an independent publication for use in planning meetings and inquiries – words, not designs.

On reflection, I now recognise that my struggle has been one of shifting from an imagined ideal of 'practice-based' research, where creative artefacts are the basis of the contribution to knowledge, to the actual 'practice-led' situation, where the research has led primarily to new understandings about practice (Candy, 2006). One might say the research has been more about practice than through practice, though there have been moments where I have performed as a kind of design consultant. For instance, through the production and explanation of

Figure 9.
Coffee Bars
(After)

sketch feasibility studies that accompanied the Product Review reports prepared for Pink & Knight. Of course, taken out of context these drawn studies do not appear to represent in-depth research.

> *"My 'design' work has been very process-led and is relatively light when considered in isolation. Taken out of context, the design work could be read as discrete feasibility studies – the sort an architectural practice would prepare quickly for an interior refurbishment project."*

If nothing else, my take-home lesson is the need to be invited to design. The following extract is an email account of a telephone conversation I had with a director representing the sponsor, approaching the end of the contracted research:

> *" …There was no mention of further design work. I offered an outline scheme for [named development site], explaining how it developed from the student work [an academic design studio I led] and design ideas presented within work package three. No comment. I suppose [Pink & Knight]'s view is that design is not the problem; it is a problem of individual personalities within local authority planning departments ('this urban designer at...'). I think the message is clear: 'no more design/ideas'…"*

The need for an invitation to design was most apparent in the way feedback was framed. The abovementioned design project – produced to illustrate an alternative design approach to a live Pink & Knight development site – while positively received in the boardroom, was regarded a 'limited objective exercise' that required a detailed and commercial assessment. The design director found many positive features though raised several points that counted against the proposal when assessed as a potential Pink & Knight project. In summary these matters were: an unknown six metre watercourse easement, limiting the development footprint; parking spaces accessed directly off the street being considered vulnerable to 'fly parking'; a massing strategy already determined through pre-planning consultation; being 'very close' to the company's target margin, due to the building form involving a section of single sided-corridor; 'internal' kitchens, including those with windows onto the corridor, being regarded 'unpopular' with customers; the apartments being nearly ten per cent larger than the company's standard apartments, and respective impact on construction costs and sales price. Furthermore, the live scheme had received planning permission. In these terms the uptake and progression of the design work was curtailed.

Conclusions

Returning to the three questions raised at the beginning of this paper, I posit that design change had been affected in the context of retirement-living developments, albeit modest (or maybe I had too high expectations?). The most significant design change is the revision of the design pattern/template of the shared lounge, to include a coffee bar as standard. This change is already having a positive effect on the lived experiences of residents and their visitors, as well as staff that manage these environments. In terms of who decided this change, well, the authorship of an idea, and its transfer through a design process and organisation, is never clear cut. Indeed, there could exist multiple stories to explain what happened.

One thing that became clear through this work is the relative lack of voice for key actors regarding design decisions, including residents and architects. Here the company architect was found to be shaped by a strong business context, multi-layered management, and clearly defined production-oriented processes designed to maximise profit. One might consider, then, whether architects within development companies are in fact 'designers', or if their role could be better described as 'custodians'; persons entrusted with guarding or maintaining a design or set of design patterns that are shaped or tweaked to fit specific development sites and contexts.

When explaining my research to a teaching colleague, it was suggested that I was concerned with 'cultural change' within the sponsor company, and to a lesser extent wider society (with respect to witnessing an aspirational baby boomer generation reach retirement). It was at this moment that I registered what it meant to evidence a design 'tweak' in the developer's standard product; the result of 'projecting a clear and consistent message' in support of good design, particularly where it 'cannot be easily quantified or measured as potential value added'.

Previously I had thought of 'success' as being an improvement in the material environment of the shared lounge within retirement chalets. But the introduction of the coffee bar also represented cultural change inasmuch that it was performed by others. For this feature to appear on the planning drawings, change had to be affected in the boardroom, then communicated to and through the in-house architect team, and to the external architects that prepared the drawings. Furthermore, for it to be materialised, the architectural idea had to be adopted, developed and owned by multiple people at different levels of the organisation, guiding it through the construction process. This is contingent design research that affects change.

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Advancing sustainability at universities through design thinking education

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Susanne Robra-Bissantz

Abstract

Teaching students Design Thinking (DT)—a team-based approach to solve wicked problems—by using real-life sustainability problems, provides an opportunity to develop solutions that benefit a university's ecobalance. To make this suggestion tangible, this chapter includes a case study describing how a student team, while learning DT, worked on the challenge to decrease the usage of disposable cups. This case study includes the workshop preparation, the course agenda, and the prototype BackCup, a deposit concept developed by the student team. Further, we illustrate how follow-up meetings with relevant stakeholders and the collaboration with a campus do-it-yourself platform raised awareness for the idea. Subsequently, we discuss how the team's efforts to implement sustainable solutions into the university's structures helped students to gain a better understanding of organizational dynamics. Future design thinkers learned that overcoming barriers towards sustainability requires several iterative process steps and the involvement of relevant stakeholders. For instructors who are interested to use a similar approach, it is explained how the DT course is integrated into the university's curriculum.

Introduction

Earth overshoot day, the annual date when humanity has used as many resources, as the world is able to renew, is antedated each year. In 2019, it was July 29, which underlines that human's usage of resources exceeds by far what the planet is able to repair. To tackle this issue, we need new and innovative ways to change behaviors within organizations and raise awareness for sustainable consumption on the one hand. On the other hand, it is important to educate the next generation of leaders to balance economic growth, social development, and ecological vitality. In this regard, universities take a critical role, not only because they educate these upcoming leaders but also because they provide a context in which newly developed sustainable concepts can be tested before they are transferred to larger society. Although this potential has been recognized (e.g., Sulkowski, 2017), concrete suggestions how a campus' sustainability could be enhanced are sparse (Disterheft *et al.*, 2012). Thus, we need tangible designs how sustainability can be implemented into university curricula.

Amongst the most crucial barriers that prevent the implementation of sustainable innovations into organizational structures are a lack of support from management and a lack of appropriate technology (Ávila *et al.*, 2017). Nonetheless, given the urgency to create sustainable solutions, waiting till these issues are resolved by structural changes is not an option (Tarrant and Thiele, 2016). Instead, we need creative solutions that circumvent these barriers and work in the existing parameters (Hill and Wang, 2018). One way to do so is by relying on participatory design interventions that involve those individuals that are expected to behave more sustainable into the problem-solving process (Disterheft *et al.*, 2015; Endrejat and Kauffeld 2018). Problem-based learning provides suitable and realistic methods how such a participatory approach can be taught to students.

However, the potential of problem-based learning is yet not fully applied in the higher education context (Leal Filho *et al.*, 2018). To fill this gap, we illustrate how Design Thinking (DT) education can be utilized as a problem-based teaching method to create new sustainability concepts. DT engages interdisciplinary student teams to experiment, prototype, gather feedback, and design innovate solutions for wicked problems (Brown, 2009). Such a teaching approach asks students not to be passive recipients but to get involved, gather new information, and create solutions that meet users' needs. Thus, teaching DT skills answers society's demand for creative teams who help to meet organizational sustainability goals (Razzouk and Shute, 2012).

To outline how DT education can be used to create solutions for sustainability that fit into existing university structures, we first give an overview of the concept of problem-based learning and how DT relates to it. Subsequently, we report a case study of a DT team that worked on the challenge to reduce the usage of disposable cups at their university. Next to a summary of the course agenda, we also elaborate on how the collaboration with a project partner, a do-it-yourself campus platform, helped to gain support for the prototype developed by the DT team. Finally, we discuss the implications that can be drawn from this case study and lay out how further studies might increase our understanding about how to diffuse sustainable innovations into university structures.

Approach: Design thinking as a problem-based learning method

Problem-based learning encourages critical thinking, decision making, and the ability to determine the critical aspects regarding a given topic what, in turn, fosters an exploratory mindset in learners (Melles *et al.*, 2015). DT can be understood as a specific way of problem-solving that asks students to consider the interests of the project partners as well as the people affected by a solution and incorporate these interests into their solution. Thus, DT has the potential to be an approach that grasps the complexity and unpredictability of social structures because the points of view from all involved stakeholders are simultaneously integrated in the process of designing a solution (Leifer and Steinert, 2014). In doing so, DT builds upon action research (Lewin, 1947), an iterative plan making and fact gathering approach for understanding and changing behavior. Confronted with a complex challenge or problem, a DT team adopts a user-centered perspective to understand how the behaviors of organizational members can be channeled in a desired direction (Gruber *et al.*, 2015). Thereby, it uses a predefined, iterative process that results in concepts or affordances (i.e. artifacts that depict a desired human-object interaction; Norman, 2013) with a strong emphasis on the user perspective. The inclusion of potential users is necessary because credible and feasible solution strategies are only developed in collaboration with the affected stakeholders

and do not arise form ideas developed by a lone genius. During this learning process, the role of an instructor is not, as in traditional teaching methods, to use top-down communication in a teacher-like manner but rather to become a facilitator. That means, instead of giving information and pointing out possible solutions, the facilitator provides an environment in which students can engage with self-determination in the solution process of real-world problems.

Furthermore, both action research and DT propose that a final solution is not attained through a linear process but rather iteration and feedback loops are necessary to integrate new insights. The iterative process applied in DT is a modification to classical problem-based learning approaches that rely on predefined and successive working steps. Another aspect that distinguishes DT from other problem-based learning approaches is that DT not only focuses on how a problem could be solved but puts equal emphasis on the aspects causing the problem and the factors stabilizing the current status (Razzouk and Shute, 2012). In other words, in DT understanding the problem is of equal importance as creating a solution. Instead of diligent analyzes and planning, there is a bias towards action. This is because, finding the correct answer for the wrong question is eventually a waste of resources. Thus, a DT team is encouraged to use the iteration steps to experiment which solutions might go in a direction that satisfies users' needs. This trial-and-error procedure requires a safe-to-fail, pragmatic experimentation climate (Tarrant and Thiele, 2016).

A complex, ill-defined challenge suitable to teach students DT would be to help a university becoming more sustainable (Kopnina, 2017; Shapira *et al.*, 2017). For instance, most students spend few thoughts to their consumption and waste, and when confronted with the consequences of their doing, many react with resistance (Savageau, 2013). Thus, we illustrate how DT can be applied to meet organizational sustainability goals on reducing the usage of disposable cups by integrating the perspectives of cup users.

Case study: How might we reduce the usage of disposable cups?

In Germany, there is an annual usage of 2.8 billion disposable cups causing massive environmental problems (Deutsche Umwelthilfe, 2015 [Environmental Action Germany]). The negative environmental impact of disposable cups is mirrored by the fact that even the eco-friendliest one-way cup is two times worse for the environment than the most unsound reusable cup (Pladerer *et al.*, 2008). Given these numbers, there is a clear need to find a solution that does not forbid coffee or tea drinkers to consume their beverages but does 'nudge' them away from the purchase of disposable cups. Taking these requirements into consideration, we set up a DT workshop to let students work on this complex real-life-challenge and generate solutions that meet users' needs and simultaneously help them to contribute to a more sustainable university. The whole process is depicted in Figure 1.

Workshop preparation: DT as a key skill

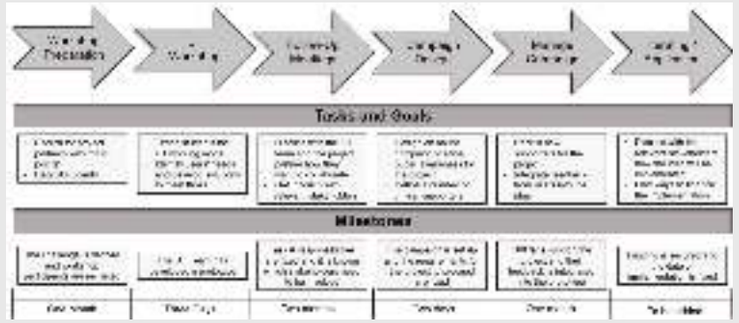

Figure 1. Overview of the design thinking process.

At Technische Universität (TU) Braunschweig (Germany), DT is integrated into the elective soft-skills curriculum. These courses are three-day workshops for students from all disciplines who receive course credit for their participation. These heterogeneous teams are a promising approach to work on a complex problem and due to divergent perspectives also requires members to develop their communication skills to function in interdisciplinary teams (Ávila *et al.*, 2017).

In accordance with the problem-based learning approach, we provide students not just with hypothetical challenges. Instead, we have developed various cooperations to introduce projects with real "pain points" that create an authentic learning environment in which students can gain the competencies to solve real-life challenges by creating a client-based project (Foster and Yaoyuneyong, 2016). The project partner for the cup challenge was Sandkasten (German for Sandbox), a campus do-it-yourself platform whose goal is to shape a campus that aligns with users' needs. Sandkasten enables organizational members not only to express their ideas but also helps them in realizing these ideas.

DT workshop: Teaching students to work in interdisciplinary teams

Our three-day DT training concept is based on the *field guide to human centered design* (IDEO, 2015) that consists of the three process phases inspiration, ideation, and implementation. In the next paragraphs, we explain the goal of each phase and what the DT team has accomplished during these process steps.

Inspiration: What are users' key needs? The first day began with an input from the course facilitator about the DT mind-set and several short exercises to make students familiar with the DT working mode. Subsequently, the group of fifteen participants got divided into three interdisciplinary teams, each working on a different challenge. For the sake of readability, we only focus on the cup project.

The team first reframed the challenge, meaning, they discussed how they could rephrase the task to make it more tangible. This step considers that concepts like 'sustainability' are usually too abstract to be worked on thoroughly (Kopnina, 2017). Afterwards, the facilitator provided an input about several methods that could be applied to collect insights of users' or stakeholders' perspectives, respectively. For the remainder of the first day and the beginning of the second day, each team split up into two sub-groups to conduct 'field research', using interviews or observational methods. These activities consider that change agents should be able to ask appropriate questions to grasp and understand the viewpoints of the involved stakeholders. While interviewing the student office, the team learned that the TU Braunschweig has a usage of 150.000 disposable cups per year, which underlined the relevance of the challenge.

Ideation: How to create solutions to meet users' needs? Following field research, the two sub-groups got together and shared their learnings and observations with each other. In a next step, the team had to select the most important insights that they gained during field research. These were: 1) users value the to-go experience, 2) users hesitate to bring their own cups with them, since this is perceived to undermine flexibility, 3) many users consume their beverage not far from the location of purchase, and 4) most users consume their beverages within the next 15 minutes after purchase. Follow-up questions regarding why the users that consume within or near the cafeteria hesitate to utilize reusable cups revealed that queuing up again to regain the deposit or having not enough money for the pledge are the major hindrances against reusable cups.

To make these insights more tangible, the students created a persona, which represents behavioral and motivational aspects of target users (Veryzer and Borja de Mozota, 2005). The key needs of this persona were rephrased into 'How to…' questions, such as *"How to design the usage of reusable cups as effortless as the usage of disposable cups?"* Through brainstorming sessions, the DT team created several creative ideas how these questions could be solved. The most promising ideas were elaborated further and transferred into prototypes.

Implementation: Turning an idea into an innovation.
At the beginning of the third day, the DT team tested their ideas by sharing the prototypes with potential users to gather feedback. The refined final prototype was presented to representatives from Sandkasten. This presentation summarized the process and insights that led to the final concept. Feedback from the project partner and from other DT teams was structured using special feedback sheets which provided the opportunity to add ideas on how the concept could be enhanced further. The workshop ended with an overall reflection about the learning experiences and newly acquired skills.

Follow-up meetings: Is there potential to bring the idea to life?
The final prototype, BackCup, is a reusable cup system that does not require to pay a deposit or wait in a queue. BackCup has a special bin design, formed as a long tube with printed cups on its top (see Figure 2 for an image of the BackCup prototype). These inscriptions avoid misuse as the new bins are placed closely to nearest garbage bins. Like regular garbage bins, BackCup should be emptied regularly.

Figure 2.
BackCup
prototype

To ensure that BackCup has the potential to become realized at the TU Braunschweig, the DT team and representatives of Sandkasten had several meetings to discuss how they want to proceed further and clarified the next process steps. Since the prototype also requires acceptance and support by the cafeteria staff, the team had meetings to take these concerns into consideration and involve this critical stakeholder group at an early stage (Tarrant and Thiele, 2016). For instance, the staff suspects that the bins will be soaked. This additional information led to to the printed cups along the tube. These should prevent users from putting their cups up-side down into the tube. Confronted with the question how the idea could be financed, the DT team developed a business plan based on the idea that the BackCup stands could be used as advertising spaces.

Campaign design: How to raise awareness and acceptance for the prototype

As a do-it-yourself campus platform, Sandkasten provides a website which is a participative tool for campus projects. The idea to make processes as transparent as possible and integrating users' feedback to increase the chances that prototypes become innovations (Leifer and Steinert, 2014). To promote their idea among students and staff, the DT team designed an online campaign, which required that 500 organizational members gave the idea their "Like" to proceed with BackCup. This quantitative mechanism aims to ensure that a prototype is supported by a critical mass before resources are invested in its realization (Sammalisto and Lindhqvist, 2008)

Manage the campaign: Gain further support from potential users

The duration of the online campaign was set to one month, but within five days the idea was supported by 500 fans that was the target number to start with the realization of the BackCup idea. To stay connected with their fans and get further feedback, the DT team posted updates of the project's progress. Furthermore, fans were also able to join and support the project, e.g. by providing their expertise.

Project application: Interweave the prototype into organizational structures

A DT team needs to consider an organization's culture to ensure an implementation and acceptance of the innovation (Michlewski, 2016). Coping with these aspects is necessary to educate students to become change agents who are dealing with the complexities of sustainability and 'soft' issues in organizational change management. Thus, Sandkasten offered the DT team access to the university's institutional network and enabled a meeting with the staff of the university cafeteria company. By making their project public via the online campaign, the team received cooperation offerings from the elected student representatives, NGOs like Greenpeace, and a reusable-cup-company. Currently, the BackCup team works on the laundry cycle and prototypes the return mechanism.

Discussion

This chapter described a case study on how to develop innovative ideas to reduce the usage of disposable cups at a university campus through problem-based learning approaches. It thereby adheres to the call to create new approaches and methods that take account for the transformative nature of implementing sustainable strategies. By using DT education, we build on Herbert Simon's (p. 111) bon mot that "everyone designs who devises courses of action aimed at changing existing situations into preferred ones". Applying this approach provides students with the opportunity to gain real-life competencies that they can use in other organizations to solve complex issues (Barth *et al.*, 2007).

We highlighted DT as an innovative and problem-based teaching method that fits into a university's curriculum and aims to develop both students' professional and interpersonal competencies. In the course of the DT training, students were encouraged to not only focus on the functional goal to reduce waste production, but also to tap into users' emotional spheres and gain empathy for their personal needs. Further, our DT training provides an example of how universities can integrate the topic of sustainability into courses that are usually unrelated to this topic. This aims at creating a connection in the minds of students between the subject in question and sustainable development (Sammalisto and Lindhqvist, 2008).

Theoretical and Practical Implications

The case study demonstrates that establishing collaboration between a DT team and a project partner with actual "pain points" can provide innovative solutions for a real-world scenario. While working on such issues, a team becomes motivated to learn and apply DT in a self-determined manner. By providing a challenge that affects a whole organization, students learn that complexity increases exponentially when several stakeholders with divergent interests are involved (Flood, 2010). In doing so, the students also acquired the competencies to cope with ambiguity: in a first step they learn to make a problem more tangible, so it can be worked on. Subsequently, they experience how it feels like when there is no predefined way towards a solution but how new information continuously impacts the process (Leifer and Steinert, 2014). By asking students to integrate their prototype into the organizational structures, they also learned other key skills such as creating a business plan or communicating with organizational members in a way that those support the developed solution.

Our educational concept can be used as an innovative teaching method in other universities and for other challenges. For instance, at the TU Braunschweig, DT teams also work on other sustainability projects, such as redesigning the allocation of office spaces to reduce energy consumption, a challenge provided by the facility management. Such ideas and concepts are also in line with—and support—broader efforts

such as *The United Nations Sustainable Development Goals* (Leal Filho *et al.*, 2017a; Leal Filho *et al.*, 2015). These goals include that the insights resulting from sustainability research are used by practitioners, such as understanding complexity as well as critically questioning systems, policies and routines that appear fundamentally unsustainable (Leal Filho *et al.*, 2015; Barth *et al.*, 2007). We provided several ideas how to contribute towards these goals by building on the beneficial effects of problem-based learning approaches as the theoretical foundation. By using the DT approach, practitioners can engage users to take part in the solution process, turning it into a bottom-up, participative method, rather than imposing changes top-down (Disterheft *et al.*, 2012). Moreover, by involving students and letting them reflect on the difficulties of how to motivate users to behave more 'greenly', our course educates future change agents to promote sustainability (Svanström *et al.*, 2012). In teaching a DT mindset, students are encouraged to work collaboratively, think critically, and apply systemic thinking which fosters the empowerment of students.

For universities that intend apply our approach and incorporate DT in their course curricula, we have three recommendations: First, qualified facilitators familiar with the DT approach and group dynamics are needed to guide students through the DT process. Second, universities should ensure the DT training can easily be integrated into the curricula. An extracurricular course program helps to ensure that they work in interdisciplinary teams. Third, an institutional cooperation network provides students to work with project partners that have real 'pain points'. In this way, students do not operate with hypothetical challenges but interact with stakeholders who need to be involved in the process. A do-it-yourself platform that supplies the resources and expertise to follow-up with an idea might be an optimal basis for such a collaboration.

Limitations and further course advancement

As TU Braunschweig's infrastructure was an important driver to foster the realization of BackCup, we cannot distinguish, whether project progress was due to the good idea and dedicated team members or the resources and support provided by Sandkasten. Nonetheless, previous research shows that the way in which intended change is communicated is important for its success (Ford *et al.*, 2008). Thus, an appropriate communication with organizational members that are affected by new ideas is critical to enhance the probability that DT projects become realized. Such an extension of the DT approach seems necessary, as thus far, DT does not fully unfold its potential to produce innovations (Arnold, 2017). Therefore, we encourage future research to consider combining DT education with motivational interviewing, "a collaborative conversation style for strengthening a person's own motivation and commitment to change" (Miller and Rollnick, 2013, p. 12) to advance DT projects. Whereas *motivational interviewing* originates from substance abuse treatment, it has been suggested as a suitable approach to improve existing management practices (e.g. team meetings, job crafting) related to organizational change (Güntner *et al.*, 2019). Motivational interviewing, as a solution focused communication approach aligns well with the optimistic and constructive DT mind-set. It emphasizes that people are not likely to embrace changes when these are imposed on them. Instead, motivational interviewing rests on exploring individuals' motives by using specific communication methods such as open questions, reflective listening, and affirmations. These basic competencies serve to understand others' needs, build up interpersonal trust, and help users co-create which aspects of an idea would enhance their motivation to change their routines (Miller and Rollnick, 2013). Therefore, we argue that teaching DT teams motivational interviewing communication methods would answer previous calls for expanding designers' empathic horizon to create innovations that meet users' needs.

Furthermore, the DT team worked on the challenge to reduce the usage of disposable cups at their university. This is a narrow and specific problem definition, as the team did not further question fundamental assumptions related to the issue of today's disposable food and beverage culture as a general societal issue. Therefore, we think it would be interesting to see in how far a more experienced DT team would take a more holistic perspective when the goal is to cut out single-use cups and re-define the challenge to tackle a problem's core.

Conclusions

Aligning a course agenda towards solving sustainable issues while preparing students to become change agents in a complex world is an efficient way to approach environmental and educational goals. As an idea how to use these synergies, we described how a student team that learned DT created a prototpye (BackCup) to reduce the usage of single-use cups at the TU Braunschweig.

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Design meets neuroscience: Future directions for developing and implementing design probes

Melanie Flory and Ninela Ivanova

Abstract

The frontiers of design and neuroscience are rapidly shifting as a result of recent advances in neuro-technologies, and the pivotal role user experience design plays across a wide range of analogue and digital applications at individual, community, and global level. These applications range from learning and education interventions to innovation of large-scale healthcare options. Every day new frontiers are forged as neurobiologists and cognitive scientists look beyond the mere structure-function neuronal correlations of thought, emotion, and behaviour. This has direct impact for design research and design-led probe development. Translating this growing evidence-base through a mind well-trained in critical, rigorous, and creative thinking, and an attitude of equitable collaboration and mutual respect, heralds immense potential for unfolding ground-breaking design probe applications through the intersection of neuroscience and design.

Introduction

In 1999 when Bill Gaver and colleagues put together a variety of cultural probes for presentation to a group of ten elderly residents of the small village of Peccioli in Italy, their intent was to gather "inspirational data" (Gaver Dunne & Pacenti, 1999, p.21) through provoking, inspiring, engaging, and assisting participants via probe artefacts, to share their thoughts, ideas, feelings, desires and lived experience of being an elderly resident of that town. This creative endeavour in engagement design came about in response to a European Union funded research call to develop technologies that would facilitate increased presence of the elderly in their local communities. These beginnings and subsequent applications of design probes in varying contexts ranging from experience of living with dementia (Wallace et al., 2013), to dealing with bereavement (Massimi & Baecker, 2011), establish context, i.e., the bigger picture, the ground, the soil, the zeitgeist so to speak, as the primary and preceding factor that gives meaning, purpose and value to design probes and designing probes.

Given that context is the seed from which the process of developing and designing probes begins to sprout and grow highlights the need to clarify the cross-disciplinary underpinnings of this paper.

Ours is a multidisciplinary partnership – a space – in which design and neuroscience intersect to innovate and create pathways to better experiences and improved futures for individuals and organisations. On a day-to-day basis we live the experience of the 2016 Design Research Society's (DRS) future-directions call for "rigorous interdisciplinary collaboration" (Atkinson & Rae Oppenheimer, 2016, p.2) between designers and members of other disciplines.

In practical terms this means developing a mutual respect and openness to central concepts, ideas, insights, methods, practices, and vagaries of each other's discipline. These are also qualities of an empathetic

mindset which is at the very heart of user experience design. A case in point that is directly relevant to the theme of this paper is how design and neuroscience define and think about probes.

Design Research or Research Design?

Design and neuroscience as disciplines with their respective distinguished and experienced practitioner communities, view and relate to probes with discipline-related understanding that includes differences and commonalities. In designing and presenting probes to a specific population, our approach has been to:

- Embrace the added levels of complexity that emerge in any multidisciplinary research or collaboration (Flory & Ivanova, 2019);
- Explore conflicting perspectives (Hooper et al., 2013), and;
- Strive to create pathways that lead to rich user experience by interweaving the methodological approaches, underlying philosophical and scientific perspectives, and research and practice culture that inadvertently influence and drive research, design and intended outcomes (Flory & Ivanova, 2019).

Beginning with definitions, an often-quoted definition of design research which includes the application of probes in design research, is that of Jane Fulton Suri (2008, p. 54):

> *"Design research both inspires imagination and informs intuition through a variety of methods with related intents: to expose patterns underlying the rich reality of people's behaviours and experiences, to explore reactions to probes and prototypes, and to shed light on the unknown through iterative hypothesis and experiment."*

Fulton Suri's definition of design research includes the words "research", "imagination" and "intuition" in the same sentence. This is an anomaly in terms for the scientist whose research training is in controlling as many variables as possible that might "interfere" with the research aim and objectives. Has the scientific landscape shifted at all from this paradigm? In the last two decades, design research has been steadily gaining recognition and application in some areas of scientific research and application (Sandoval, 2014). It is however, referred to by terms such as, "design-based research" and "design experimentation" (Sandoval and Bell, 2004). For the science community, this terminology ensures that design research, i.e., design discipline research methodology, is not confused with the systematic scientific methodology of "research design".

The role of design research has been especially appreciated and applied in the learning sciences where designers work with educational psychologists to innovate novel and creative environments and approaches to learning, problem solving, improved memory and

focused attention in the classroom and other formal teaching and learning settings (Anderson and Shattuck, 2012). Thus, through design interventions that are developed for real-life educational contexts, learning research scientists and educational psychologists are able to develop relatable and usable theories of education, training and learning. The cross-pollination of design thinking with its attending research methods and processes have been pioneering pathways to fulfilment of the DRS's call for interdisciplinary collaboration and co-creation via multidisciplinary project teams in the field of educational psychology.

In educational research, the remit of scientist and designer differ. In the case of design probes, the overall design thinking, methods and processes adopted by the designer is guided by the question, "what effect am I looking for on user thinking, behaviour and experience?" (Penuel & Frank, 2016). User experience in the context of the classroom is therefore the conceptual basis for designer engagement, innovation and creativity in this case. Beyond the remit of learning science however, user-centred design probes that enable positive experiences through creative activities have been introduced in a diverse range of contexts and projects addressing the needs of vulnerable populations such as the elderly (Mattelmäki, 2003), the deafblind community (Ivanova, 2015), survivors of domestic violence (Clarke et al., 2013) and vulnerable women in secure hospital settings (Thieme et al, 2013). Hannington's Human-Centred Design Model (2003) succinctly sums up the design probe and probe design approach as creative, participative, visual, requiring cognitive, emotional and behavioural engagement of both the designer and the user, in order to extract and yield understanding of patterns, themes, affinities, aversions, and other cognitive and behavioural responses.

In scientific disciplines ranging from earth and space science to biological life sciences, probes are designed technologies used primarily for collecting information and data. Twenty-first century space probes, DNA probes, neural probes – and an ever-growing list – are all technology-based innovations aimed at detecting, diagnosing, decoding, mapping, measuring, and monitoring patterns, connections, anomalies, changes, and activities of their host. Probes in their own wake contribute to developing and expanding the scientific research and knowledge base. They play a major role in developing solutions to current and recurring problems, predicting outcomes, and informing future scenarios planning (Flory, reflective journal, 2014 - 2019).
Blending the best features of design research and design probes with research design and research-based outcomes of design and neuroscience respectively, has led Flory to establish Neuroscience for Design Worldwide (NfDW) – a consultancy wherein the integration of neuroscience and design is focused on raising the potential to design creatively and efficiently for human health, happiness, behavioural change and user experience (MindRheo, 2019). This multidisciplinary model of practice and application depicted in Figure 1 is about fulfilling

the aim of expanding the role of design research and design probes in scientific enquiry, clinical applications, and subjective wellbeing. This is demonstrated through the Emo-TTM and SwatchathinkingTM probes the authors developed and applied in 2015 (Flory & Ivanova, 2016), and continue to do so, in a variety of circumstances.

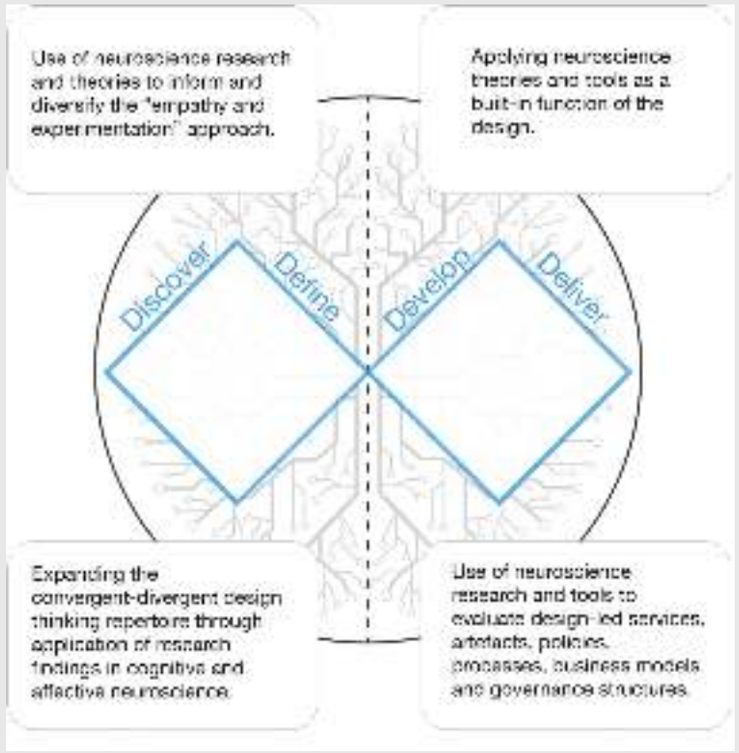

Figure 1. Neuroscience for Design Model 1

P.R.O.B.E.S.

When we the authors met in 2014, Ivanova was in the writing up phase of her doctoral research. The pivotal objective was to introduce a wearable probe – in this case a globally recognised garment – the T-shirt – to advance engagement and understanding of challenging concepts related to novel materials and sensory experience (Ivanova, 2015). Flory, who had founded MindRheo in 2010 had been developing and delivering neuroscience-based workshops and training tools aimed at stimulating brain plasticity for personal and organisational development and advancement. She was also exploring innovative and novel ways to enrich the learning experience, growth of self-awareness, sense of agency , and other personal and organisational transformative change components of her practice. The design probe with its empathetic user-centred approach to engagement, personal context, and guided exploration (Mattelmäki, 2003; Wallace et al., 2013; Ivanova, 2015), she felt, was the perfect fit for purposive and strategic activation of

brain plasticity in a range of personal and organisational transformation projects. Over the last five years Flory and Ivanova have collaboratively researched, designed, developed and delivered a number of design probes aimed at improving emotional intelligence, subjective wellbeing, sense of agency, and cognitive and emotional reframing.

Design meets Neuroscience which is a lived experience in multidisciplinary working and collaborative design for us, has yielded a six-component design probe model depicted below (Figure 2). It captures the planning, research and operational phases and processes in our development of design probes.

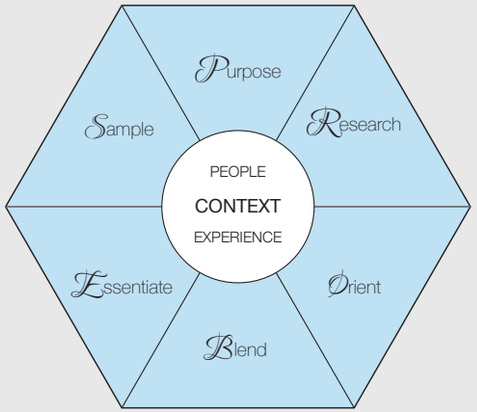

Figure 2. Six-component process model for developing design probes

Context

Tennant (2017), a palaeontologist, defines the term context in the context of research, as "The circumstances that form the setting for an event, statement, or idea, and the terms of which it can be understood." In terms of design, Esser (2019) advises that "it is essential to understand users and the context in which they will use your design." These perspectives demonstrate agreement between the scientist and designer that research, design and implementation are all primarily rooted in context. An example of the context mapping, which is presented in Figure 3, shows the initial mapping exercise for

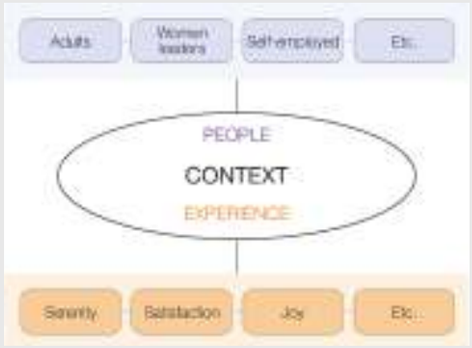

Figure 3. Context of Design Research / Probe

the first design probe – the Emo-TTM – which we developed in 2015. A fuller exposition of the Emo-TTM appears in the section entitled Multidisciplinary Beginnings.

Mapping the people and user experience context through this simple but effective method gives clarity regarding two central themes of "user group" and "user experience" remits for the designer, and direction to the scientist regarding the evidence base to consult and draw from.

Six-Component Process Model for Developing Design Probes

The six-component PROBE mapping exercise is in effect, a blueprint for developing design probes. Similar to an architect's plan, this mapping model (Figure 4) provides an at-a-glance design brief for the probe. It's the blueprint against which both designer and neuroscientist can exchange and blend their ideas, knowledge, expertise and efforts to optimise – in this case – user engagement and experience, in utilising imagination to expand emotional intelligence and emotion regulation.

Figure 4. Six-Component Process Model derived from developing the Emo-T™ Probe

The value of design probes which are a synthesis of empathic inquiry, creative play and iteration, in collaboration with cutting-edge psychology and neuroscience, has exponentially added value in provoking and precipitating human cognitive, emotion, and behaviour changes at personal and organisation level. Neuroscience for its part, must rise to a better understanding of the potential for design – of a building, healthcare service, or crime reduction intervention, for example – to influence and engage human beings (Flory & Ivanova, 2019). Our experience in adopting an agile, inclusive, multidisciplinary

approach that is a willing sharing for the betterment of the user, is one of the future directions that applies equally to design and designers, and neuroscience and neuroscientists.

Contextual Beginnings: The T-probe

The contextual underpinnings of our multidisciplinary collaboration in developing design probes began with Ivanova's doctoral research project. It is an essential component in the storytelling of our history together of design probes and probe design.
In her fashion-based research inquiry, Ivanova (2015) chose the T-shirt – which she later termed "the T-probe" – to explore participant engagement and response to novel materials and related sensory experience. The following two sections provide examples of the inquiry in practice.

Novelty and User Experience

In relation to novel materials such as fungi-based textiles as an emerging proposition for sustainable fabrics, the challenge was two-fold: novelty, and negative associations such as decay and deterioration, e.g., with moulds (Figures 5 and 6). These cognitive associations and attitudinal mindset would have to first be overcome in order for such types of materials to be introduced successfully and ethically in the future of high street culture.

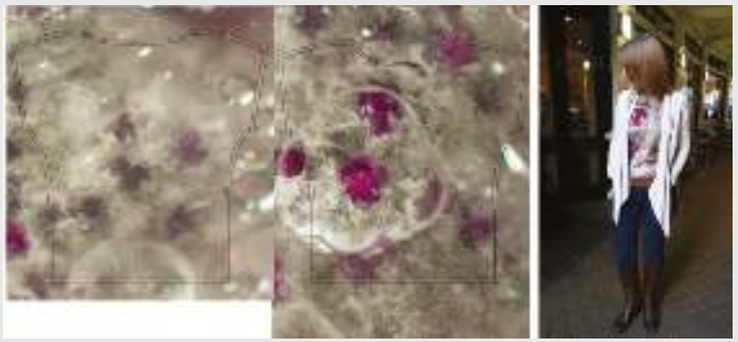

Figure 5 and 6. A 'Mouldy' T-shirt designed by a research participant and then worn in social situations. The T-probe was used to engage participants creatively with mould-based designs by transposing the 'raw' engagement with mould-based visual stimuli to designing an actual garment that they would wear in social situations.

Sensory Experience of Inclusion

In relation to fashion experience, a group of six young adults with dual-sensory (deafblind) and cognitive impairment, a user group who are currently not catered for in mainstream fashion, were introduced to the experience of choosing one's own clothing (Figures 7 -11).

The research aimed to test whether the T-probe could be applied with agility to fulfil a range of design and research intentions at various points of engagement throughout the project, e.g.:

- in participatory workshops, to elicit engagement and gather participant feedback and response;
- in post-workshop settings where participants were required to wear the probe in day-to-day settings such as cafés and at work, and note down any responses and engagement with it by the public;
- in enabling the research and the wider design community to engage with novel ways of thinking about fashion materials and design;
- in scoping ways for probes to be implemented within stakeholder engagement and education;
- in advancing understanding of fashion-led probes.

Figures 7 to 11. Deafblind participants creating their T-shirts with support from communication guides. Techniques included textile collage, image transfers, and direct painting / drawing onto the fabric.

The literature on design probes revealed very few examples of fashion-led, or 'wearable' probes, which could fulfil the above intentions. Such probes often address technologies and experiences that appear foreign and within the realm of science fiction (Philips, 2006; Philips, 2008). In considering how design probes of such speculative value could be developed within a methodological framework, the practice of designers Helen Storey and Becky Earley appeared more closely aligned with the intentions of the research. Storey's Field of Jeans (Story & Ryan, 2012), and Earley's 5 Ways and Top 100 projects (Earley and Fletcher, 2003; Earley, 2014) evidenced the potential of everyday, ubiquitous garments such as jeans, scarves and shirts, in creating platforms for discussion and engagement, and eliciting a shift in attitude and perception. The wearability of such garments provides an accessible point of reference to a wider research demographic. Their everydayness presents a relatively culturally neutral ground for discussing novel and complex ideas. Additionally, their replicability and customisability can be quickly employed as a blank canvas for the development, exchange, and communication of ideas.

Therefore, the research required a probe that:

- could be worn by a diverse demographic;
- was culturally familiar, yet versatile, customisable, and capable of operating within a wide range of social situations;
- was aesthetically simple and neutral, and could serve as a 'blank canvas' or framework for the exploration of new ideas;
- would elicit imaginative engagement;
- fulfilled both a research intention to study user perception, and the design intention to advance understanding and engagement.

> *"Identity, community, difference, gender, sexual preferences, political affiliations, humor, corporate slogans, support for causes, product endorsements, religious beliefs, profundities, athletic teams loyalties, school and college links, travel trophies – T-shirts say it all." (O'Connor, 2010)*

The 'humble' T-shirt, which is universally worn around the globe, and has been historically used as a bridging mechanism to address a variety of challenging topics, e.g., in political and environmental campaigning, in advertising and activism (Talbot, 2013), fulfilled all of the above and was a natural choice as best fit for this research.

During the course of this research enquiry (2011 – 2015) Ivanova had gained invaluable knowledge and practice in contextual alignment and sourcing, and developing relevant materials and artefact-fit to context.

Multidisciplinary Beginnings: The Emo-T™

Emotional intelligence (EI) was a term first used by Salovey and Mayer in 1990 to describe the human ability to master one's own emotions and understand and influence the emotions of others. Over the last three decades much has been written and researched on the subject resulting in evidence-based applications for clinical and non-clinical settings. These include a diverse a range of subjects from post-traumatic stress disorder (PTSD) and depression, to political negotiation and marketing. Prior to these authors meeting each other, Flory, whose client base included combat-related PTSD survivors had repeated clinical experience of military personnel "putting on a brave face" and "carrying on as normal" whilst supressing feelings of sadness, alienation, insecurity, fear, and lack of identity. This was in direct contradiction to the popular belief and EI discursive theory that quoted consistent alignment between outward expression and behaviour and internal emotional experience. To Flory's relief, EI research carried out in Dr Barrett's lab (2011, 2017) at Northwestern University in Illinois, resulted in the categorical statement: "we have misunderstood the nature of emotions for a very long time." Through a series of studies, Barrett and colleagues discovered that face and body language which are taken for granted to gauge emotion in ourselves and others, are not as straightforward and reliable as they are alleged to be. Flory interpreted

these findings as an exciting new opportunity for incorporating creative and novel ways of addressing the EI component of her clinical and non-clinical practice which includes workshops, learning and development, and organisational consultancy.

Together, Flory and Ivanova's mutual appreciation for the agility of the T-shirt as a probe in a variety of participant engagement settings, led to a series of brainstorm, discussion, and futures-thinking sessions which resulted in the co-creation of the Emo-T™ probe.

As they bounced and blended ideas and discipline-related knowledge and expertise, they were convinced that a T-shirt probe would be an apt item for developing self-awareness and practical learning of EI. Flory's expertise in neuroplasticity, which is the innate flexibility of the brain to form new neural connections throughout life in response to new learning and behaviours, resonated with Ivanova's use of probes to change perception, behaviour and mindset.

The resulting Emo-T™ probe is a creative, fun, relatable, and inclusive way for people across different continents and demographics to feel connected as they collectively learn and train in cultivating and nurturing specific positive emotions and felt-experience (Figures 12 and 13). Evoking and regulating emotion for personal wellbeing and health, we envision, could become a personal practice and art through creative and intelligent design and application of this and other probes, which we continue to develop.

Figures 12 and 13. The Emo-T™ probe used in a group setting to stimulate and elicit specific positive emotions

The Emo-T™ probe is rooted in the neuroscience (Barrett, 2011 and 2017) of emotion and inclusive design thinking and practice. It's a probe that flips the design-to-provoke-emotion concept used in marketing and moviemaking, to emotion-inspired design. The aim is to engage and activate creative imagination related to a positive-feeling emotion, e.g., joy or excitement, which in turn creates a "felt response". Research by leading neurologists and neuroscientists are increasingly uncovering the role that specific emotions and feelings such as empathy, joy, and gratitude play in decision-making, creative thinking, positive self-image, leadership ability, and personal and professional accomplishments. In our workshops, using the Emo-TTM

probe, participants are able to evoke and memorise their experience of positive feeling social interaction or wellbeing emotions.

The Emo-T™ is a paper or cardboard T-shirt which "probes" participants into visualising and imagining that the T-shirt is a self-designed wearable emotion. In "wearing" an emotion of their choice, i.e., one they wish to experience, practice, and express through creative media, the brain registers the information and stores the memory for recall at a later time.

Using creative imagination to evoke a wellbeing emotion, participants express their internal experience through designing the T-shirt via drawing, writing and other artistic media. This creative exercise can take 5 to 10 minutes from start to finish which is an important factor in ensuring emotion-memory retention for future recall. More importantly, participants come to recognise that they have a distinctive felt sense related to a specific emotion. This is like a unique signature.

It is not uncommon for participants to report that a particular bodily sensation that they had been associating with fear or anxiety, is now recognised and understood as positive anticipation and excitement. This personal understanding and cognitive reframe not only bears out Barrett and colleagues' findings (2011), but more importantly, it has expanded the user's EI repertoire and ability to self-regulate emotion through recall and association. Maintaining a visual journal of these T-shirts helps participants to conjure up the emotion instantly through visual association.

The Emo-T™ has been well-received in the boardroom, classroom, leadership, branding and sustainability workshops to date. Our intention is to collate a million Emo-Ts which will become a design portfolio demonstrating the emotion-expression-design connection, whilst also serving as an artistic global platform for future education and training in the development of EI. We call this project the Emo-T™ Global Wall.

Figures 14 to 16. Participatory engagement with the emotional experience of "confidence", having reported a previous emotional experience of "chaos" in relation to academic performance

Co-creating and developing the Emo-T™ probe with a designer (Ivanova) has been a novel and freeing-up experience for Flory (2017). Departing from the traditional experiment, data collection, analysis and interpretation practice within scientific enquiry, and putting personal experience at the centre of the research aim and design has brought new insights about the importance of personal experience and meaning, and the symbiosis between positive self-expression and self-agency.

SwatchaThinking™: The Reframe Probe

Texture is ubiquitous and a major portion of the sensory input that we receive every day (Liu et al, 2015). Touch and texture perception cause sensory receptors in the fingers and hands to send information signals up the arm which results in corresponding patterns of activation in the brain. Human beings interpret this as sensation.

Exploration, discovery and coming to sensory conclusions about the world we live in through touch and texture perception begins in early childhood. Toddlers explore their world through hands-on sensory engagement. This learning continues into adulthood. Sensory information stored away in memory from childhood and current lived experiences determine attraction and avoidance preferences with accompanying emotion-based responses. Social media capitalises on these responses through the emoji culture.

Flory had been mulling over the possibility of texture perception and association with cognitive and emotion reframe during the course of her work with PTSD survivors for over a decade. The idea of rekindling and evoking the early childhood instinct for play and exploration through positive-feeling touch periodically surfaced from the ignored recesses of her mind. Ivanova's tacit knowledge of the sensory qualities and feel of materials accumulated through formal education and practice in fashion and textiles was essential in translating these ideas and insights from neuroscience into a palette of fabric swatches to be used as tactile stimuli to reframe cognition and emotion. Over a period of several months spanning 2015 and 2016, the SwatchaThinking™ probe was born.

Ivanova, choosing a variety of fabrics with varying texture, weight, drape, temperature and so on, set up a user-experience design grid of textile materials. Together, the designer and the neuroscientist began to ideate the engagement-association effect of these materials on emotion and thought. The SwatchaThinking™ probe (Figures 17 and 18), nudges participants to engage with the various textures in the swatch to reframe thoughts and feelings about topics and areas in their life that generate feelings of frustration or stagnation. The self-learning and training through voluntary engagement helps in developing new understanding, new perceptions, and better emotional experience.

Figures 17 and 18. Participants engaging with the Swat-cha-Thinking™ probe at a Company "futures-thinking" workshop. Image courtesy of Ezzidin Alwan.

After four successful trials, the probe continues to be well received and used by participants to reframe aspects of thinking and emotion about topics ranging from the personal to the global.

A documented example of the SwatchaThinking™ probe in action is that of a female entrepreneur struggling to bridge the gap between bootstrapping and competing against her "betters" for funding investment. She reported battling feelings of loneliness – an experience that often accompanies early start-ups. She was asked to choose a material in the swatch the "feel" of which was a good fit for her emotions. Beginning with the fear-evoking thought of "there's no money in the bank" and associating this thought with the tactility of coarse-grit abrasive sandpaper, she progressively shifted to softer fabrics like cotton and silk chiffon. With this fabric came new thinking ("Actually, I have enough to get by") that then progressed to personal, professional, and global insights about money, monetisation, investment, and so on. This entrepreneur thus began an organic process of reframing her relationship with money and the creative leadership her business demanded.

Strategic reframe can remain a purely intellectual exercise in a clinical or therapeutic setting. True internal shift begins with a shift in emotional association which is then expressed through new behaviours and habit formation. Reversing a top-down reframe approach through using touch to identify where one is, and then identifying a new texture or texture range that one wishes to arrive at in their lived-experience, begins the reframe process of "changing one's mind."

Our research, design and implementation efforts on the SwatchaThinking™ probe continues to progress and evolve.

Design Meets Neuroscience: Future Directions

The frontiers of design and neuroscience are shifting at a rapid pace every day as these disciplines continue to evolve, expand the remit of their applications base, and form cross- and multidisciplinary teams and partnerships across the globe to develop better futures and new experiences for people and communities. Recent advances in neuro-

technologies and designer-led applications ranging from encouraging environmental awareness (Gaver et al., 2013) to mobile health interventions (Poole, 2013) have placed both these disciplines at the centre of the ever-expanding Industry 4.0 world we live in.

Every day new frontiers are forged as neurobiologists and cognitive scientists look beyond the mere structure-function neuronal correlations of thought, emotion, and behaviour. Understanding this growing evidence-base through a mind well-trained in critical, rigorous, and creative thinking heralds immense potential for ground-breaking applications and multidisciplinary collaboration. In adopting a translational approach in sharing knowledge and cutting-edge research, and embracing an equitable stakeholder attitude in multidisciplinary endeavours, scientists can significantly increase the potential for creating and implementing innovative, novel and mitigating solutions to global problems and crises ranging from hunger and nutritional deprivation, to the worldwide increase in recurring or early onset ill health problems expressed through coronary disease and depression. Designers have a major role to play in this futures direction agenda. At the heart of the designer mindset and focus is empathy-driven user engagement and the "experiencer" who is best informed to provide the key for scientists and designers to develop ideas, insights, hypotheses, pathways, and quantum leaps that result in positive changes and improvement.

Proliferating the knowledge transfer "space" with inter- and multidisciplinary workshops, research, think tanks, conferences and expert panels is an essential in the way forward for design research. Building and strengthening communities of people actively engaged in multidisciplinary research and design, collaboratively addressing key issues and possible solutions, building bridges that remove barriers to understanding and cooperation between disciplines is no small task. The authors endeavour to do this through their collaborative partnership.

Charles T Munger, the world-renowned investor and businessman considers multidisciplinary partnerships the key to successful outcomes. Munger's words (2005) succinctly summarise our own experience of working together:

> *"If you skilfully follow the multidisciplinary path, you will never wish to come back. It would be like cutting off your hands."*

Although we're still in the early stages of the Design meets Neuroscience paradigm, every day reveals new opportunities and potential for complementary and compatible intersection between the two disciplines. Cognitive and affective neurosciences in particular have the capacity to inform and clarify design-related decisions involving emotions, mental associations, and affective response. In this way the "empathise and experiment" approach is fulfilled through multidisciplinary exchange.

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The ontological nature of design: Prospecting new futures through probabilistic knowledge

Fernando Galdon and Ashley Hall

Abstract

As design thinking evolves we are beginning to develop a clearer idea of its relationship to other domains of thinking and in particular its specific ontological nature. Here we consider design's special relationship to the future and how concepts of anticipation, probabilism and prospectivity underpin a new understanding of design's relationship to cross-domain collaboration potential. In effect we discuss how design cares for the future of transformation in an era where rapidly advancing technologies via exponential technological developments are challenging human-machine interactions. Probabilistic knowledge emerges as an ontological reality for addressing the intrinsically abductive nature of future design research. Ultimately this approach implies a different form of knowing and aims to position design research as the discipline better prepared for addressing the future.

Introduction - The ontology of design

Design approaches have been compared to and categorised among the sciences, arts and humanities. For instance, Snow (1959) defined the separation of the domains of knowledge into the sciences and arts and humanities. However, the design discipline can be seen as having its own distinct way of understanding the world. In classic Greece, Aristotle classified knowledge into three categories: the theoretical, the practical and the productive (Atwill, 2009, pp. 165-166). Therefore, positioning productive disciplines such as design in its own dedicated practice, distinctive from the aforementioned sciences, arts and humanities. Design's intrinsic approach based on planning, solution-based problem solving, problem shaping, synthesis, preparedness, readiness and appropriateness in the built environment determines a different way of knowing.

In this context, Archer (1978) went some way to proposing design as the third culture of thinking fulfilling Snow's challenge to 'fill the vacant plot'. Cross developed this further in his seminal paper Designerly ways of knowing building on Archer's work at the Royal College of Art. He describes a third culture as:

> *'…the collected experience of the material culture, and the collected body of experience, skill and understanding embodied in the arts of planning, inventing, making and doing'. (Cross, 1982, p. 221)*

In the process, Cross differentiated design from the sciences and humanities by comparing the terms of different kinds of phenomena studied in the three cultures; the sciences focus on the natural world, the humanities on human experience and design on the man-made world. He also differentiated among the appropriate methods to approach each 'culture'. The sciences use controlled experiments, classification and analysis, while the humanities use analogy, metaphor, criticism and evaluation, finally, design uses modelling, pattern-formation and synthesis.

In terms of the values of each culture, the sciences aim for: objectivity, rationality, neutrality, and a concern for 'truth', whereas, in the humanities the aim is for: subjectivity, imagination, commitment, and a concern for 'justice'. Finally, in design practitioners aim for: practicality, ingenuity, empathy, and a concern for 'appropriateness' (Cross, 1982, pp. 221-222).

Archer proposed design as a third way of knowing in 1978, however, this proposition was previously presented by Aristotle in the form of productive knowledge in several works (Physics, Nicomachean Ethics, Rhetoric and Metaphysics) more than two thousand years earlier. Productive knowledge is defined by Aristotle as "identical with a state of capacity to make, involving a true course of reasoning" (Nicomachean Ethics 1140a10-16). In this type of knowledge, the "origin" resides "in the maker and not in the thing made" (Nicomachean Ethics 1140a10-16). Like practical knowledge, prospective knowledge deals with what can be "otherwise". However, practical and productive knowledge have different goals.

In practical activities such as ethics, politics or art, goals are directed toward the end. Whereas, productive practices are directed towards means, and knowledge is neither in the user, nor the producer. In this paradigm, neither of them is capable of determining productive knowledge (Nicomachean Ethics 1140a11-13). It is defined by an act of exchange (Metaphysics 1033a24-26). Which always redefines the subjects involved by effecting a shift in power and status. This type of knowledge resides in its transformational capabilities. It is concerned with competing standards of value rather than securing boundaries of knowledge. Its ontology is indeterminate as it is based on potentialities or alternative possibilities (Rhetoric 47;7357a4-5). Things that can be otherwise. It cannot transcend time as it depends on time, circumstances and contexts, therefore past, present and future exist. Knowledge is always "outside itself" residing not in the "product" but in the use made by a receiver or audience. It is defined by an act of exchange. It has no external arbiter and no final judge. Only users and makers who change with exchange. It is transformational in nature.

This lack of historical research beyond design may have prevented Cross from proposing why there is a dichotomy among scientific and humanistic knowledge and why design, as an embodiment of productive knowledge has been out of the picture. Atwill, building on Ball's (1977) critique of theory/practise opposition argues that in the 19th and 20th centuries the "post-enlightenment perspective of knowledge fostered the binary opposition of theory and practice, which only further obscures the place of Aristotle's (productive) knowledge" (Atwill, 1998, p. 163)

Additional contemporary arguments can be found in Lawson differences among scientist and designers/architects;

> *"the scientists focused their attention on discovering the rule, the architects were obsessed with achieving the desired result. The scientists adopted a generally problem-focused strategy and the architects a solution-focused strategy." (Cross, 1982 p. 223)*

In this context, the scientist does not have a client and architects cannot work without a client. As described by Aristotle; knowledge is in the exchange and not at the end result. Furthermore, the designer's role demands to 'go beyond' what already exist. This ontological demand differs significantly from science. Building from Levin:

> *"The designer knows (consciously or unconsciously) that some ingredient must be added to the information that he already has in order that he may arrive at a unique solution. This knowledge is in itself not enough in design problems, of course. He has to look for the extra ingredient, and he uses his powers of conjecture and original thought to do so". (Cross, 1982 p.224)*

Another fundamental element that is missing in Cross's analysis is its temporality or timeframe interventional positioning. In this area John Chris Jones, one of the first design science theorists postulated in his seminal book Design Method that design was different from the arts, sciences and mathematics. In response to the question 'Is designing an art, a science or a form of mathematics?' Jones responded:

> *"The main point of difference is that of timing. Both artists and scientists operate on the physical world as it exists in the present (whether it is real or symbolic), while mathematicians operate on abstract relationships that are independent of historical time. Designers, on the other hand, are forever bound to treat as real that which exists only in an imagined future and have to specify ways in which the foreseen thing can be made to exist." (Jones, 1992. p. 10)*

From these perspectives we could position design as a prospective thinking activity in the context of abductive reasoning (making decisions without having all the information). In this area research by Dorst (2011) or more recently Cramer-Petersen et al. (2018) have concluded that design combines deductive and abductive reasoning, however in both cases abductive reasoning plays a fundamental role as the initiator of design activity. Without abductive reasoning there cannot be deductive as there would not be anything to reason from. Furthermore, as the digital paradigm with its exponential development and network uncertainty will become more prevalent for design and research, researchers will need to focus more on the preventive and prospective aspects of design (preparedness, readiness and appropriateness). In

this context, the deductive becomes limited by access and abductive reasoning aspects becomes more dominant, prevalent and necessary.

Design's intrinsic prospective approach, based on planning, solution-based problem solving, problem shaping, synthesis, preparedness, readiness and appropriateness in the built environment determines a different manner of knowing. In this scenario the designer is neither a scientist nor a sociologist as they are projecting what is yet to be known. Therefore, knowledge cannot be empirical nor observational, but as Aristotle stated; transformational. Consequently, its output is based on potentialities not certainties. In the same way that anthropology is not about facts, but approximations which are updated as new information emerges. As Glanville proposed, 'knowledge for' future action and transformations rather than 'knowledge of' past actions and events (Glanville, 2005). This position connects to John Chris Jones's statement above (1992. p. 10). In this context, as the life of the intervention is placed into the future, the time to assess the impact of the design is extended during its lifetime and forever bounded to its environment. In this context, validation is always a posteriori, and the proposed output becomes the main element to be assessed. This intrinsically argues that knowledge in design is probabilistic in its nature.

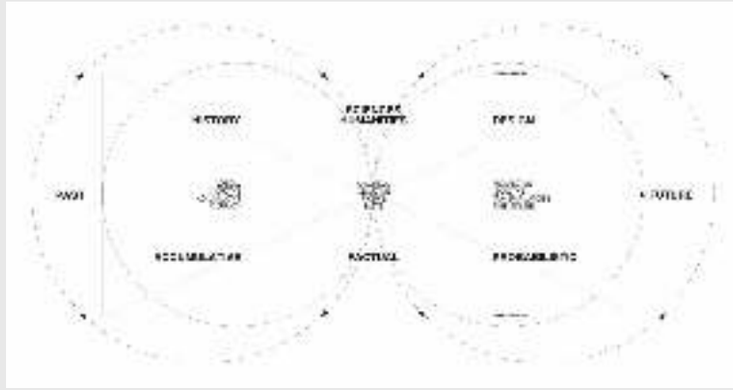

Figure 1. Knowledge and time. Fernando Galdon (Galdon, 2019).

This argument is extended and explored in three applied examples of a prospective nature in the forms of actions, practice and products that demonstrate probabilistic future knowledge aimed at underpinning a proposed new framework.

Method - Examples and Prospective Actions

Recently, due to emerging technologies transforming the future of our cities, the Swedish government decided to investigate future housing typologies. They selected a plot of land and invited a range of architects to present proposals for addressing the rising concerns around sustainability and mobility. Some of these proposals were completed by 2018 (Mallet, 2018). The experiment was finished however we do not know whether these new typologies are adequate or not as we need to

wait another 10 years to find out. As proposed by Aristotle, productive knowledge is defined by an act of exchange.

Prospective Practices

In fashion, once a collection is presented, designers start to prepare their next collection. In this context, first they research potentialities; colours, fabrics, new materials, culture, etc. From these referential points, they must generate ideas (vision), then design ideas are created (technical aspects of making), and finally these ideas are presented to the public (show). The designers must develop this process without fully knowing how the world will be. They start a collection in September which will be presented in February, yet will be bought by consumers in the following September. At the time of the presentation when 'the experiment' is finished they will know if the designs have been technically well constructed, but will not know whether or not they will be successfully adopted in the marketplace. They need to wait some months to know whether they were the right designs or not. And they will be able to assess them by the level of exchange generated.

Prospective Products

In term of technology, another case can be illustrated by the iPhone. When the design is finished we know if the camera works, whether it creates photos with the right amount of pixels, whether the GPS is accurate or whether or not it is ergonomic. However, we do not know whether the iPhone will change future social and economical factors in 2 years time. The iPhone X is better in many ways than any predecessors as it has a better camera, better screen, better sensors and better software Etc. However, it is not being adopted at the same rate as previous versions were. A posteriori social, economical and environmental factors affect the exchange mechanism. As proposed by Aristotle, productive knowledge is defined by an act of exchange.

Critical analysis

The iPhone is a paradigmatic case to understand how we are grasping the a posteriori impact of design as time evolves. In the first 2 years we discovered that it had transformed the mobile industry. After 5 years we discovered that it had transformed the manufacturing system. Over 10 years, we are discovering that it has transformed society. Scientific extrapolations could never have predicted the social implications of having a tracking device in your pocket capable of monitoring everything you do and everywhere you go and use this information to manipulate society, trends, markets and beliefs. Neither science nor sociology could approach this a posteriori reality as they are limited by what we do and have done and how we have achieved it. In other word an ontology of the past. As Glanville suggested, we are limited by knowledge of the past (Glanville, 2005). However, the intrinsic prospective approach of design, based on planning, solution-based problem solving, problem shaping, synthesis, preparedness, readiness and appropriateness can provide a suitable framework to access these future spaces for knowledge.

The same aspects could be drawn from the previous example in government lead prospective transformation to investigate future typologies in cities. Neither scientist nor sociologists can grasp potential developments as they are limited by the present, either by measurement or observation. Yet the government must take action.

Finally, design practises may be understood as practises aiming for personal fulfilment or personal development. However, the authors address the applied nature of these disciplines aiming to go beyond personal transformation to deliver practical interventions to transform society. This implies exchange beyond oneself involving social, economic and environmental activities. This exchange is always a posteriori and forever bounded to its environment. When you finish a fashion collection, or an iPhone, or a house, or a song, or a theatre play, or a movie, or a book, or an app, you do not know whether it will transform society or not. It will be known a posteriori and will be valued based on whether there is exchange or not. Therefore, design is a prospective activity and knowledge in design is probabilistic in nature.

These examples present a totally different knowledge, which is radically different from the humanities and sciences observed by CP Snow. As described in the examples presented in this section we may know 'technical' aspects; for instance structural or material qualities, or whether they comply with a set of regulations, however we do not know whether these are the right typologies for future living or the social impact they may inflect in some years time. In sociology or science once the experiment is finished we know the answer via measurement or observation. Design is prospective and this implies a probabilistic nature to the knowledge generated as we are dealing with new propositions that evolve in time.

Discussion - Design as a method in research

Design research practice emerged as a professionalised activity in the 1960's, where domain thinking was largely dominated by the humanities and the sciences. This 'late arrival' forced designers to adapt design practice through methods from other domains. A good example of this is Bruce Archer's doctorate which attempted to explain design as a special branch of science (but usefully it failed in doing so)(Boyd Davis, 2016). Other examples are critical design, participatory design and social design which could be argued as conducting aspects of social science through design. Even environmental design or engineering design could be thought of as doing science though design. In these cases design is dissolved into a methodological process based activity. If we position design as a data gathering method then we are tying design to the present. These aspects imply the dissolution of design

as a discipline into views of the present and prevents it from being recognised as an independent domain. Furthermore it questions the core ontology of design's knowledge base for transforming that which has yet to arrive.

In this context, design becomes secondary and is subjected to other disciplines' rules and mindsets. In this scenario thinking is analytical, reasoning is deduced and knowledge must be factual by means of observation or measurement. In this context abduction is denied. The traditional paradigm positions design as a method within research which creates tensions that arise between the prospective nature of design and the factual requirements of working in the present. There is an ontological problem between the nature of design as future-led and prospective, and the nature of research which is present-based and factual. We argue that the core nature of design is probabilistic research, not empirically driven research. We trade some degrees of accuracy to access areas yet-to-be or not-fully-formed, therefore our output is probabilistic and research is always preliminary in its nature. Moreover, in exchange we provide guiding knowledge for prospective technological developments; 'knowledge for' instead of 'knowledge of'. We are concerned with how things 'ought to be' (Simon, 1996. p.111-167) instead of how things are.

Design as a discipline of the future

From this perspective we would position design as a future-led prospective thinking activity in the context of abductive reasoning. In this scenario, as the designer is neither a scientist nor a sociologist (Cross, 1982, p. 221), design cannot be experimental as understood in scientific terms nor observational as understood in sociological terms, but transformational, as Aristotle suggested. (Hall, 20111).

Consequently, its output is based on potentialities not certainties. In the same way that anthropology is not about facts, but approximations which are updated as new information emerges. In this context, as the life of the intervention is placed into the future, time to assess the impact of the design is extended during its lifetime. Validation is always a posteriori and the proposed output becomes the main element to be assessed. The validity of the output generated, whether in a commercial or research context will be judged by the transformational impact generated, which is defined by the level of exchange. The function of design is to transform and if the output does not achieve this, it has failed.

This perspective also repositions the role of the designer from a facilitator into an expert in prospecting what could or should be done in the future. It challenges current ideas in the field positioning the designer as an event gatherer, whose main function is to facilitate exchange among experts. By repositioning the designer as an expert of the future, the role of the designer is to sit in the same room with an equal status

among experts. To participate and collaborate with them as equals. In this approach the gathering of an event returns to sociological practices and the designer is embraced as a prospective expert whose main duty is to develop and envisage the potential transformations between a knowledge-based technology and future society. This framework does not aim to prevent designers from becoming facilitators or doing sociology through design, rather it aims to provide a new possibility for designers to act as experts and embrace the intrinsic perspective of their true ontological expertise.

Probabilistic knowledge

However, this future-led proposition presents a problematic situation for the ontology of knowledge, by which the limit is the present and the researcher is the witness, either through measurement or observation. In this area, if we analyse what happens in economics research we may find a suitable framework to solve this conundrum.

Economic forecasting is the process of making predictions about the economy with many institutions such as the International Monetary Fund, World Bank, the Organisation for Economic Cooperation and Development, national governments, central banks, private sector entities, including think-tanks, banks, consultants and companies use economic forecasting. Economist use statistical analysis of historical data to determine the forecast. Formal forecasts are produced once a year, however, quarterly updates or corrections are implemented to fine-tune the projection. The fundamental function of the economist is to anticipate future risks (i.e., events or conditions that can cause the result to vary from their initial estimates). These forecast are continuously updated as the conditions of the environment evolve. These evolutions determine whether the adjustments will get tighter or looser, how interest rates vary affecting a wide range of factors from loan repayments to employment levels.

At this point a fundamental question arises; is this knowledge? Of course it is knowledge, it is probabilistic knowledge of the future. Based on theses economic forecast international institutions and governments implement all manner of adjustments impacting the lives of millions. From this perspective economics research enables design to access the future by legitimising probabilistic knowledge as a valid type of knowledge. This element provides a bridge to reconcile the probabilistic nature of design with established frameworks of knowledge so far understood as factual.

The value of probabilistic design knowledge

In 1969 Peter Drucker popularised the 'knowledge economy' in his book The age of discontinuity. (Drucker, 1969). Some decades later, the 'Cox review' established the need for an hybrid model entangling academia, the public and the private sectors (Cox, 2005). One year later, the World Bank presented its Knowledge Economy report and KAM

methodology which asserts that sustained investments in education, innovation, information, communication technologies and a conducive economic and institutional environment will lead to increases in the use and creation of knowledge in economic production, and consequently result in sustained economic growth (Chen, D. H.C.; Dahlman, C. J. 2006). Following this report the Sainsbury review positioned science as the main paradigm in developing the hybrid model. (Sainsbury, 2007). From this perspective a four years translational quarterly pilot project started in Liverpool. It was a project aimed at experimenting with the hybrid system proposed by Cox. Following this experiment, in 2012 a report enhancing the advantages of the pilot was published (Knowledge, 2018). Finally, in 2014 two £1 billion pound projects were announced; Imperial west and UCL East they aimed to scale the Liverpool pilot project.

In this context, what is changing is the productive model, from the production of goods to the production of knowledge. The main element to account for in this paradigm is the translational potentialities of it, in other words, how to transform basic research into social and economical opportunities. Nowadays, the value of research is not in the discovery but in the value and impact it returns to society. In this context sociologists and scientist are struggling when presenting the future translational potentialities of their research and many institutions are moving from fundamental to applied research to fulfil this shift.

For instance in sociology, building from the work of Pain, Gregson and Olsen (Pain et al. 2011; Pain, 2014; Gregson et al. 2012; Olssen, 2015) the LSE's Impact Blog explains that "Anxiety around the impact agenda arises from the increasing instrumentalisation of knowledge, the corporatisation of UK higher education, and the relationship between assessment metrics and neoliberalism" As well as "fears that impact will prioritise certain kinds of knowledge" or "there are also concerns it rewards particular types of researcher" (Marchen, 2018). In a demonstration of the transformational nature of research output and impact, the LSE blog's author argue that instead of building from Pain et al.'s emphasis on the "political imperative to restate the kind of academy in which we want to work" (Marchen, 2018). Researchers need to apply participatory action research to address the evolving nature of research (Marchen, 2018). Clearly the translational imperative of the knowledge based economy is starting to affect practices in sociology. In this context cross-disciplinary collaborations among sociologists and designers may enhance the transformational potentialities of sociological enquiry.

However, it seems that instead of fostering collaboration, which imply understanding the expertise of designers and treating them as equals, others disciplines are either rejecting the new reality in the research ecosystem or adopting design methodologies as part of their toolkit rather than inserting designers in the research process. For instance,

several universities in the sciences such as Stanford, University of Maryland, or Ball State University have been integrating design thinking courses into their curriculums for some time (Morris, 2015). According to Dorst 'Design Thinking' is identified "as an exciting new paradigm for dealing with problems in many professions—most notably IT (e.g., Brooks 2010) and Business (e.g., Martin 2010)" (Dorst, 2011, p.131). If we look at the term in Google trends, we can observe an exponential increase of the term 'design thinking'.

Figure 2. Design thinking evolution. From Google trends.

However as Dorst point out its adoption is much more complex that current simplifications. This reality positions design and designers centre-stage as key partners in knowledge production and translation with an expertise as catalysts for prospective transformations.

Social

As we are completing the transition from the industrial to the digital economy the acceleration of innovation is transforming reality and affecting the development of society. In this context recent strategies in the social sphere call for anticipatory strategies, for instance Guston (2014) introduced the idea of anticipatory governance defining it as "a broad-based capacity extended through society that can act on a variety of inputs to manage emerging knowledge-based technologies while such management is still possible" (Guston, 2014). In this

context, design, due to its intrinsic prospective characteristics based on preparedness, readiness and appropriateness, seems the most appropriate partner to deal with the exponential nature of technological development from a prospective and preventive perspective. In this context applied ethics emerge as a fundamental implementation of prospective design.

However, this acknowledgement has been missing in the area of social governance, where traditionally three main methods have been implemented to deal with ethics in technology; technology assessments, ethical quandaries and public engagement. Sheila Jasanoff, professor of ethics and invention at Harvard University provides a critical review of these procedures, and based on an extraordinary amount of supporting evidence, she states that these processes while interesting are not sufficient to deal with the exponential nature of technological advancement. Her book is a testament of the limitations of sociological methods to address prospective technological development. As a conclusion Jasanoff illustrate "how the power to set the rules of the game for governing technology rests with capital and industry, and not with the political representatives of the working, consuming, and too often suffering masses". (Jasanoff, 2016. p. 266). The future of governance is determined by design and only prospective activities may access those spaces from a proactive perspective. Sociological strategies are reactive in nature, as they limited by the present. Jasanoff's account presents an empirical need to enable a research space to address the rising concerns of technological development from a social perspective. And design prospective ontological nature fulfils this requirement.

Finally, in a report presented by the Institute for the Future on 'anticipatory governance' (Future, 2009) the authors aim for processes that involve the simulation of possible futures to address anticipation as a strategy for good government. In this context the prospective and probabilistic nature of design may contribute significantly to the future development of society supporting anticipatory governance through abductive-prospective thinking.

In this processes we aim to change the directionality of the action; instead of waiting for the anticipation to happen, design allow us to be proactive and move for more imminent future transformations. The role of the prospective research-focused designer is to enhance knowledge-based technological potentialities and reduce future risks.

From time-based research to prospective interaction research

How do we approach prospective design practice in the knowledge landscape? If we go back to the categorisation of knowledge presented by Aristotle we can observe that he established three main categories; the theoretical, the practical and the productive. Theoretical knowledge encompasses abstract subjects. It is concerned with things that are universal and necessary. Yet that cannot be applied. The idea that

theoretical knowledge can never be utilitarian builds on the ancient sense of theoria as observation rather than participation. In contrast, the practical is applied and question based; it has a beginning and an end. Finally the prospective is based on a continuous interaction with the environment. It is transformational and a commitment to practice (Atwill, 1998). Therefore prospective knowledge is defined as a capacity to make involving prospective reasoning to 'go beyond' what exists and propose what can be 'otherwise'.

These assertions and arguments question the reality of the methodological nature of design and confront the practice-based timeframe with a beginning and an end model imposed from the sciences and humanities. The nature of time-based industrial processes of knowledge production and traditional research approaches are affecting the very same nature of these transformations and potentialities.

Conclusions

We have argued to reposition the origin of design research and place it with an Aristotelian rationale of productive knowledge. This implies that design research has no end in itself as it is always implicated and will remain in exchange. In this scenario design research has no external arbiters and no final judge in the present. In this context neither the user nor the producer is capable of determining prospective knowledge as it is defined by an act of exchange. This exchange always redefines the subjects involved by effecting a shift in power and status through its transformational nature. It cannot transcend time like mathematics and depends on time, contexts and circumstances. Therefore assuming past, present and future timeframes and the impact of the environment changing future social and economical factors. It is instrumental and situated, and its value is social, economic and environmental.

Design research is concerned with competing standards of value rather than securing boundaries of knowledge and its practice is based on the capacity to make new futures involving abductive reasoning. It is concerned with something coming into being indicating that things can be otherwise and beyond themselves as currently configured. It is concerned with indeterminate and possible within alternative possibilities. From passive intellect (contemplation becoming its object) to active intellect (object being defined) to prospective intellect (object being transformational a posteriori through exchange).

In the prospective framework we have proposed design research can access the future, however current models of research are limited by the present either by observation or measurement. In order to address this fundamental aspect we present the concept of probabilistic knowledge by building from new approaches in design and economics. Probabilistic knowledge in the context of design could be defined as the potential impact of transformational initiatives.

The value of design research as presented here is economic and social therefore aiming for mixed methodologies to implement strategies building informed interventions to support planning, solution-based problem solving, problem shaping, synthesis, preparedness and appropriateness in the built environment. These aspects are fundamental for an adequate development of society in an ever evolving world based on exponential technological developments. So far inaccessible due to the present limit framework of sociology or science that can only analyse what already exist. We propose making a contribution to contextualising Glanville's concept of knowledge for transforming the future as a probabilistic knowledge ontology.

This approach reposition the role of the designer from a facilitator to an expert in prospective future-led translational and transformational technological developments to enhance knowledge-based technological potentialities and reduce future risks. In the process reposition multidisciplinary research collaborations from a subject facilitating discussion between experts to being one of the experts in the panel with the same status and role. This prospective nature excludes the designer from being a scientist or a sociologist and prevents design from being experimental or observational (in the scientific meaning of the term), as the projected potentiality is placed in a society yet-to-be or not-fully-formed. Therefore it cannot be precisely measured or described as it does not fully exist.

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The future of seafaring: Designing an on-board user-Interface to predict engine faults on marine vessels

Simone Gumtau

Abstract

This paper describes a collaboration between a communication designer and data scientists and engineers at the University of Portsmouth, to work with a consortium of companies in the marine industry around the Solent in South East England. The change affected here was economic and environmental: to add value to marine engineering services in order to retain market competitiveness, to comply with international standards to reduce fuel consumption and emission through innovation, and also to provide a better user experience through design.

In particular, the design research for a user interface on board the ship to assist non-experts in monitoring engineering data will be described. The design visualises sensor data taken from various engine components by utilising body schema like movement and rotation. Theoretically, this design approach draws on phenomenology, embodied cognition and metaphor.

This project involves a design lecturer working with data scientists in order to make the data more user-friendly. The context is data taken from the marine and dairy industry, which is ultimately used to detect and predict faulty engine parts. The design aspect here is to provide a user-friendly interface, but involves much more than that. To make sense of the data and make it accessible to a wider audience, the designer has to work closely with the data analyst to decide upon relevant parameters in the raw data, which then also determines the hierarchy of information on screen – i.e. questions of which information the user needs immediately, and which can be hidden in a different layer, can only be answered if the whole of the data collection and processing system is understood. In practice, the collaboration between the designer and the data scientists was crucial in determining an approach to visualise the data set and to develop the story that the data tells. The challenge for the data visualisation was to move beyond simple traffic light systems – as the data was processed through intelligent machine analysis, the key approach to the data science here is that a 'healthiness' score is generated, which contains more complexity than a threshold-based system, which could be dealt with through 'on' or 'off' states.

The design approach seeks to enhance understanding of the data, by letting users / the audience experience it in an embodied and also tactile way. Sample data, which represents healthy and faulty engine performance, has been visualized in a prototype user interface and translated into a vibrating display. These different 'data materializations' set out to problematize the human experience within the scientific process of data processing and representation.

Changes in the Shipbuilding Industry in South East of England

The Solent area with its busy commercial and naval ports Southampton and Portsmouth has a rich history in terms of maritime industries (Coad, 2005; Winton, 1989; Brown, 2016). They have equally suffered in times of globalised changes in labour markets and manufacturing capacities in the maritime transport industry (Lee, 2010). In spite of local protestation (BBC News, 2013) around the outsourcing and relocating the majority of the shipbuilding works (Rankin, 2013; Milmo, 2013), the lure of cheaper labour overseas and the advantages of centralising resources, as well as the decline of naval contracts as government investment has dwindled has meant that companies have to look for alternative and increasingly creative solutions to survive. The UK government has recognised and partially addressed this issue and through their funding body 'Innovate UK' seeks to invest in skills training and technology research & development – their solution is to maintain market competitiveness through the creation of innovation, knowledge and service. In 2011, Innovate UK released a UK Marine Roadmap for Growth (Department for Business, Innovation & Skills, 2011), as part of their funding call 'Vessel Efficiency II – Better Systems at Sea' (Vessel Efficiency, n.d.), which pictured greater cooperation across the marine industries and maritime services sector. Key opportunities for business growth were predicted to exist for business and research that work together to develop innovative solutions in advanced materials, and, relevant to this project, green ship technologies, positioning and communication and vessel design and engineering.

Rising fuel costs, shipping overcapacity and the International Maritime Organization (IMO) requirement for all ships to have a SEEMP (Ship Energy Efficiency Management Plan) meant that there is a concrete incentive to develop technologies that support the monitoring and management of ship engines to their optimum performance, reflected in the government funding call 'Vessel Efficiency I & II'. The collaborative project IConIC (Intelligent Condition Monitoring with Integrated Communications) was timely for addressing these global and societal challenges, and proposed to utilize state of the art technologies involving intelligent data solutions, big data and satellite communications as well as the design of a user-centred interface.

IConIC project: improving maintenance and communication systems through intelligent data use

The IConIc project consortium received £1.4million by Innovate UK (the former Technology Strategy Board government investment arm for tech research & development) to develop and implement new technologies using data to improve marine vessel efficiency and safety. The performance of marine engines used for propulsion and power generation has a significant impact on efficient vessel operations. Inefficient or failed engines, when undetected, can leave a vessel stranded at sea resulting huge costs in time and money, and with increased risk to crew and passengers. Famously, one of Carnival Splendor's cruise ships was unable to propel itself forward for days after a mechanical error and resulting fire in the engine room, leading to very uncomfortable conditions for the people on board and at a huge cost for Carnival Splendor in 2010 (Medina, 2010). If, however

the crew was able to monitor and predict engine faults, planned repairs and maintenance could then take place in a timely fashion at a suitable location with suitably trained engineers, rather than out at sea. Global societal benefits in the reduction of fuel consumption and emissions were a direct aim of this research – the target for IConIC was a 3-5% reduction in fuel consumption and emissions coupled with a 25% increase in engine availability. Regional benefits were envisaged to be achieved by working towards ensuring economic competitiveness of local employers and growing and maintaining skilled jobs in a future less reliant on defence contracts (in this case mostly implementing, monitoring and maintaining systems and services on civilian marine vessels like ferries and cruise ships).

The IConIC consortium formed of The Centre for Intelligent Data Solutions / Institute for Industrial Research based in the faculty of Creative and Cultural Industries at the University of Portsmouth, the University of Southampton, the Digital Catapult for Satellite Applications and a consortium of Solent based shipping companies worked together to develop an advanced automated condition monitoring system for diesel and electric engines, to predict and prevent catastrophic faults in a timely manner. The engines in question on these marine vessels are huge and opaque and tend to reside in dark, noisy and inaccessible spaces (for an indication of the kind of engines that are being referred to here, this video of an engine starting up at the Diesel House Museum (2015) in Copenhagen serves as an illustration https://www.youtube.com/watch?v=g3DsWLn0r24). The engineering solution therefore was to deploy sensors on the main engine parts, to monitor the rate (frequency/intensity) of vibration and torque in real time – for the purposes of this paper and the prototype data visualisation, we focused on vibration data. An engine part showing large and frequent anomalies in their vibration pattern would be diagnosed as likely being faulty. The innovation in this system is not to rely simply on 'thresholds' in the data, but to be based on the algorithmic analysis of the data (autonomous intelligence), which allows each component to be diagnosed with a 'healthiness score', which needs a more complex representation than simply stating 'on' or 'off'.

Design challenge: Visualizing 'Healthiness' of Sensor Data

The design problem now was to visualise this data in a way that it would be a) readable by low skilled crew, who would be able to monitor performance just by a glance while performing other tasks on board b) communicate anomalies and decay in the data that would go beyond a simple traffic light system, as this form of colour coding is too limiting for the complexity in the data and only indicates 'healthy' or 'faulty'. So, in a sense this interface would serve as a first point of call, an alert that would prompt further investigation of the issue, and it therefore would have to be as user-friendly as possible.

The team enlisted the expertise of a designer (author of this paper) to work on visualising the data into an easily perceivable form, and to allow non-experts make sense of the information.

Making sense of and preparing the sample data

The first step in the design process was then to get familiar with the kind of data that the sensors were generating, and how we might make sense of it in terms of what needs to be communicated. To this end, communication and collaboration with the data scientists on the project, Dr. Edward Smart and his PhD researcher at the time, Dr. Faith Thompson was essential. They provided me with a data sample taken on 3 different dates, that I could use to pore over and experiment with. Looking at the Excel tables, it was clear that some editing, filtering and organising was going to be needed if any sense was to be made here. While somebody dealing with this data every day in numerical form, and even in classic mathematical diagram form (such as a box and whisker graph) may have been able to glean some information from these rows of data, anybody less familiar with it and less skilled in decoding these visualisations would have been lost.

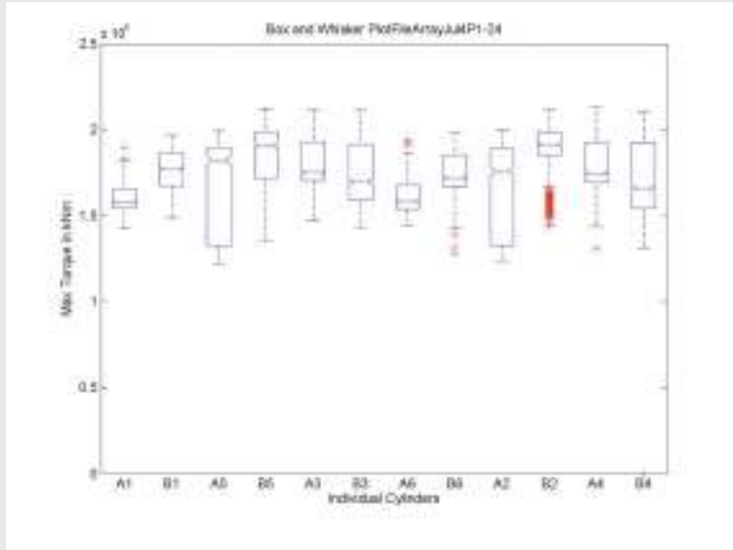

Figure 1. Box and Whisker Plot of Sample Data 1-24

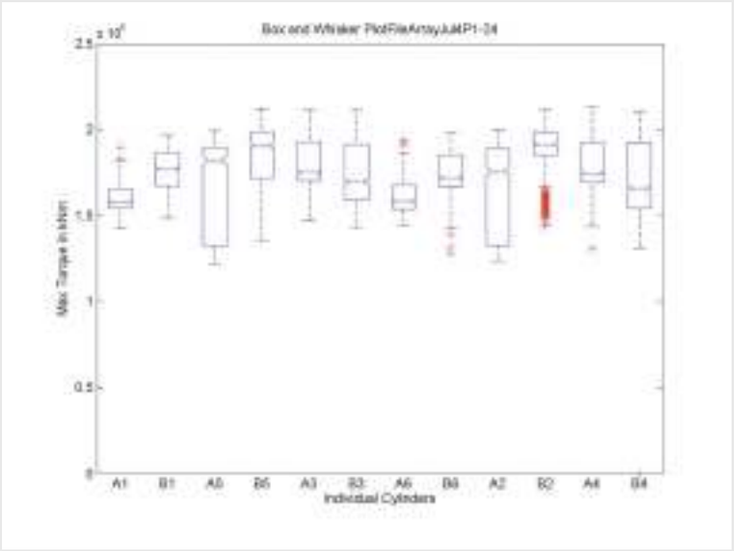

Figure 2. Box and Whisker Plot of Sample Data 3-3

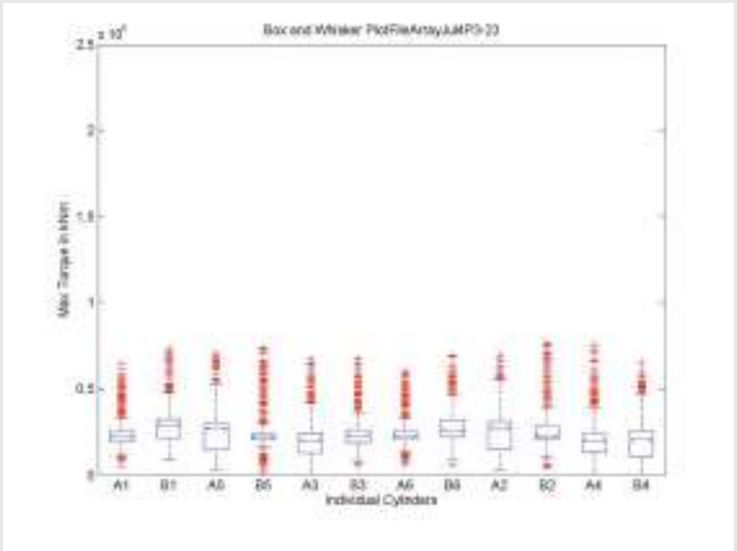

Figure 3. Box and Whisker Graph Sample Data 3-23

Sensor data was read at a frequency of ca every 2.7 seconds, so a timespan of 1 hour would already generate approximately 25 data rows in Excel, and there are 13 columns representing the different engine components. To get a sense of the data, I generated some simple visualisations within Excel, and that allowed me to see enough patterns in the data to be able to talk about this in more depth with the data scientists. When I showed these figures (4-6) to my collaborators, they were able to explain the key consideration in terms of the intelligent data solution: that this was not simply about recognising and responding

to thresholds, but about a more nuanced recognition of 'healthiness', which is inherently more complex.

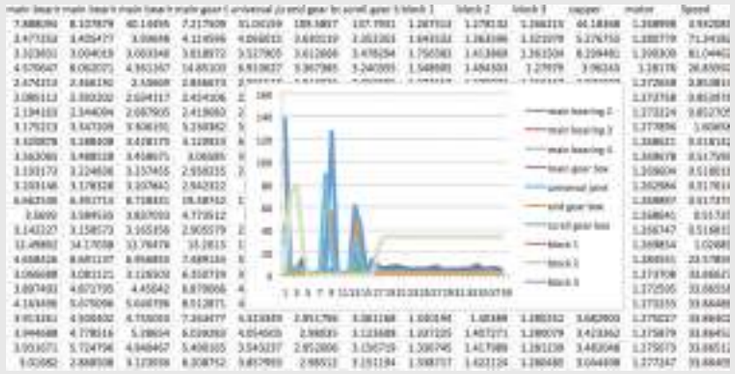

Figure 4. Sample Data in Excel x

Figure 5. Sample Data in Excel x.1

Figure 6. Sample Data in Excel x.2

So, for example, it may seem logical to look for the largest 'outliers' and highest 'spikes' in the data, because this would seem to indicate that there is a problem – due to the scale / severity of the anomaly. However, familiarity with the nature of the sensor data provides a more in-depth view – singular spikes and extreme outliers are not as interesting to this particular purpose of engine fault diagnosis, because they may simply

be a freak, or singular, occurrence. What is much more of interest here are incidents where the data graph seems to be changing its shape over time, as that is more likely to reflect an engine part becoming 'unhealthy'. Another key thing to look out for was if 2 graphs start to change their shape, within the same timeframe, especially if they are representing connecting engine components – as this can indicate that the faulty engine part is starting to transmit its wayward force to another engine part.

The next step in the data handling was then to reduce the data further in order to get to more depth in my sensemaking – so I focused on 3 engine parts (1 showing no variation, and 2 showing some amount of variation, i.e. 'unhealthiness') and reduced the sample data to 24 rows (which roughly translates to one hour of sampling). This step in the design process enabled a much better communication between data scientist and designer, and together we were able to agree on the parameters that were going to be used in the visualisation.

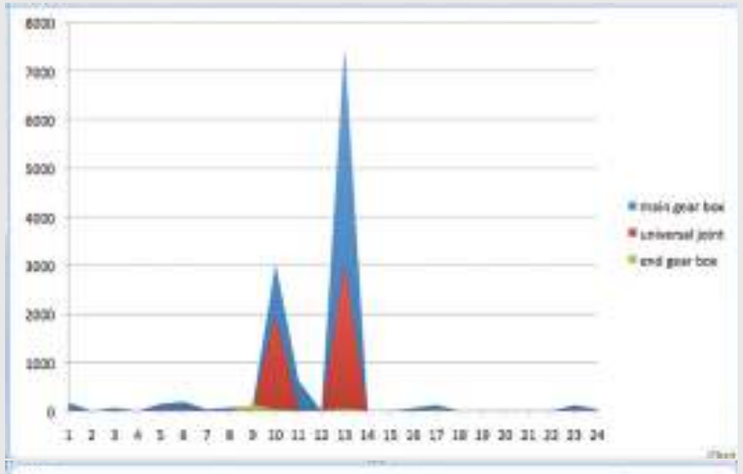

Figure 7. Excel graph of 3 engine parts: short, intense spikes – probably healthy

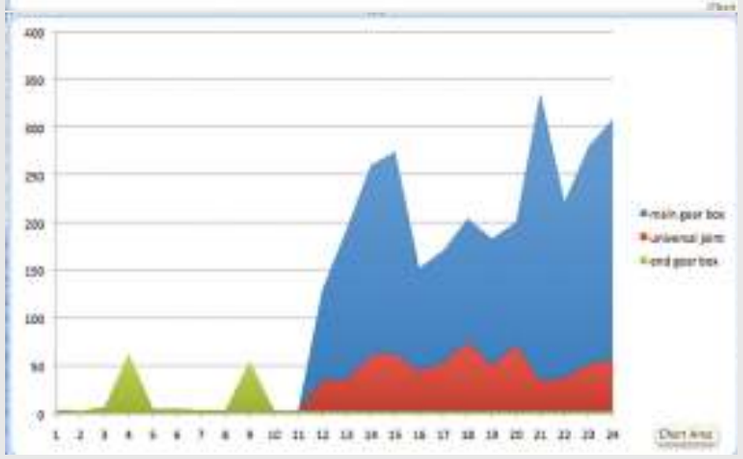

Figure 8. Excel graph of 3 engine parts: 2 parts showing anomalies over time – alert

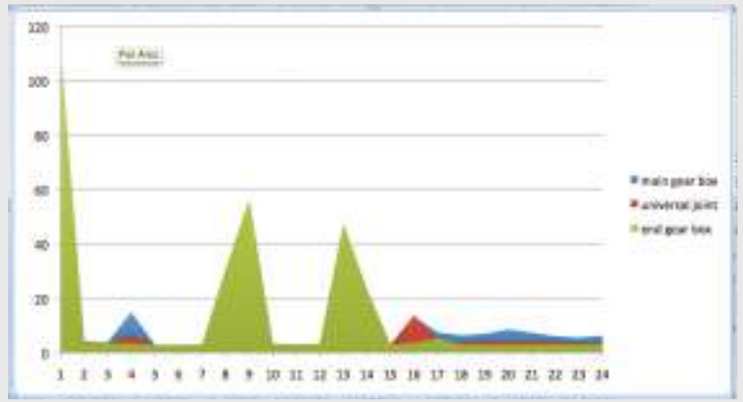

Figure 9. Excel graph of 3 engine parts: 1 part spikes below very low threshold - healthy

The figures 7t o 9 illustrate 2 states that we were interested in, and that were going to be visualized as distinct points of interest in the data story: fig 7 shows 2 extreme spikes, which are not necessarily of interest as they are high, but short. They are however occurring in 2 engine parts, which may be relevant. Fig 8 shows at a later date, that these 2 engine parts have indeed started to show anomalies in their performance over time. Although the spikes are not nearly as extreme as before, what is relevant here is the fact that the shape continuously changes, and that there seems to be some correspondence in the graphs of the different engine parts, which might reflect that they have started to affect each other. Figure 9 shows a couple of spikes, however they are fairly low in reach on both intensity and timespan, and only affect one engine part – we can therefore probably safely assume that this shows a 'healthy' engine.

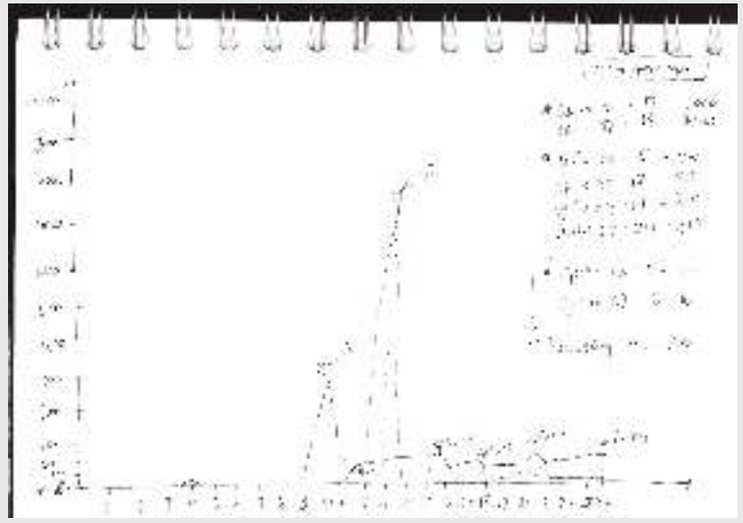

Figure 10. Sketch of Data graphs - all samples layered

In the following, I set to work on writing a set of rules, akin to an algorithm, that would allow a systematic processing of this data into a visualization. So, for example if the graph stays below a certain point, data will be assumed to be 'healthy'. If the data shows intense, but short, spikes, then this might bring up a slightly different state and act as an alert to keep watch. If the data shows spikes over a certain value, over a certain time, then this will be reflected in a changes state visually, and if this includes another component then another visual element will be added. The next section will describe how the visual responses were mapped to the data.

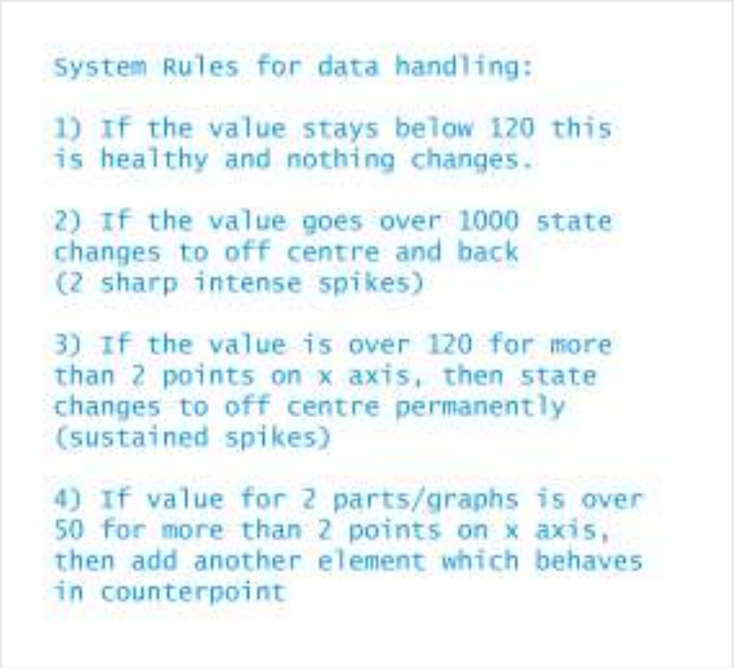

Figure 11. Rules generated to handle the data into 4 data states

Enactive Metaphors for Making Sense of Abstract Meaning

The visual data visualization design concept draws on theoretical approaches to embodied perception and metaphor. Embodied perception considers the body and actor-environment relationship as essential for communication and interaction (Gibson, 1966; Gibson 1979; Nöe, 2004; Merleau-Ponty, 2002). Understanding embodied metaphors as something fundamental to communication means there are synesthetic phenomena we can draw on to enable interaction that is more immediate, intuitive, pre-linguistic and multimodal. This was intended to be a key characteristic of the data visualization in the design project described here.

Lakoff and Johnson (1980) describe in 'Metaphors We live By' how metaphors are more than just literary devices, but allude to mental concepts that we share and understand and are essential to understanding the way we make sense of our experience. Lakoff and Johnson write that "the essence of metaphor is understanding and experiencing one kind of thing in terms of another" (Lakoff & Johnson, 1980, p.5). Exploring metaphors can therefore unpack some of the ways we understand certain concepts. These metaphors are emergent in everyday language and 'we live by them' to the degree that it is hard to step outside of them. Lakoff & Johnson (1980) also describe how a lot of metaphors are based on our physical experience (e.g. 'intangible'): our knowledge of what we know and what we don't know about our bodies in space and time.

Mark Johnson further explores the relationship between the body and the mind, and suggests that the formation of internal concepts is grounded in physical experiences. They are based on patterns of occurrences between our bodies and the environment. These patterns become coherent structures through which we make sense of our world and develop "publicly shared meaning structures" (Johnson, 1987, p. 13). He introduces the idea of embodied 'image schema', based on Kant's definition of schemata as "non-propositional structures of imagination" (ibid, p.19). That is to say they "exist, rather, in a continuous, analogue fashion in our understanding" (ibid, p.23). They are also not strictly images in the sense of concrete pictures, and can, and often do, incorporate the haptic modality, in a cross-modal manner - often linked to spatial manipulation, orientation, and movement. Image schemata share some basic elements that have related structures, yet are flexible. They have gestalt characteristics: "coherent, meaningful, unified wholes within our experience and cognition" (ibid, p. 41). He suggests they form structures for organizing our experience and comprehension. Also, Johnson in his more recent work (2007) provides more detail and evidence towards the claim that some meaning is pre-linguistic and pre-reflective, unconscious and the base for metaphor processes. He defines several categories of sensorimotor schemas, and the most relevant here is the 'spatial motion group' of embodied metaphors, in particular the concept of containment or a container (understanding 'in' or 'out', and the concept of a path (understanding something that goes 'up' or 'down'. Gallagher (2005) also writes about body schema as relevant to contemporary cognitive science research. Reed's work on the ontogenetic precedence of indicational, pre-linguistic interaction between infants and caregivers makes a similar point, from the perspective of ecological psychology (Reed, 1995). Ramachandran (2003), drawing on the famous 'kiki' (spiky shape) and 'buba' (soft, bulbous shape) example argues that the mapping across different sensory modalities is the phylogenetic foundation for language itself. It is the metaphoric link between the visual form of the shape, and the aural shape of the word that are important, not primarily the more abstract symbolic content. Jay Seitz further elaborated on the origins and exact processes of metaphor and provided extensive evidence

for the neurological, developmental, biological and evolutionary basis of metaphor. He proposes metaphors to be so fundamental as to include preliterate, prelinguistic and extra-linguistic factors. Perceptual metaphor (e.g. colour, shape, texture, size) is described mostly a case of 'it looks like that' – for example, even children will be able to identify a plate of spaghetti as a "bunch of worms". Enactive metaphor (movement, action and activity) could be classed as a case of 'it moves like that' – where movement and motion information are correlated, for example in associating a spinning top with a dancing ballerina. The other two types of metaphor are classed as cross-modal or synesthetic (e.g. brightness and loudness) and physiognomic experiences (visual-affective and sensory-affective) and can be useful for design, but will not be explored further here. Images schemas, embodied perception and in particular enactive metaphors inform the design concept in this project, and it is assumed that this will allow the user to generate meaning in their interaction with the data visualizations.

Applying Perception Theory to Develop Design Prototype

The concept of enactive metaphor, actor-environment interaction and image schemata has been applied to the data visualization design concept here in a way to draw on our (or the engineer's) embodied experience of the world. For other work related to embodiment, metaphor and data visualization, refer to Risch (2008) or Zhao & Vande Moere (2008).

We (the project team) were told anecdotally that the ship engineers that used to travel onboard would be able to diagnose the state of a vessel engine by using all their senses and tacit knowledge. They would be able to place a hand on these huge, opaque and inaccessible engines, and roughly locate the sources of any anomalies through feeling the vibration pattern, and they would use their highly attuned listening skills to further identify the state of the engine. Now unfortunately through the rationalization in the ever more competitive marketplace, these highly trained and skilled workers are no longer in place. With this project, we could neither bring them back nor seek to replace them – but what the technology and design innovation here could provide is some measure of 'tacitness' and 'intuitiveness' that would benefit the less skilled person on board in order to help them make the right decision (which is to either alert the ship crew to a severe error in case this becomes obvious, or to decide that no extra effort and investment is needed in case the engine shows healthy scores).

I therefore decided to place intuitiveness and embodiment, as discussed above, at the heart of the design concept. In one way, what I was trying to do is to revert the abstract numbers back to their original analogue form of vibration as much as possible. The data in the Excel table makes no sense to us, the human user, because these are numbers are representing motion in a very abstract, alphanumerical way. If we could see the motion behind the numbers, we may be able to make sense

of it much easier. If we look at an engine part going wrong, we could probably tell by the way it jars and moves off kilter. There is a level of experiential, embodied knowledge we can all employ to tell when there seems to be an error. This is how intuitive this data visualization design needed to be. I continued with the theme of cyclical rotation and off kilter motion to design a representation for each engine part made out of a set of moving circles that could interlink, line up, and be off set against each other. Visual research included exploration of geometric form (Fabiano Coelho, 2009; Eva Schindlig, 2008), graphic ways of expressing traces of motion (Pierro Zagami, 2010) and spirograph patterns (Max Frey, 2007).

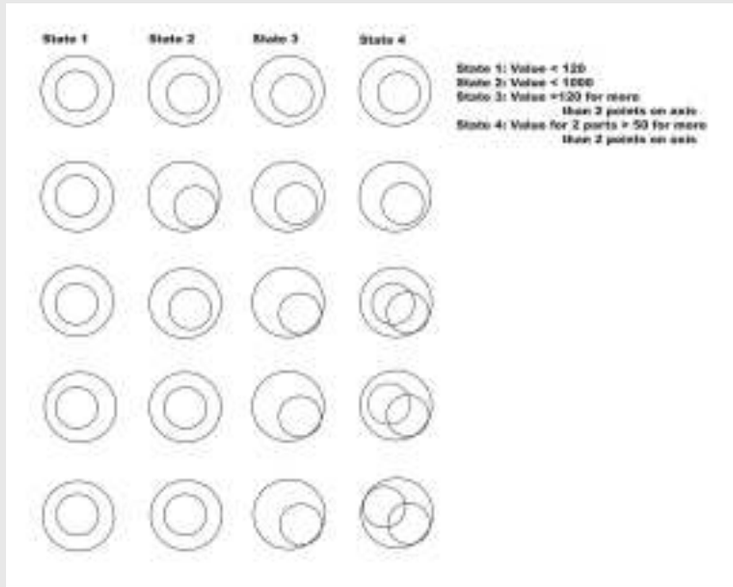

Figure 12. Rules for handling the data mapped into visual form: 4 state changes

Figure 12 shows the 4 states of data that was derived from the sample, the rules to process this data, and the corresponding visual response mapping to communicate the state change. From State 1, which is healthy, and the circles do not move off centre, to State 2, where one circle goes briefly slightly off centre, to State 3 where one circle goes right off centre, and finally State 4, where 2 circles simultaneously go extremely off centre. This was produced as a sequential animation, to demonstrate the visual effect of seeing the parts move and go off centre. The static image captures some of this intuitive perception, but the motion in the animation really enhances it and makes it more immediate.

The rules that were developed are open to interpretation, if they are to be used for creative development – in this case, I had to decide in which way to map the data, via the 'algorithm', to a designed visual response. A demo prototype focusing on 3 engine parts from the sample data:

End Gear Box, Universal Joint and Main Gear box was developed to show how this could be implemented.

For state 1 (value stays below 120), data seems to be healthy, and the 3 circles representing the engine parts rotate at a steady pace (fig 13). For state 2, which was identified as short intense spikes (value goes over 1000 briefly), that might be worth investigating, but probably are of no concern to the state of the engine, intense dark jagged circular lines are added to the rotating circles (fig 14). For state 3 (value is more than 120 for more than 2 points on the x axis), this was meant to communicate that this may need monitoring, as the engine part is starting to behave differently over some time - another component is added to the circle, in this case a light blue shape that rotates around the circular shape, starting to look slightly 'off centre' and 'off kilter' (fig 15). For state 4 (value is over 50 for 2 elements for more than 2 points on the x axis), this data shows that a part of the engine is going wrong for some time, and has possibly started to influence another component of the engine, so this will definitely have to raise an alarm – in this case, 2 red elements are added to the rotating circles (fig 16). Reflecting on the implementation of the 'rules', there has been some adjustment when it came to making sure that the visual mapping really does communicate intuitively and without the need for explanation in this demo prototype. The prototype was placed in an exhibition at the University of Portsmouth (Gumtau, 2015), but as the IConiC project was not centred around the design of the GUI, but rather the intelligent data and satellite communication system, there was not enough time within the funded project to implement this on board. It is envisaged that a second stage of this project would entail the installing of the GUI on board of the company vessels that formed part of the consortium – for example, a Solent ferry. This would then entail in situ user testing of the intuitiveness and effectiveness of the interface.

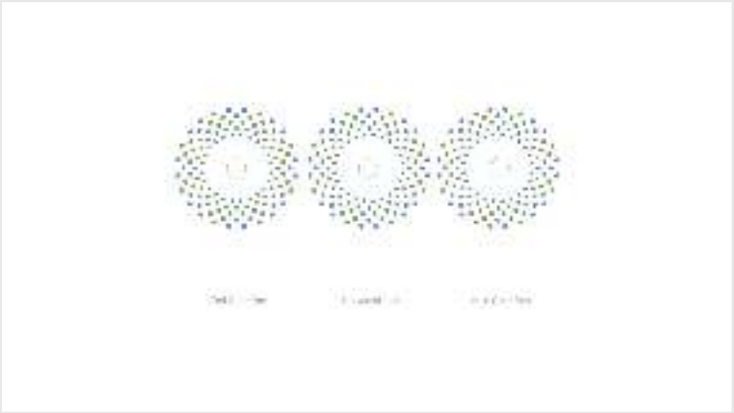

Figure 13 Visualization of State 1: Healthy Data

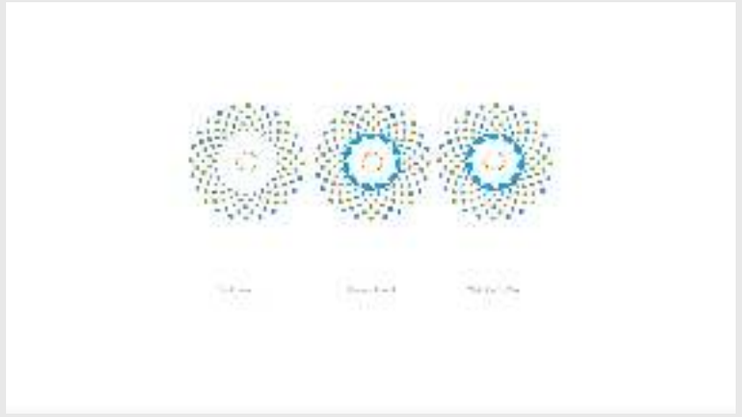

Figure 14 Visualization of State 2: Short, intense spikes in the data on 2 engine parts

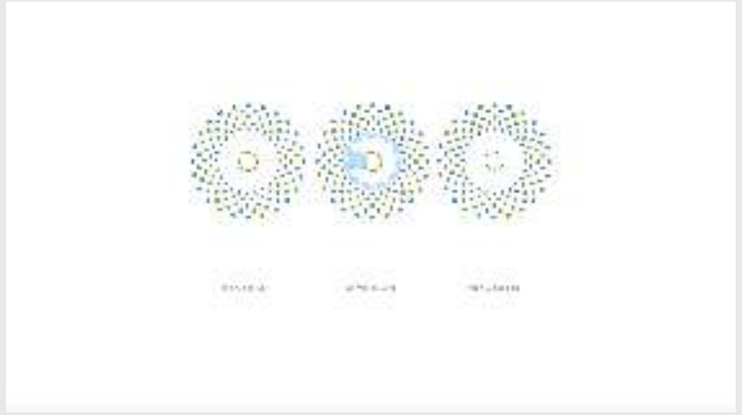

Figure 15 Visualization of State 3: Data is showing anomalies over time

Figure 16 Visualization of State 4: Data is showing anomalies over time, on 2 engine parts

Materializing the Data: Vibration to Vibration

For the purpose of the exhibition and experimenting with making the data even more intuitively perceptible, we decided to take the return to the original stimulus behind the abstract numbers even further and developed the haptic interface: "CodeEye". Inspired by the tacit – and tactile knowledge that ship engineers use to allow them to diagnose the state of an engine, the sense of touch was going to be an obvious choice to extend the immediacy and intuitiveness of the communication for a non-expert. This kind of interface would also go some way to address the difficulty of perception in the spaces that these engines are situated: dark, noisy, uncomfortable and inaccessible places. CodeEye was designed to allow the user to place their hand on a circular surface, which provides the data as vibration patterns, picking up the circular theme from the data visualization. The aesthetic of the physical interface takes its cues from materials utilized in industrial shipping, such as a black rubber surface, stretched across a circular wooden frame, making the unit resemble a kind of analogue marine navigation instrument. The rubber surface was embellished with a circular pattern made from conductive paint, that could respond to the presence of touch by communicating the sample data via a circular array of small vibration motors underneath the surface. The design research for this interface will not be described in depth here, but it serves to exemplify the experimentation around the materiality of the data, and the stated aim of transforming the abstract alphanumerical data back to its original analogue qualities.

Conclusions

In the context of global changes in the maritime industries, and in the South East of England in particular, the project IConIC has been described. This was not a design-led project, but it was aimed at

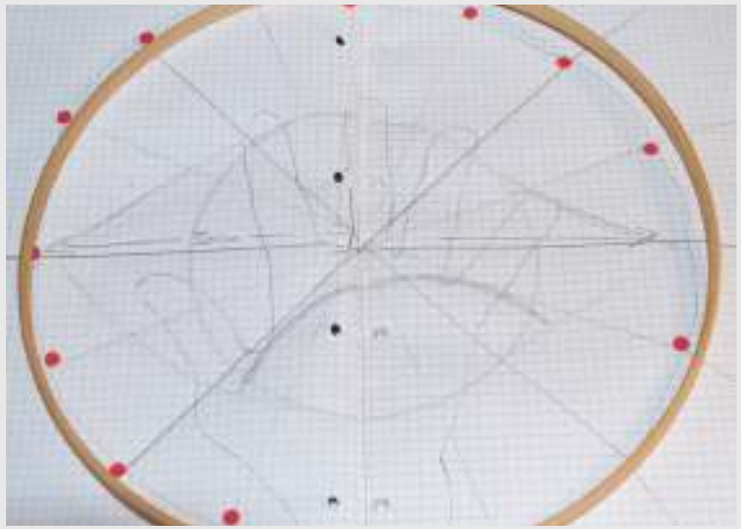

Figure 17. Sketch of the vibration motor array in CodeEye

Figure 18. Haptic interface CodeEye representing data through cyclical vibration patterns

developing innovation in a consortium of marine services companies, academic research and development departments and the end users in form of shipping companies using ferries, cruise ships etc. The aspect of the intelligent data analysis was shown to be a complex data visualization problem and therefore prompted some design research experiments to develop an intuitive graphical user interface that could be used by non-expert members of the shipping crew. As part of the prototype development for an exhibition, a haptic interface was also designed. Both interfaces seek to return the abstract data to the form of their analogue stimulus in order to make them easy to understand, while complex enough in terms of the state of the meanings rendered. Drawing on perception theory like phenomenology, embodied cognition and metaphor, body schema of rotation and motion were applied into a system using circular elements to represent different states of healthiness in 3 engine parts: End Gear Box, Main Gear Box and Universal Joint. Working with the sample data set, 4 different states were devised that would be relevant to make sense of the data and require different levels of responsiveness from the user. The vibrotactile interface 'CodeEye' develops the theme of tacit knowledge and intuitive perception by adding the haptic modality to perceive circular data patterns. Concluding, it can be said that this project was useful to explore new boundaries and ways to apply design thinking and user-centredness in the context of engineering, which has traditionally focused more on the utility of design. It has opened up channels of communication between the data scientists and the data visualization designer, which would be useful to explore further as this kind of development of a shared language and process would benefit this quickly developing discipline of data visualization. In a future project, the implementation and evaluation of the design would have to be

integrated into the project plan in order to further improve the value of the research.

It would be interesting and rewarding to see this kind of design approach and collaboration applied in a wider context, paving the way for user-friendly experiences with data and a human interface to big data processes. A designer will always seek to ask pertinent questions and ways of making complex information graspable, and can therefore make valuable contributions to increasingly abstract data interactions.

Not only engineering, but in general the communication of science, data and research, which is seeking to have an impact, can benefit from bridging the perception gap between data and insight through design.

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Designing a sensibility for sustainable clothing (S4S): Affective activism

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Abstract

The need to improve the sustainability of fashion has been widely noted by academics (Black 2012, Fletcher 2008, 2016), activist campaigns (Greenpeace, Fashion Revolution) and policy makers (DEFRA, EAC). While there have been creative attempts to provoke sustainable fashion, few studies have explored ways in which making fibre, using 'waste' fabric and modifying clothes might change individuals' behaviour (thoughts, feelings and actions) in relation to how they dress. This chapter will present, analyse and reflect on work-in-progress research from the Arts and Humanities Research Council (AHRC)-funded project 'Designing a Sensibility for Sustainable Clothing (S4S)', which combines arts with social science methods to investigate how creative activities might shape a 'sensibility' for sustainable clothing and promote pro-environmental behaviour change. Drawing on social design thinking, the project works with communities to co-produce knowledge through 'hands on' making. It involves community groups in dialogic, reflexive workshops that mimic phases of the lifecycle of clothing (making fibre and fabric, purchasing, mending, modifying and making clothes, and dealing with waste fabric) and has produced a rich array of data including co-generated creative outputs, in-depth interviews, short reflective videos, wardrobe audits, clothing diaries and surveys. In collaboration with partner Fashion Revolution, the project proposes these methods as a mode of quietly affective activism that is embedded in, stems from, and is fuelled by everyday lived experience (Hackney, 2013a). Fashion industries, cultures and imaginaries are multi-faceted and complex with significant social and environmental consequences. Drawing on theories of affect (Ahmed, 2004), S4S findings suggest that participatory design and crafts practices offer an affective response to the pressing problem of fashion's devastating environmental effects.

Introduction

The dangers of 'fast fashion': a 'buy now, throw away tomorrow' culture (Birtwhistle et al., 2003; Michon et al., 2015) are increasingly known. High street and online retailers, motivated by economic drivers, provide low cost garments often designed to be worn only a few times. Clothes are manufactured to a lower quality than even in the recent past and garments are rarely thrown away because they are worn out. Young women in particular prefer to buy several cheap disposable fashion items rather than one durable piece, while low costs discourage consumers from repairing worn out clothes (Morgan and Birtwhistle, 2009; Binotto and Payne, 2017). While designers such as Katherine Hamnett and Phoebe English, and design researchers such as Professor Dilys Williams and her colleagues at University of the Arts London (UAL) (Black, 2012; Fletcher, 2012; Erhman, 2018), play a crucial role in critiquing and rethinking fashion from the perspective of design, manufacture and textile technologies, less work has been done on how changes in consumer/user behaviour might address this situation. The Arts & Humanities Research Council-funded (AHRC) project Designing a Sensibility for Sustainable Clothing (S4S) aims to do this by involving community groups in dialogic reflexive workshops that both mimic and reimagine phases of the lifecycle of clothing by, for instance: making fibre and fabric; making, modifying and mending clothes; up-cycling, repurposing and dealing with waste fabric. The underlying thesis is that engaging in such activities will not only raise consciousness about the appalling effects of the fast fashion industry, but also help to change everyday behaviour through affectual engagement with dress and textiles communities and processes, skills, materials and methods. As such, S4S proposes a mode of 'quietly' affective, everyday activism that is embedded in, stems from and is transmitted through communities (Hackney, 2013a), a lived, embodied equivalent to partner Fashion Revolution's global activism. Research draws on data from a rich mix of social science and arts methods, including co-generated creative outputs, in-depth interviews, short reflective videos, wardrobe audits, clothing diaries and surveys. For the purposes of this chapter analysis will focus on findings from two areas that demonstrate the benefits of a combined quantitative and qualitative approach: 1) preliminary surveys; 2) film screening workshops.

Extant research reveals the difficulty of reversing fast fashion. Even those aware of fashion's externalities can get caught in a value-behaviour gap since quality fast-fashion items are more readily available in the marketplace and out-compete eco-fashion (Moon et al., 2015; D'Souza, 2015). To effect change we have to locate clothing behaviour within wider formations of identity, attachment, socially constructed values and psychological drives. Part of the answer lies not only in our intellectual but also our affectual relationship with fashion, its deep connections with individual identities that are themselves rooted in socio-cultural attachments (Cassidy and Bennett, 2012; Kaiser, 2012). Such complexities underpin the project's focus on the notion of 'sensibility'. Defined in the Cambridge Dictionary as 'an understanding of or ability to decide about what is good or valuable, especially in connection with artistic or social activities' and in the Oxford Dictionary as the 'quality of being able to appreciate and respond to complex emotional or aesthetic influences', a sustainable fashion sensibility suggests the ability to identify, develop and practice a new set of clothing qualities, values and behaviours. Thinking about sensibility, moreover, foregrounds emotion as a driver of change in making sustainable fashion choices, as Otto Von Busch argued in his recent keynote at the Global Fashion conference, LCF, 2018. Finally, the notion of forging a new sensibility for sustainability is valuable because it involves both change in our outer 'sensible' lives - from physical sensations to sociability – and our inner thoughts, subjectivities and imaginaries.

Fashion is not solely the preserve of global corporations, it is also about individual experience. As Dilys Williams recently observed on a radio programme about environmental change, fashion makes 'climate change human in scale because each day each of us makes a decision about what we buy, what we wear, how we value it, how we care for it' (Fidgen, 2019). Furthermore, we know that buying things does not

increase happiness. Psychologist Lorraine Whitmarsh, speaking on the same programme, identified three fundamental psychological human needs that drive our actions and behaviour: 1) Autonomy through experiencing an element of freedom of choice; 2) Competence that comes from feeling good about doing something; and 3) Relatedness, which fulfils our need for social bonds with people. Significantly, all three featured prominently in S4S videos, participant reflection and discussion. Policy makers are more alert than ever to the damaging social and environmental effects of the fashion industry. Recommendations by the All Party Parliamentary Group on Ethics and Sustainability in Fashion and DEFRA's Sustainable Clothing Roadmap (DEFRA 2011) have recently been supplemented by an intensive interrogation of fast fashion by the cross-party Environmental Audit Committee (EAC). The latter's report into the Sustainability of the Fashion Industry closes with an urgent call to action: the 'current exploitative and environmentally damaging model for fashion must change' (HoC, 2019a). S4S recommendations for reinvigorating the high street with spaces dedicated to skill sharing, making and mending, repurposing, swapping, and clothes rentals are featured in the EAC's final report, Fixing Fashion: Clothing Consumption and Sustainability. Fashion: it shouldn't cost the earth, (HoC, 2019b), suggesting one way in which the S4S method for promoting more sustainable clothing behaviour might be scaled up, or more properly scaled across, by connecting multiple agencies.

Method and Methodology

S4S is an interdisciplinary collaboration between researchers in the social sciences and the humanities: politics academics at University of Exeter and arts research practitioners at the University of Wolverhampton. The project also involves external partners: community organisations in Cornwall and the West Midlands, sustainable fashion designers Antiform, the campaign and advocacy group Fashion Revolution, and a group of specialist design, fashion, and environmental advisors. Concurrent linked launch events in Cornwall and the West Midlands attracted over a hundred people to listen to sustainable fashion experts, participate in maker workshops and help shape project research questions and themes. The forty people who elected to become involved in the project proper went on to attend between five and twenty workshops and participate in project research methods . Twelve participants attended all twenty workshops in Cornwall while twenty-eight took part in at least five, and in some cases all twenty, workshops held in the West Midlands. All workshops lasted for a full day and they ran over a period of nine months in total. Around twenty people engaged in wardrobe audits, counting, logging and talking about items they own (Fletcher and Grimstad Klepp, 2017).

The project draws from three main strands of research. First, it extends work on social design, co-design, and the relationship between crafts and material affect (Armstrong et al., 2014; Kimbell, 2011; Hackney et al., 2016a and 2016b; Twigger Holroyd, 2017). Second, it contributes to the field of sustainable fashion and design (Fletcher 2016). Third, it contributes to research on behaviour change. Dominant approaches to behaviour change, which focus on information and fiscal incentives, have limited efficacy due to the value-behaviour gap. A novel aspect of the project is its use of the concept of 'affect', which refers to how socio-political contexts and emotional responses shape how people learn and behave. Affect is particularly relevant to fashion and consumerism, since the current economic system 'mines affect for value' by generating emotional responses to sell products and make profit (Clough, 2008). This is most notable in celebrity culture (Morgan and Birtwhistle, 2009), but it also pervades self-identification with clothing (Guy and Banim, 2000) in relation to peer approval (Roper and La Neice, 2009). Clothes generate culturally resonant affective markers of popular aesthetics and symbolic meanings that determine how individuals communicate their identities to others (Schofield and Schmidt, 2005). Integral to understanding 'affect' is recognition that emotions can be seen as sticky markers which attach to things and ideas, shaping how they are absorbed into identities. Understanding how to encourage a sensibility for sustainable clothing choices thus requires us to unpick the layers of emotional attachments that underpin human responses to what might otherwise seem to be 'rational' choices and transfer them to more sustainable behaviours.

In order to explore this the team developed a range of research methods and tools, including: experiential workshops involving 'making interventions' (Hackney et al, 2016a), questionnaires, in-depth wardrobe audits, clothing diaries, interviews and short reflexive video films, to replace standard notions of production and consumption with material, sensory and emotional practices generated within communities (Clay and Bradley Foster, 2007). A conceptual framework around processes of thinking, feeling and doing: 'think, feel, act' was devised and embedded in mini-questionnaires, longer interviews, group discussion and film-making to help participants identify and reflect on and their responses throughout the project. The workshops were designed to mimic and rework the lifecycle of clothing, from production to consumption and disposal, by enabling participants to rethink their relationship with the fashion system through processes of engaged, participatory making (Barthes, 1990/1967/; Kaiser, 2012). They include a range of activities, from spinning fibre, weaving fabric and natural dyeing processes, deconstructing and reconstructing knitted garments and bespoke pattern cutting, to make-do-and-mend, up-cycling and repurposing charity items, embellishment as visible repair, and leather-working (Figures 1 & 2). The workshops were conceptualised as spaces 'in between' the flow of fast fashion which short-circuited it through creative interventions that foregrounded the quality, skill, labour and environmental impacts conventionally hidden in mainstream discourse. Skype conversations, film viewings, social media, and the reciprocal exchange of collaboratively produced items at the end of each set of workshops, enabled groups in different regions to communicate and learn from one another.

Figure 1. Make-do-and-mend workshop, Chyan Fields, Cornwall

Figure 2. Visible Mending, West Midlands

Our method, which combined quantitative social science method with qualitative practice-based arts research, was underpinned by 'embodied research' approach, which invites participants to use their bodies to explore and generate knowledges (Spatz, 2017; Thanem and Knights, 2019; Vachelli, 2018). The principle combines the emphasis on activity and learning as part of the research process found in more action-oriented research with a focus on the physical and emotional use of the body. The benefits of using this kind of methodological tool is that participants are provided with the spaces and opportunity to connect and reflect on the topic matter in depth through engaged social material practices as they make and talk together (Hackney et al 2016a). In this respect, the research is both informative, and transformative (Heras and Tabera, 2014). There were two objects to the activity. Firstly,

it was to provide the spaces for conversation so we could understand more about how participants felt about clothes, and the kind of learning journey that they were on. Here, the act of doing and being through the material act of making facilitated a more in-depth understanding of how individuals constructed their phenomenalogical lifeworlds around clothing (Mead, 1934; Blumer ,1992; Goffman, 1959; Lee 2016). Secondly, the tasks in themselves were designed to enable participants to learn about the journeys that clothing takes (for example, making yarn or fabric from raw materials); the kinds of ethical questions that are raised by fast fashion (eg. The human and environmental costs of mass consumption of cheap clothing); and to learn skills to make, mend, and modify clothing themselves.

Participants in both locations were introduced to four series of workshops, familiarising them with various aspects of the clothes making process. The workshops followed iterative themes that responded to, and built on, one another: 1) Fluff to Fibre: spinning, dyeing and weaving yarn; 2) (De)Constructive/(Re)Constructive Knitting: un-picking and re-making garments; 3) Towards Zero Waste: learning about the problem of global textiles waste; 4) Vintage Pattern Cutting: making patterns and garments using 1940s techniques and waste materials; 5) Make-Do-And-Mend: learning and applying sewing, darning and repair techniques; 6) (In)Visible Mending: using stich techniques such as needle weaving and goldwork to embellish stains, rips and tears in clothing; 7) Second-Hand and Ethical: charity shopping, adapting and re-making garments; 8) Re-Make, Re-Purpose, Upcycle: upcycling, repurposing existing garments and making new artefacts from waste leather. A set of colourful leaflets, including workshop summaries, participant quotes, and instructions about skills and techniques, is available in print form and will be downloadable from project website (currently in process https//www.sites.exeter.ac.uk/s4s).

The Cornwall group was formed in the initial phases of the project, and although there was some attrition, most participants remained involved in some way over the duration of the study. Due to the wider geographic spread, working with partner organisations, West Midlands participants were asked to attend a minimum of four sessions in any of the four workshop series. The majority in fact were present at far more than this, some being involved in all twenty. All the Cornwall participants were female with most aged around or under thirty. The West Midlands group included a more diversity in terms of age and gender, including teenagers and three men. As the workshops progressed people began to invite friends and family along, and a number of parent/child teams developed (Figure 3). The workshops were recorded and transcribed, and participants were asked to keep a reflective 'clothing diary' recording details about the skills they learned, their participation in the group, the garments they made, and to what extent and how their thoughts, feelings and actions around sustainable clothing changed. All data was inductively thematised following the principles of grounded theory (Charmaz 2006; Strauss and Corin 2008) looking specifically

at the ideas and affective emotions (Ahmed 2004) that participants attached to clothes, the various aspects of the clothes making process, the materiality of clothing, and how participants felt about clothing choices. These themes were then coded for further analysis, clustering around: how people feel about clothes; how they shop; clothes and ethics; the process of making, mending, and modifying clothing; creating behaviour change.

Quantitative Data Analysis, Style and Practice

A quasi-experimental questionnaire was devised asking participants for self-reported assessments of skills, attitudes and behaviours before and after engaging with the workshops. This enables us to gather a quantitative measure of the effects of the workshops in relation to how

Figure 3. Mother-daughter team repurposing maternity wear, Antiform workshop, West Midlands

people think, feel and act about their clothing. Our approach illustrates the value of survey research for making such assessments and the considerable multi-faceted effects that our workshops have had on our participants.

We asked our participants to provide a list of their top five shops for purchasing clothes. We then characterised these as: high street, charity, online, vintage and reused. The majority of the twenty two participants for whom we have valid pre- and post-participation answers preferred to list high street sources both before (on average 2.8 out of 5) and after (on average 2.2 out of 5) workshop participation, with a very slight shift away from the high street towards charity shops (mean before =0.6, mean after = 0.7).

Most of our participants (16 of 20 valid answers) reported that they would 'not continue to buy fast fashion' in general except for essentials, like underwear. This marks a significant change from the claim made by 19 of 23 that they had purchased clothes from a fast fashion retailer in the past 2 years. However, a minority would be tempted to purchase fast-fashion in a sale (only 4 of 18 said they would do so). Their overall spending on clothes appeared, on average, to have increased from pre- to post-participation.

Of our 22 participants with valid answers to the question on clothing spend in both the pre- and post- survey, 9 had increased their monthly clothes spend, 8 had remained the same and 5 had reduced it. Of the 12 spending less than £20 per month at the start of the project, four had maintained a low spend, and 7 had increased to £20-50. Of the five participants who spent £20-50 at the start of the project, three had remained the same, one had increased to £100-200 and one had reduced to £5-10. One participant spending £50-100 kept her spending constant, but another had reduced from £50-100 to less than £20 per month. All 3 of our participants who used to spend more than £100 a month on clothes had reduced their spending: one to less than £20 per month, another to £20-50 and the third to £50-100.

That some participants had increased their clothes spend seems to be related to their more discerning tastes post-participation, as they increasingly sought more ethical – and presumably more expensive – fashion items. In Table 2, we show the mean scores (where 1=not at all and 5=very much) for a range of factors that influence decisions to purchase clothes. Despite the low sample size, the mean scores are a good summary of the data given the low variance in responses across our participants. Table 2 also includes the standard deviations of the mean, which give an indication of the high measure of fit of the mean to the majority of participants. After taking part in the workshops, people are markedly more influenced in their buying choices by the quality of the fibre and construction, the brand and locally produced clothing items. They are also slightly less concerned about what their peers think about their clothing choices and, overall, never concerned about being in fashion.

Factors that influence purchasing choice (n=26)	Mean score before (1-5)	Mean score after (1-5)
Quality of fibre	3.6 (SD 1.18)	4.6 (SD 0.80)
Country of origin	2.0 (SD 1.16)	4.1 (1.22)
Quality of construction / manufacture	3.9 (SD 0.95)	4.4 (0.95)
Price	4.3 (SD 0.95)	4.0 (0.76)
Brand	2.6 (SD 1.31)	4.1 (0.95)
Locally produced	2.6 (SD 1.20)	4.1 (0.84)
Being in fashion	2.1 (SD 1.26)	2.0 (2.03)
What peers think	2.0 (SD 1.16)	1.6 (1.62)

Table 1: Factors that influence clothes purchasing choice before and after our workshops

Notes: SD refers to the standard deviation of the mean, which indicates that the majority of cases in the sample fall just a small distance from the mean.

A battery of agree-disagree (5-point likert scale) questions further reveals the impacts that our workshops had upon our participants in relation to thinking carefully about what they buy, learning new skills, buying fewer items, finding new meaning, sourcing clothes ethically, thinking differently about how they dress and being more likely to fix their clothes (Table 2). Strikingly, few reported that they have changed their style, suggesting an enduring emotive connection with style, despite shifting preferences towards more ethical attitudes to clothing. Less than half acquired new equipment, such as a sewing machine. The effects of the workshop series might be compromised because the 'things' that facilitate behaviour change are no longer readily available.

Category	Impact (n=26)	Number agreeing or strongly agreeing
Think	I think more carefully about the clothes I buy	23
Feel	I feel more empathy for the people who make my clothes	22
Act	I am more likely to fix my broken clothes	22
Act	I have learned new skills	22
Feel	I feel I have made new friends	21
Act	I buy fewer new items of clothing	20
Act	I try to find out who made my clothes	19
Act	I increasingly source my clothes ethically	19
Feel	I find different meaning in the clothes I wear	16
Think	I think differently about how I dress	15
Act	I have acquired new equipment	12
Act/feel	I have changed my style	8

Table 2: Thinking, feeling and acting impacts of our workshops

Feeling Film, Aesthetic Affect

Short video films were made iteratively throughout the workshops and from the outset this was envisaged as integral to research activities. The film-makers: Nina Constable in Cornwall (www.ninaconstable.co.uk) and R & A Collaborations in the West Midlands (www.racollaborations.co.uk) operated as co-researchers, sometimes participating in discussion and making activities (Figure 4). Over thirty short films have are available on the S4S You tube channel along with 'Resolution' a twenty-minute summary of the project and its findings (S4S Films, 2019). Academic work on community film is growing (Malik et al, 2017) and S4S builds on earlier research by team members who used film as a reflexive device for community craft groups (Hackney, 2014; Rana and Hackney, 2018). The films were intended to operate as a discursive device helping participants to better understand their own and others' experience of the workshops, to what extent and how their ideas, attitudes to and feelings about clothes, their clothing habits and behaviours, might change.

Figure 4 Nina Constable filming while the Cornwall Group spin

As the project progressed the film makers began to identify themes that underpinned an emerging sustainable fashion sensibility. These include: identity (Jack's Jumper), changing values (Value), time (The Gift of Time), economy (Being Thrifty), affective connection (The Ripple Effect), community and communication (Group Chats), science and environment (Detergent Test), family (Family Influences), abilities and asset-building (Hidden Potential), media (Unravel: The True Cost), heritage (Reclaiming the 1940s), facilitation and learning (Hanny's Workshops), skill-building (Upcycle), and material practice (Make-Do-And-Mend). Screening workshops gathered feedback about participant responses. The degree to which the films prompted an emotional connection with the project was immediately apparent. West Midlands participants felt that they rekindled 'the feeling … from doing the

workshops together and then the feeling can come back through the films'. Watching them in chronological order, moreover, they noticed how they communicate a journey: '[T]hat very first opening sort of session I don't think we really were aware of what kind of journey we were really going to step onto … You can start to see the change happening … It's changing, it's changing your habit pattern isn't it'.

These perceptions of filmic affect as an emotional conduit and memetic device can be linked to the films' aesthetic qualities, whereby colour, texture, detail, light, close-ups, personal narratives, and temporal slowness convey values of trust, intimacy and honesty, and a sense of emotional closeness and pleasure, something that may be equally available to wider audiences (Hackney, 2013b). Cornwall participants noted that the film narratives felt true to their experience of the workshops, communicating a sense of authenticity that would appeal to others. One West Midlands' participant saw the films as connecting people with the experience of working in a community even when working alone. Another talked about how they communicate the ethos of the project and the pleasure of participation: '[A]s a body of work it's a lovely, a lovely portfolio to look at and just kind of keep remembering some of the ethos … it's reminding that actually when we do things together we're probably more productive as well [and] by doing things together it becomes a pleasurable thing rather than a weight on your shoulders you know'. A third, projecting into the future, thought that the films will help to keep feelings and habits formed during the workshops alive for her:

> *It's been a nice reminder of the journey actually and I think I probably will watch them to keep my momentum going myself. I think the changes have been made up here so when I go and buy new clothes or, you know, I'm looking at where they're from I'm not necessarily going to go to those cheap chains anymore. So that's kind of, that's integrally changed. But I think it's too easy to get wrapped up in so once you move away from the project … if I sustain it I'm going to get the feeling back again. (West Midland's participant, 2018)*

The films helped her 'get the feeling back' of embodied affective participation becoming, not only a prompt but also the emotional glue forging a felt sensibility for sustainable clothing by attaching experiences, things and ideas to identities.

Conclusions

While the shock effect of films such as The True Cost (Morgan, 2015) and Stacey Dooley's documentary *Fashion's Dirty Secrets* (2018) raise awareness about problems in the industry, they are less helpful in providing strategies for change. Designing a sensibility for sustainable clothing, in contrast, approaches the problem from the ground up, affectively and experientially including: point of purchase, the context of use, the social milieu in which clothes are worn, cared for, appreciated and become socially meaningful, and the mentality through which they become markers of identification on a deeper psychological level. The combination of social science and arts research methods provide quantitative and qualitative insights into this process helping us to better understand and assess, not only the changes that are taking place when participants engage in this kind of work but also the context, conditions and motivations for change. They also suggest the ways in which a sensibility for sustainable clothing might disseminate, as participants take ownership of the research methods and techniques (workshops, films, diaries, design, stitch skills) and embed them in their lives as tools for behaviour change.

An affectual economy of making emerged as participants connected with their clothes in new embodied ways. Inductive analysis of project data uncovered the ideas and affective emotions that were attached to clothes, the making process, the materiality of clothing, and how people felt about their clothing choices with a focus on: feelings about clothes, shopping and ethics, processes of making, mending and modifying clothing, and creating behaviour change. The films prompted group discussion about the social and environmental impacts of fast fashion, but this was framed within a context of lived experience and personal connection. They reconnected people with the 'feelings' experienced during participation, something identified as a motivator for future behaviour change. Continuity, meanwhile, thrived alongside change. The questionnaires reveal that as clothing thinking and practice became more ethical, an individual's perceived sense of style, and identity, remained unchanged. The workshop materials (booklets) and accompanying films show how participants adapted project learning and methods to reinforce/develop style/identities by making and reshaping their garments as the tyranny of fast fashion loosened its hold, at least to some degree.

The questionnaires and films evidence behaviour change in related and complementary ways. Many participants have restricted their shopping, buying from charity shops or swapping, repairing and upcycling clothing. A number have not bought any new clothes, taking a pledge to buy second-hand or swap with friends and family, accepting new clothes only as gifts. Fast fashion began to be judged as unacceptably poor in quality and not worth the social and environmental 'cost'. As their affectual relationship with clothing shifted, several remarked that buying new clothes just didn't 'feel right'. The Cornwall group emphasised the importance of developing a self-reflective mentality: to slow down and 'pause' before buying, asking oneself, 'do I really need this item? How and where was it made? How can I look after it?'.

A West Midlands participant declared that the workshops made change seem achievable because 'they weren't about saving the world, they were about darning'. Both groups agreed that change had occurred gradually through a 'process of doing things with the group' rather than

any prescriptive demands 'directly stopping you buying things'. They also described how they might deploy their learning, repopulating the high street with making spaces, running classes in schools, or adapting workshop methods to challenges for Girl Guides, for instance, signalling the power of an affectual activism that is 'quietly' enacted and embedded in everyday life.

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So, what do you do? The role of design research in innovation for worklife inclusion

Lise Amy Hansen

Abstract

This paper focuses on the role of design research in a large innovation project in Norway – InnArbeid - where technology and services are developed for social change. There are numerous policies in place and an increased awareness in Norway that agree to and support worklife inclusion of young people with developmental, intellectual disabilities (ID). Also, technological advances today could allow for a more diverse workforce, yet the opposite is happening and their participation in working life is in decline. Our case then, presents a challenge where even national policy together with a general consensus of agreement and good intents do not lead to change, and we argue that design research can play a role in teasing out novel areas of opportunity for creating and in particular co-creating technology-supported services. This is through creating scenarios and dialogues where the user involvement provides a radical expertise that may go across sectors and silos and be put into play. Here design has a role through its explorative and adaptive nature as well as its wide applicability and – at times – as a trouble-making, wishful and wicked approach to current needs and state of affairs.

We reflect on the strategies that underpin the research design towards innovation. Design is positioned as explorative and - for service design in particular - as a visually and holistically driven practice. We explain our thinking behind the use of design research approaches for developing sensitivity to emergent processes and involvements, and how they are blended with practical methods and skills in building design knowledge. We will discuss three positionings of design research within the InnArbeid project: as an experimental development (design school work), as co-created ideation and conceptualisations (workshop involvements) and as well as the role of design research as an overarching approach (research designs).

In an innovation project, there is tension between creative explorations and critical analysis on which we elaborate, by way of reflections on the development of our innovations. In particular, we look at how such a design-centred approach can provide access to nuanced yet meaningful, dimensions of knowledge. We conclude with a reflection on the challenges involved in developing an explorative, yet critical innovation approach grounded in co-design sensibility, and the need for building communities of practice for ongoing design literacy in design research.

The Innarbeid Project

InnArbeid forms the case for this paper and frames the discussion on the social turn in design research today. The three-year innovation project's aim is to contribute towards increased work participation for people with developmental, intellectual disabilities (ID). We will do this by co-creating services towards four aspects: coordination and process support, everyday support, work application support and (staying in) work support (Figure 1). The project is currently midway and we will share some reflections and early findings from the process so far.

The project was initiated by Sogndalen municipality in the south of Norway, where they noticed that young people with ID where leaving school and increasingly struggled to find their place in working life. Research confirms that in recent years there have been fewer - not more - people with ID in working life (Engeland & Langballe, 2017). This sits against a broad political and general consensus that society should facilitate such work participation.

Key factors that challenge the research in developing innovations for the transition from school into work, are that the end users are persons with developmental disabilities, which entails cognitive and adaptive functional impairments (ICD-10, 2011). Additionally, the transition from upper secondary school to working life is part of a complex context involving many different actors with mutual dependencies (Holen-Rabbesvik et al, forthcoming).

The project adopted an Action Design Research (ADR) which draws on action research and design science in information systems (Sein et al, 2011). The combination of action research and design science provides an approach to open, complex and dynamic problems whilst contributing with design research on general solutions. The aim is to innovate beyond the problem situations which today's situation presents, and to enable a set of actors to become proactive in their relationship to their environment (Dorst, 2015). Thus, the project is set up partnering with the key actors in the life of young people with ID; from the municipality to upper secondary school to health care, to assisted living to employers and colleagues. This broad involvement reflects the systemic challenge of the project and to anchor the wider systemic changes through co-creation to ensure the ensuing implementation (Murray et al., 2011).

Figure 1. Stills from the introduction film of the project available at https://innarbeid.uia.no/

Innovation for Norway's public sector

The Norwegian public sector is now increasingly identifying a need to innovate its services, and several national plans support this (KS, Direktoratet for e-shelse & Helsedirektoratet 2019; Norsk Forskningsråd., 2019a; Helse- og omsorgsdepartementet, 2013). At the same time, the need is also increasingly facilitated through national financial support schemes to initiate more innovation in the public sector (e.g. Helsedirektoratet, 2019; NHO, KS & Difi, 2019; Norsk Forskningsråd., 2019b). The InnArbeid project is financed as part of such a strategic programme - the NFR Helsevel programme – where the

public sector is invited to be the initiator of innovation projects. It has been shown that when the public sector employers themselves partake in the practical experience of identifying users' needs and co-create service concepts, the public sector participant's attitude towards service innovation and user insights changed (Hansen, Kistorp & Almqvist, 2016). Our ADR approach includes mapping of needs and co-creation, and the user involvement continues through the evaluation stages as well as the implementation stages in iterative processes (Sein, 2011). This proposes that the act of framing the problems and the solutions, involves a sequence of creative and critical steps (Dorst, 2019).

For the InnArbeid project then it was central to have a close involvement of users and a transdisciplinary approach to the identification of underlying needs and themes. The main research group comprises health care, ethics, information systems, inter-organizational cooperation and service design. We have conducted interviews, workshops of various forms and observations to be able to form an in-depth mapping of needs whilst also creating engagements with the end users and the other actors (Engström & Elg, 2015).

Below, we present three aspects in the InnArbeid innovation project where design played a central role, in order to tease out some concerns and considerations for design research towards social change. We will first describe a design studio module with Master AHO student which tackled the innovation project as a design brief. This is to describe some experimental and discursive aspects of design and how these may feed innovation research. Next we describe a set of workshops that were central for our user involvement – both to validate and challenge the user needs identified initially in the project - and to involve the various users and actors in ideation and concept development whilst informing and challenging the problem framing and the solution spaces. Thirdly, we describe how the project group came about and how we negotiate and collaborate on the various phases towards the proposed innovations.

The Design School

The Oslo School of Architecture and Design, Institute for Design, is a partner in the project and lead the service innovation and research design. One year into InnArbeid, AHO created an elective Master course module to run alongside the project independently, where master service design students were invited to work with our research-based design brief to produce future service design concepts. This took place over half a semester – eight weeks. The design brief was to develop service design concepts the enable and ensure the transition from school to working life. Their challenge was that there is a lack of knowledge concerning people with disabilities, where especially inclusion in working life has received little attention (NOU, 2016) yet it known that participation in working life is known to give positive

psychological and physical effects (Dalgård, 2006), and that it is particularly important to people with disabilities (Law et al.,1998).

The students were given access to the project's ongoing research findings through presentations, papers and project references and in particular the transcribed and anonymised interviews, workshops and observations – the involvement of over 60 people thus far. They also had access to the interdisciplinary research group and other partners in the project.

Their early concepts were presented to central actors from the Department of Health in Oslo (Helseetaten) and Nordpolen Enterprises who working with young people with ID in policy and practice respectively. The independent yet informed concepts introduced some experimental and discursive aspects on the framing of the challenge of getting young people with ID into work, as well as insights from their own research from their own concept development. The presentation afforded for Oslo municipality and Nordpolen Enterprises to give critical, real-world feedback, which was followed up in a co-creation workshop (Figure 2). With an overall challenge of such complexity, the challenge is 'to intervene in a way that makes the whole system move to a more desired state' (Dorst, 2019: 123). Working on the experimental and midway concepts formed a way for Helseetaten and Nordpolen to engage with InnArbeid by creating ways to implement reframings and insights into new service design innovations.

Figure 2: Early concept presentation and work-shop with Helseetaten and Nordpo-len.

Holistic solutions and visual challenges

The students worked in groups and were asked to select and scope their new service designs and were invited to make use of the project's research to date. When working on the project they learned to draw upon advanced research whilst they were able to take risk beyond perhaps what a research group would had the time or nerve to - in particular with such fundamental social issues at stake.

The work resulted in two distinct directions – towards systemic changes and towards user-empowerment solutions. An example of the former was the concept 'On Track'. Here the students suggest a re-organised flow of the work training and employment to ensure continuous development and engagement (Figure 3). The students took on board a complex and explicitly wicked problem –- ensuring that young people with ID do not end up in their first positon after school. This could be the day centre, at home or at a work training centre, but that they develop in

their post-school life. Their project reflected a thorough understanding of the current state of needs, services, roles and institutions. They did take an art school flight of imagination – yet firmly grounded in research – and by embracing the freedoms this offered suggested a bold and innovative set of services for changing the transition from school to apprenticeship to work for young people with Intellectual disabilities. They re-adressed the roles played by the different institutions in order to stagger the road to employment – a radical move, yet also one that makes 'sense' if one were to enable change from a user perspective and with a service delivery in mind.

Figure 3. The resulting concept 'On Track' proposed a new 'track' for the person with ID whereby the daycentre/ activity centre was positioned as a place of transit and furthered training towards an assisted working position and towards traditional employment.

Advanced service co-design requires knowledge transfer and negotiation of the contextual frame for the design projects, as the participants need to understand, decide, and cooperate on acting forward. Therefore, alongside the service concept development, the students were set challenges such as visualising central user insights – which is quite a challenge with these hard-to-reach users (Figure 4). The student' design process explored how we may visually present these users' 'voice' that is 'information about a particular user's preferences and perspectives' (Langergaard, 2011: 227). The resulting visualisations aided an understanding on the perception of people with ID.

Figure 4. Shivani Prakash using graphic marks illustrating insights, whilst untangling the visual issue of avoiding identifying the people with ID whilst also working on avoiding the stigmatizing clichés of ID.

Making do

When explorative design processes are teamed with co-creation and user-involvement, we have an activity that is a 'working with' rather than a 'doing to' (Ingold, 2011; Sanders & Stappers 2011). I mention the design school's involvement to make a case for the experimental and discursive aspects of design and how these may feed innovation research. Design research has a role to play to ensure that the practical relevance is explored within a practical 'makers' frame – reshaped through co-evolution. Through such investigations, one may seek assurance that the problem framing can potentially lead to realistic and relevant solutions (Dorst, 2015). The final presentation was to a senior service designer at a leading Norwegian design consultancy, several of the partners in InnArbeid and the AHO researchers.

And in the making processes of our service design concepts, there are also insights appearing that may only be apparent or come about only during the creative process. These may in turn be pivotal in the work of implementation and transferability, and as such are crucial for innovation projects. Such an emergent approach in design practice to the problem framing has also been described as non-linear, and explorative (Van der Bijl-Brouwer, 2019). This 'reframes the task of design as system transformation, rather than the creation of a solution' (Dorst, 2019: 117)

The Workshop Design

The InnArbeid ideation and concept stage is led by AHO and it followed on from the user insight work led by Sogndalen municipality. At this stage, we'd gained some early insights; an interdisciplinary perspective and a conformation that close cooperation with the public sector is important (e.g. Jacobs 2016). Furthermore, a flexible and pragmatic approach to data collection is crucial for obtaining relevant knowledge from all involved actors (Holen-Rabbesvik et al, forthcoming).

We designed a series of co-design workshops to explore what design intervention may support systemic coordination and mapping of work ability. We ensured a broad involvement across professions and with the various roles that relate to our end-user in the workshops: from the municipality, department of employment (NAV), upper secondary school, assisted living carers, to work training employers, to employers and colleagues. The rational for this broad involvement was an increased understanding that services are not only an end product in themselves, but that services increasingly become a driving force for broader societal changes (Sangiorgi, 2011). The first set of workshops focused on participation for idea generation and the second set for concept design developments.

Ideation workshops

To start of the idea workshops, a design researcher presented the project through a narrative visualized by way of a user journeys (Figure 5). Upon entering the workshop, each participant could place themselves on the journey.

Figure 5. The timeline and scope for people with ID in the InnArbeid..

Figure 6. The complex sets of actors mapped out.

Figure 7. Each task had a question card with reference material.

The workshop material and activities were shaped in order to leverage the expertise of the different actors, by using questions informed by the user insights thus far infused with current research and framed within the project goal of innovating technology-supported services (Figures 5 to 7). We also invited young people with ID themselves as well as parents of people with ID. Whilst the workshop was designed to include – we confirmed ahead that questions were relatable and we used visualisations actively – we also knew that the young people with ID would have limited opportunity to contribute in such a setting. We therefore also had smaller, individual meetings where the work could be more on the terms of the person with ID.

These activities gave us an opportunity to confirm or contest the collected narratives and insights as a way of ensuring robustness in our new insights and current challenges. However, as this is an innovation project, the focus went beyond this and the activities were designed to leverage the participants' ideas for future technology-supported services and the implications for the networks each actor presented. The discussions allowed for an untangling of why something was chosen or why it was important to an actor or set of actors.
The transcribed material from these workshops was analysed by inductive thematic analysis (Braun & Clarke, 2006). The emergent themes were summarized and presented back to participants in the next concept workshop, as well as to project partners and other

Figure 8. Four workshops were conducted each engaging 12-14 participants, of which several participating twice.

researchers involved in the project. This formed a feedback loop and quality insurance whilst also prompting further feedback on new ideas and new user insights. The emergent problem framing was thus keep firmly within an innovation frame, where each involvement with the users afforded reframing – beyond merely conforming what we knew thus far.

Concept workshops

From the ideation workshops, we chose to develop three concepts: a visual CV; a digital meeting place between employers and a digital 'market place' to connect potential workers and employers. These concepts came out of a combination of ideas generated in the ideas workshop and were presented as incomplete (Figure 9) as incompleteness has a generative force in triggering new ideas, attracting contributors and adapting to changing environments. However, there is also a challenge in establishing enough rules to provide stability, without stifling the design (Garud, Jain & Tuertscher 2009).

Figure 9. Early concepts sketches presented as incomplete designs.

Engaging with the great variety of users at every stage in the innovation project opens up a space for thinking and exploring through doing – not relying only on cognitive reasoning. Such an involvement, whereby the actors are not just sources of information on the outset but active participants throughout as in co-creation and evaluation, we acknowledge that the stakeholders constitute the system and that any change will be tethered to or depend on the involved stakeholders (Jones, 2014). From the ideas workshop, we developed a CV probe (Figure 10 & 11) towards the concept workshops in order to further develop a conversation on possible designs and directions (Boehner, Gaver & Boucher, 2012).

During the workshop, sketches or visualizations of different concept solutions were shown to the participants who was asked to further explore and critically discuss these concept designs. The visual concepts worked as a kind of experience prototyping: "any kind of representation, in any medium, that is designed to understand, explore or communicate what it might be like to engage with the product, space or system we are designing" (Buchenau & Suri, 2000, p. 425). The participating young people with ID had either a parent or a carer

with them to ensure that they could participate as much as possible of the workshop and also to inform facilitators ahead in creating a safe and inclusive experience.

Figure 10. The CV probe was worked on by individual members in the workshop, and was also discussed in a group at school prior to the workshop participation – led by a teacher.

These workshops show how design researchers' may make tactical forays into exploring a complex and difficult situation, which in turn generate knowledge towards the next technical development stage. However, the main challenge at this stage in the innovation process was not only to identify solution spaces but rather to co-creatively decide on a problem framing. With such a complex social issue - we do not lack problems to solve – neither singular nor systemic ones. As a recent study shows, the problem framing in the social sector tends to be non-linear, emergent and explorative (Van der Bijl-Brouwer, 2019).

Figure 11. Annotated probe.

Figure 12. screenshot of an experiential prototype of the CV explored in a workshop through visual components.

The analysis of the concept work embraced this complexity and leaned on process studies that sees change and innovation as ongoing, instead of a linear approach consisting of phases, and focus on 'how and why things emerge, develop, grow, or terminate over time' (Langley et al., 2013, p. I). Process studies are stories about change; patterns in events, activities and choices over time; who did what when (Langley, 1999) and the participation and engagement were designed to tease out the relevant practices for our project's overarching aim to 'design a new service model for the transition between upper secondary school and working life for people with ID'. However, the positivistic ethos of co-creation (Manzini, 2015) is pushed to its limits when working with people with ID and we had a focus on performativity and practices, approaching practices as the unit of exploration, where knowledge is embedded and expressed in the doing – in the practice itself.

The Research Group

For this paper, we have focused on the design research interventions and methods rather than on our results and the paper highlights the research entanglements of using design for future service innovation processes by way of engaging with and for people with reduced cognitive abilities.

Collaboration dialectic

The project's trans-disciplinary group found a way to work together during our pre-project and during the application process we agreed on participation across work packages. The application procedure however demanded a certain division of labour. When we successfully gained funding, we realised we would need certain set times to working things out together and planned more frequent two day meetings. This set-up was in keeping with a holistic approach to innovation: research shows that a holistic understanding of problems - and in turn, of the underlying user needs - is necessary to bring about innovation in contexts where the problems are complex, dynamic and linked to networks (Thies, 2015). The lack of knowledge base is particularly challenged when it comes to identifying needs in complex contexts that require inter-organizational cooperation such as for InnArbeid, and when end-users have various degrees of cognitive impairment.

In order to support our emergent problem formulation (Van der Bijl-Brouwer, 2019) we strove to combine academic rigour with practical relevance through engagement. AHO also initiated and engaged an eclectic mix of researchers and designers to be a disruptive group (e.g. 'forstyrrergruppe') to ensure the project group was not tripped up by their own good intentions or their own learned practices entering new fields. Importantly a 'forstyrrergruppe' is not tasked with solving anything – they are free to give critical feedback without repercussions of an increased workload as a consequence of any critique or corrections.

Collaboration as a shared balancing act

By ensuring this extended, shared time, we created a productive space which has given us joint publications, a national conference and exhibitions well as the innovation concepts thus far. We propose that out of this space grew a dialog that can be seen as a frame through which views and perspectives forged from differing discursive paradigms, disciplinary trainings and personal histories that were brought into an improvisational activity of critical co-production. These voices speak from particular positions within design, computer science, municipal work, health care studies and interaction design, information systems and ethical studies. We also knew that we had to work with a hard-to-reach expertise from our end-users – young people with ID - and find ways to involve and engage them. Therefore, many kinds of expertise were necessary towards our contribution in an academically funded innovation project and we negotiated the lines between pragmatics and possibilities, from politics to propositions.

Design Research For Innovation

Next we discuss the potential for design to contribute and enact and enable change and challenge society by way of some tactical designerly and scholarly forays together with other knowledge domains.

As mentioned, the research project group created a dialectic space to develop an emergent problem framing together, as opposed to the more distributed (and perhaps more time efficient) way of delegating separate sections – a typical approach to such wicked problems (Jacobs, 2006). As a group, we have created a conference, produced joint publications, workshops and by now early concept innovations. Design research infused with informed freedom presents as an interesting idea generator for innovation. The robustness as well as the emergent solution space was held in place through the wide user involvement – from the practice field to the trans-disciplinary research group to the disruptive expert group.

Here, design as a practice and an approach could contribute by creating, conceptualising and enabling innovations in particular 'where the conceptual thinking depends on the craft skills' (Frayling, 2015). The new Horizon 2020 program - Horizon Europe - asks for just such an approach: more innovation, industry collaboration and tackling of complex problems such as climate change and health. Design's expertise has a close fit to such innovation work in making 'unthinkable discoveries' , in other words to not only rely on cognitive current knowledge, but on the actionable knowledge – the practices - of the expert users. However, design's participation in a research group require a certain set up - it asks for an iterative process, whereby insights and needs have to be revisited and revised because of the complexity involved in proposing change into an interdependent system (Jones, 2014).

Dialectic spaces

Our planning led to long meetings where we moved forward at a slow pace, yet it was crucial to be exposed to the same material and respond to it from our own individual practices. Design can play a role in rigorous research through informed yet experimental forays into new solution spaces (Wood, 2012). Research has shown that people from different fields not only work with their specialist languages, but 'they are actually trying to achieve different things'. (Blackwell et al., 2009: 4). Working with and through methods of design that encourage experimentation, can help researchers and developers 'uncover the virtually unlimited inherent contingencies of the world and gain new insights, both within and across their particular disciplines' (Grand and Wiedmer, 2010: 5–6). In this sense, design is a cultural endavour and the cultural semantics aspect of this is under researched (Frayling 2015). Methods of design can help transcend the limitations of dominant terminologies or methodologies and aid a transformation of diverse perspectives into shared visions. By presenting a visual or tangible presentation of proposed functionality, they can 'encourage engineers and researchers to focus their attention, not only on the science of prospective inventions, but also their design' (Heidingsfelder, Kimpel & Schraudner, 2017: 48).

Innovation projects such as InnArbeid is also an opportunity for design to evolve, not just contribute to other fields. It allows for a contextualization of design practice or a self-reflection. As Margolin has previous argued: 'if designers are going to realize the full potential of design thought, then they should also learn to analyse how the situation that frame design practice are themselves constructed' (2002: 241). For InnArbeid the involvement of design research meant we collaborated in visual and in part experimental ways. This contributed to a holistic approach to a complex and necessarily incomplete innovation environment. InnArbeid is the only Norwegian research project to approach the entire timeline from school to finding work as well as starting and remaining in work. The trans-disciplinarity of the research group is part of ensuring a wide engagement and actual user involvement with the complex transition that people with ID find themselves in when going from school to work.

By involving all actors by partnering them into the project and inviting young people with ID and their parents and carers ensured that we had many iterations and alterations on the development of ideas as much as concepts. And by applying for and designing ways in which the user engagement and feedback may involve alternative ways of communicating – whether through a trusted advocate such as parent or experienced carer or through using visuals and video to communicate concepts e.g. experiential prototypes.

With our design research participation, we suggested some tactical designerly and scholarly forays into the knowledge domains of adjacent fields, such as education, care, work training and work assessment. In turn, research has pointed to that 'research through design is likely to produce theories that are provisional, contingent, and aspirational' (Gaver 2012: 937). There is a tension in the propositional nature of design, with that of a deductive, rational progression towards innovations as well as the diverse insights from such hard-to-reach people. Research suggest that such a long view of development via communities of practice helps to "focus energy and intention to build a body of design knowledge that may take design into a desired future" (Poggenpohl, 2015: 44). As such the innovation project InnArbeid highlights design research as less of a technical, improving activity than that of a cultural and performative endeavour.

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The digitisation of cordillera weaving: Designing a new oral tradition

Rachel Kelly

Abtsract

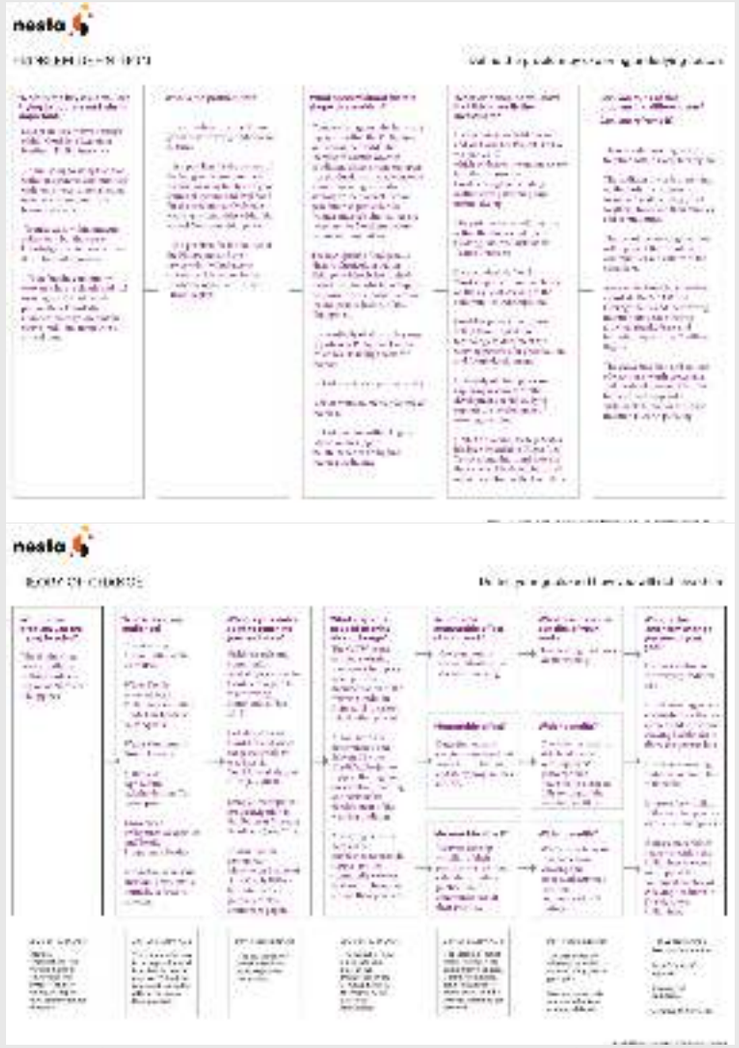
Under the remit of the UN Global Challenges Sustainable Goal 4, it must be understood that the capital value of knowledge preservation needs to be elevated by the economic benefits of formal education and the ongoing and often lifelong socio-economic impact it creates. The development and support of ethnolinguistic weaving practice may enable real-world benefits for Philippine society, culture, the environment and the economy; it may address global challenges of diminishing craft skill bases and knowledge and it may encourage an education ecosystem which challenges dominant craft and design education structures…

It has been evidenced that while the Cordilleran weaving tradition has the status of National Heritage within the Philippines, the numbers of community weavers able to practice is dwindling. A 2019 British Council & Crafts Council / Crafting Futures grant project enabled a collaboration between the Philippines based CordiTex project and Manchester School of Art to support the future digitization of indigenous weaving tradition within the Cordillera region of the Northern Philippines entitled: Creating a Sustainable Textile Future for Women via the Digitization of Cordillera Weaving Tradition (CSTFW) project. This project developed a Learning Framework and Toolkit to support the preservation of an oral based weaving tradition and to develop interventions for practice and knowledge based change. The project raises the voice of oral craft traditions and presents a heteroglossia, defined by Mikhail Bhaktin (1895 – 1975) to describe the relationships between different voices which can be heard within authored works such as hand woven textiles. The CSTFW project is considering the structures and systems from an educational and social standpoint to understand the perspectives for change this project identifies. Our rationale was to listen, observe and consider the research context and its challenges, in order to be able to respond with effective and useful strategies for support. We asked if the weaving tradition of the Cordillera is to transform and change from the problems it faces, what impact might the shift from of an oral to a digital tradition create?

We became a part of the CordiTex project in their second year out of three years funding and we brought Crafting Futures based research questions from our project funders. The British Council Crafting Futures project asks, How can craft generate economic opportunities and enhance livelihoods for women? and, how can the global craft sector address the declining youth engagement in the practice as well as the growing intergenerational divide? These questions sit beyond the CordiTex project aims and part of our work in the collaboration, has been to consolidate our differing research destinations and aims.

Research Context

In the Cordillera region a rich tradition of weaving can be traced back through time for centuries. Cordillera weaving occupies a niche, that is



Figures 1 & 2. Nesta Problem Definition & Theory of Change plans devised by Kelly, 2018

cultural, functional, and which represents the artistry of ethnolinguistic communities in the northern Luzon geographic region. The major groups in the region include the Ifugao, Kalinga, Tinguian, Kankana-ey, Apayao and Ibaloy, each presenting unique histories, rituals, language and weaving styles. The weaving techniques across the whole Cordillera region and communities is represented by a weaving design process and culture which is underpinned by distinct religious, socio-political and mathematical values. The process of weaving is often taught from grandparent to grandchild and features a meditative process of counting from memory which weavers learn from a young age. The uptake of weaving amongst younger women today and the knowledge of weaving techniques, pattern structures and traditions

are diminishing due to a range of socio-political and economic factors. Weaving knowledge is not held in a written form but is passed on via an oral tradition, where the holders of this knowledge are mainly elderly women 'Master Weavers'. The impact of the oral tradition as an unwritten knowledge base for Cordillera weaving is now in a critical state and the weaving tradition may become extinct.

> *"The focus of the CordiTex research was conducted among the Tinguian of Abra in northern Luzon, who had scarce documentation of its weaving tradition, but revealed the most intricate designs based on the collections from the museums in the US. The weaving declined in the 1980s, and only one Tinguian community in Manabo, Abra is still weaving, and natural dyeing is revived in Penarubia, Abra. Most of the master weavers are elders and many who passed away without transmitting knowledge to the younger generation" (Salvador-Amores 2018).*

Project Approach

The groups of weavers from the Cordillera are identified by their ethnolinguistic languages which define their cultures and represent identities specific to place, ritual, beliefs and work. The Cordillera ethnolinguistic groups were traditionally "a society made up of small, dispersed, rivalrous groups, with a reputation for wildness (e.g. headhunting)" (Rosaldo 1980). The difference between the knowledge systems, culture, and material knowledge held within the Cordillera communities and the knowledge we hold as research practitioners is distinct. The value of the weaving community languages and voices is a richness we as western contemporary educators find hard to improve upon.

In terms of approaching data collection we employed phenomenological and ethnographic methods including field research and deep hanging out (Geertz 1998). Such approaches meant that we were located in the research context where we could listen, looked, feel and remember rather than walk around with a notebook or camera. We were fortunate to have a photographer with us during our first field visit (Arnold Salvador-Amores) and his photographs tell a visual story of the project. Amores captured what we couldn't always see and our reflections on the data he collected via the photographs have supported us to figure the range of practitioner identities and voices we encountered (Holland; Lachicotte; Skinner & Cain 1998)

This project held a mirror up to us as researchers, educators and women and we the project team of Rachel Kelly and Dr Michelle Stephens maintained an identity as textile practitioners and weavers rather than researcher outsiders (Walmsley 2018). A Design Thinking Cycle was employed post-field visit, as an evaluation methodology to move the research from understanding to exploration and materialization (Cross

2011). A Theory of Change model (Nesta 2018) was the backbone of our methodology and we utilised our model to inform the project research questions, aims and outcomes. The Theory of Change framework was key to embedding a consideration of the wider landscape of change in which this project is located.

Research Part 1: Field visits to five Cordilleran weaving communities in Kiangen, Abra, Manabo, Santiago and Mindoro

While the CordiTex project is looking to preserve the Cordillera weaving tradition, our research focused upon two communities who are considered in most critical need of support due to the near decline of their tradition. The communities from the Abra delta area near to Llocos Sur and the South China Sea are described as having Ibaloy and Tinguian heritage (Tolentino 2018). Both groups weave textiles such as the Binakul which was a cloth originally used to call upon the wind gods to warn off dangerous spirits.

Figure 3: Binakul Fabric. Credit CordiTex Archive

Groups such as those who live in Manabo & Illocos are geographically dispersed communities of Tinguian heritage having had to move due to deforestation and problems faced as a result of environmental problems developing in rice growing (Gabattiss 2018; Glover & Stone 2018). The groups have an identity which is demonstrated by their ethnolinguistic language and the representations of their language by their textiles. If their textiles disappear, a large part of their identity will also be diminished.

The Manabo community from the Abra Delta

The Manabo community has a status and history that places it in a superior position in the hierarchy of weaver communities and culture in the Cordillera, due to the complex weaving patterns and fine

cotton yarns used. Paradoxically, it is now in the position of being the community most at risk from the weaving tradition dying out and they cite many reasons, but the inaccessibility of Philippine yarns which are sold for export before they are even planted is making it too costly for them to weave. There is activism within the Philippines seeking to remedy the inaccessibility of Philippine Cotton and the UNESCO heritage status of the rice terraces is going some way to support the preservation of Philippine cotton growing (Glover & Stone 2018).

Manabo is a new village still under construction, mainly consisting of breeze-block houses with foot weaving looms housed in a garage. From what we were told, the village had moved to this new location from their traditional area due to a change to growing tapioca rather than rice.

The Manabo women weavers we met were all united in their view as to why weaving was declining in their community, via specifically, the lack of interest in young women to become weavers. The decline in

Figure 4 Manabo Village Garage which houses last remaining community looms. Credit Amores 2019

weaving take up means that the end of weaving in the community will come when the older Master Weavers we met, die. Our project partner had arranged during our visit to collect a loom belonging to the community to take back to the Museum Kordillera due to lack of space in the garage space and because it was unlikely ever to be used again.

There was a sense of despair that the young of the community were either not prepared nor interested in learning to weave. With this group in particular, the potential of weaving as a good source of income could be developed and our project had been designed with this type of community in mind. Our rationale as researchers was to is scrutinise what we saw and understood to be true, and we have been mindful not to over romanticise the problem, but to seek via our evidence if positive outcomes for the preservation of the weaving tradition may emerge.

Figure 5. Manabo Community Weavers. Credit Amores 2019

A shift in the tone of the visit came when researcher Stephens showed examples of her digital weaving work to the community on her mobile phone. The group became mesmerised by the images and the conversation opened up. The Manabo weavers, in a sense

Figure 6. Dr Michelle Stephens mobile Phone. Credit Amores 2019

decided to listen to us because they were interested in talking about weaving rather than talking about the problems in their community. The exchange with the phone opened up a creative space where we were able to introduce our project and to demonstrate hand and digital weave drafting methods. Explaining that they could write down their designs and that they could be developed in many ways as a result.

Drafting is the notational language required for the translation of woven fabric into a binary design code which will enable weaving to be developed, patterns to be preserved and for the draft to be used as a teaching tool.

Figure 7. Manabo Community Weavers look at mobile phone weaving images. Credit Amores 2019)

Figure 8. Manabo Community Weavers learn to draft their weaving. Credit Amores 2019

> *"…draft notation uses graph paper as a framework. The space between its evenly spaced verticals is understood to indicate the warp threads, that between the horizontals, spaced similarly and intersecting at right angles, the filling threads. The little squares thus formed denote the intersection of warp and weft… of course more than the thread construction has to be identified in the analysis of a cloth…when these facts have been established, all the information required for the reproduction of a cloth has been ascertained, for the procedure of weaving is merely a matter of inference" (Albers, 2017: 22).*

The weavers saw the potential to enable the expression of their ideas via the drafting process and each weaver became fully engaged in what we were showing them. The Master Weaver worked with quick marks and the other weavers worked slowly and precisely. The drafting process became an expression of their signatures, just as they are the writers of their cloth. What the oral tradition holds on to is the un-common nuances of textile language manifested in work which is crafted and made rather than designed. Drafting is the written notation of woven

structures, so is a design process. The binary language of drafting is universal and this first writing of a draft was the first step away from the oral tradition. For these women it was the first time they had written their designs down.

It is implied by the oral tradition that the draft process creates a boundary object with which to mediate between the tradition and the present (Star & Griesemer 1989). The drafting process in this context became a mediating practice and the workshop which took place in the small garage space captured a sense of future potential which the Learning Tool Kit will hopefully enable within contexts such as the Manabo.

The concerns of the weavers are the lack of young people prepared or interested to take up weaving. There was a sense of despair that this is the situation. With this group in particular, the potential of weaving to be a good source of income needs to be communicated better to the non-weaving community members and there was a sense that the

Figure 9. Manabo Community Weavers working at outside table. Credit Amores 2019

weaving might be a nuisance to other activities. The contrast between the lack of space in the garage with the 'packed-in' looms with the freedom of space the impromptu workshop and draft process created was startling. The workshop ended with the weavers, sat outside in the fresh air at an outdoor table with the women continuing to draft their patterns after the project team had left.

The Sabangan Weavers Association in Santiago Ilocos Sur

The Sabangan Weavers Association comprises three elderly women weavers and one granddaughter; Talin 85, Ibing 75 and Petra 79 and Shara 16. Within this visit we observed a rare apprentice pairing between grandmother Talin and granddaughter Shara, who practices sections of weaving on her grandmothers loom. We were also exposed to the affect climate change is having upon these communities directly and in the home of Talin which is very close to the South China Sea wall, she had lost sections of her roof in the December 2018 typhoons.

Figure 9. Manabo Community Weavers working at outside table. Credit Amores 2019

Figure 10. Master Weaver Mam Talin.

This community will hopefully benefit from our project in particular, via the development of the Learning Tool Kit, which will support apprentice learners to work with more independence via the introduction of portable weaving technology, access to a weavers network and weave learning hub. In the research reflections we have made since we undertook the first field visit, we have looked closer at the choices such women face in choosing weaving as a livelihood. We have used a range of perspectives and methodologies to understand how the development of a language-based understanding of their identity (Gadamer 2006) might better support the weaving women to maintain strength in their choices. We heard many stories of women who were master weavers who gave up and now walk the highways selling eggs. Shara, the apprentice Sabangan weaver was in school but has since January 2019 dropped out to look after her family.

Figure 11. Master weaver Mam Talin's typhoon damaged home.

To contrast with the despairing situation we were presented with, there were also high levels of actualizing/wellbeing (Maslow 1943) demonstrated by the elderly weavers in that they work independently, they are long living, active and they are Masters in their craft. The manner in which weaving has been a central part of their family's communities and the oral tradition which has enabled the weaving to be passed on is remarkable. Concerns for the Sabangan women are their very low income and their exposure to environmental dangers such as typhoons and tsunamis, but wellbeing comes from their independence and

autonomy and from the act (or ritual) of weaving rather than the income they generate.

Figure 12. Apprentice weaver.

Being a weaver is the identity taken by these women and they demonstrate this via:

- Their independence
- Their work from home
- Pride via photographs of work in the home
- Participation in education projects
- Family support structure and the connectiveness across generations
- Direct selling, costing measuring and business capability
- Peace at work – one weaver described her loom as 'her office'

The undertaking of the field visits such as the one to the Sabangan community raises a concern that sympathetic researcher lenses can often be adopted when complex and challenging research experiences are encountered. We experienced confusion as to how we were responding to these women and our responses were polarized between positive and negative.

Discourse Analysis and in particular discourse analysis which uses a Foucauldian process of text reversal (Lee & Poynton 2000) can be used as a method to help reveal an alternative to the sympathetic bias which can arise from projects such as ours. The visit to meet the elderly Sabangan women living in extreme poverty could affect our bias and understanding. The results of a reversal analysis (see figure 14) using a section of text highlighted above creates a picture which reveals an alternative perspective of the structures which are implicated in the enabling of such a despairing position for the Cordillera weavers.

The process of translating the text into an opposite version of the truth, enables a version of the project which can be used to better undertake a response to the research questions asked How can craft

Figure 13. Talin's dry garden appeared like a paradise in contrast to her typhoon ravaged home.

generate economic opportunities and enhance livelihoods for women? By opening up the picture of the context via a discourse analysis, conceptual spaces are created around which to think, research and potentially to design interventions and tools which can support and enable the weavers to change their situation.

Our visits to the communities enabled us to understand the context first hand and exposed our biases, challenging us to seek a method to see different perspectives. Due to our research and practitioner led figuring

~~Concerns for the Sabangan women are their very low income.~~ (The Sabangan women work independently and survive on what they earn from their weaving) ~~Wellbeing comes from the act or ritual of weaving rather than the income generated.~~ (Weaving is an active practice, it is physical, repetitive and time consuming). ~~Being a weaver is the identity taken by these women and they demonstrated this via:~~ (Weaving is one of a range of work types available to these women, alternatives include egg selling, prostitution and factory work) demonstrated via:

- ~~Their independence;~~ Their Dependence;
- ~~Their work from home;~~ Their home is their place of work;
- ~~Pride via photographs of work in the home.~~ There are only pictures of their work;
- ~~Participation in education projects;~~ It is useful for education projects to use examples such as these women as data;
- ~~Family support structure and the connectiveness across generations;~~ Ties that bind;
- ~~Direct selling;~~ No one to support the sale of work;

~~Peace at work – one weaver described her loom as 'her office'.~~ Life is so challenging in terms of poverty that the sanctuary of work brings a sense of relief.

Figure 14. Discourse analysis undertaken as part of understanding research process.

(Holland; Lachicotte; Skinner & Cain 1998), we were able to adapt and respond to the situations we were presented with. We started to identify more deeply with the women and began to understand the wider implications for our research.

A Learning Tool Kit Development Workshop held at the University of the Philippines in Baguio

The Learning Tool Kit Development Workshop in Baguio was attended by Thirty-Five participants from The Northern Cordillera villages, academics and textile stakeholders. The methods used in preparing for the workshop reflected a process designed to most effectively meet the project aims and collect the data we required. A process for the multi-lingual multi stakeholder workshop was sought which enabled inclusive participation and a Lego© visualisation method (Lego© 2015; Blair and Rillo 2016) was used. Using Lego© we asked simple questions to generate meaningful qualitative data and the process replicated somewhat how oral teaching and learning works by supporting discourse to evolve and for the process to be captured via a shared group experience (Gauntlett 2011; Kelly 2017).

> *"…significant symbols – words for the most part but also gestures, drawings, musical sounds, mechanical devices… anything that is disengaged from its mere actuality and used to impose meaning upon experience" (Geertz 1973 p45 in Crotty 1998 p53)*

We posed three simple questions:

1. "Describe a place which is yours…
2. Tell us something only you know about Cordillera Weaving Tradition...
3. What most concerns you about the preservation of Cordillera Weaving Tradition?"

The community in the workshop revealed that they felt a pressure which is multi-layered where they are responsive to the range of voices from their past, present and from their children looking towards the future.

Figure 15. The Learning Tool Kit Workshop at University of Philippines in Baguio held 19th January.

Figure 16. A Lego loom visualisation and reflection on weaver concerns. Credit Amores Jan 2019

The oral tradition supports all of the Cordilleran communities by way of the maintenance of their living culture. The practice of weaving has been an unstated support system for these communities and in particular the women within these communities, for such a long time that the value of weaving to sustain and maintain livelihoods, most likely reaches far beyond what is currently recognised.

Key reflections from weave Drafting workshop were:

> *I.That weaving at home with the family and community is an important part of the weaving experience for the women. They value the peace their practices bring.*
>
> *II. The value of weaving as a source of income now that typhoons are occurring across all seasons is vital. The typhoons make work in the rice fields less dependable and more dangerous and women can weave in all weathers so is seen as a positive aspect for the maintenance of both community and livelihoods. Having weaving resources which can support teaching and learning in the community, was seen as a positive idea.*
>
> *III. The autonomy of weaving as an identity, for the women was crucial, and while all the weavers we met were living below the poverty line there were high actualizing outcomes for the women being able to work independently. NB: This is something which our ongoing research is looking into in more depth.*

Participants as part of the Learning Tool Kit Workshop, were also taught to draft their weaving via a stage by stage demonstration which used old Cordilleran fabrics from the CordiTex archive during which, again we learned that the community weavers are completely adept at understanding weave drafting even though it was a first-time learning experience for all. Participants expressed their revelations in the closing workshop plenary at being taught a new weave language. Drafting is

the Threshold Concept (Meyer and Land 2003, 2005) required to enable digital weaving to take place, because it translates woven cloth into a binary language. By stepping through a knowledge portal during the workshop, a seed for change was sown.

The final part of the Learning Toolkit workshop was a tour offered by the CordiTex team of their project archives at the Museum Kordillera. While the weavers were amused at coming face to face with the work of their ancestors, there was a palpable sense of concern, or it could have been awe, when the weavers viewed the carefully preserved fabrics. The past and present collided at this moment and there was a huge contrast between the circumstances of the weavers and the high-tech air-controlled archive. The weavers returned, literally chilled, from the archive environment and we can only reflect that the experience was deeply affecting for the participants.

Figure 17. 'Mam' Master weaver speaking during the reflective plenary at the Learning Tool Kit Workshop. Credit Amores 2019

Figure 18 Weavers visit the Feasts and Rituals Exhibition at Museum Kordillera at UoP Baguio. Credit Amores, Jan 2019

Figure 19. Workshop participants visit the CordiTex project archive at Museum Kordillera in Baguio. Credit Amores, Jan 2019.

Figure 20. Workshop participants visit the CordiTex project archive at Museum Kordillera in Baguio. Credit Amores, Jan 2019

Discussion

The story of our project is that there is a diminishing weaving tradition within the Cordillera which is evidenced by the low interest among young members of the communities to become weavers. Elderly community weavers are and will be the last generation to pass on their knowledge in an oral tradition. Weaving knowledge has maintained the ethnolinguistic oral tradition where master weavers teach apprentices, but the weaving tradition is now in a critical state as the elderly weavers are dying.

Figure 21. Workshop participants visit the CordiTex project archive at Museum Kordillera in Baguio. Credit Amores, Jan 2019

The value of Cordillera weaving has been recognised by museums and by private collectors with cloths being documented, sold and collected globally. The CordiTex project aims to preserve Cordillera weave knowledge via the digital translation of the weave structures and by purchasing a specialized TC2 Digital Loom to use to translate the lost patterns. The Museum Kordillera will dedicate an exhibition in 2019 to the Cordillera weaving tradition, however, this preservation process is disconnected from the communities and weavers from which this culture of textiles has arisen.

Weaving has enabled trade and income for the predominantly female weaving communities within the Cordillera area of Northern Philippines for millennia. If weaving declines with the decline in culture (CordiTex 2018), a source of income and livelihood for women also declines. The Creating a Sustainable Textile Future for Women: Digitising Cordillera Weaving Tradition project aimed to address this. The weavers met via the project workshops and activities, expressed the paradise their work creates via the autonomy and sense of connection to their history, community and land their weaving provides. The weavers convinced us to support them to find methods to bring young women into weaving practice via a new learning system (Drafting), supported education, learning tools and apprenticeship.

The reflections of the weavers at the UoP Learning Tool Kit workshop and in the field and the small literature review undertaken so far, have enabled the identification of an emerging link between weaving practice and rice growing. The changes to rice growing as a main reliable income source for Northern Luzon Communities is changing (Glover & Stone, 2018) and weaving creates an opportunity within the changing climate as an enduring occupation which may in the future become more reliable than agricultural work. Climate change and the impact of typhoons within the Philippines is having a negative impact upon the rice growing eco-system and rice growing is under increased scrutiny as a possible contributor to climate change (Gabbattiss 2018).

The Indigenous History Curriculum within Philippine Schools (a K-12 level ages 3-12 years) has limited formal learning which aimed to underpin a nationwide consciousness around the ethnolinguistic history of the Philippines and in particular an understanding of ethnolinguistic cultural traditional crafts. The inaccessibility of affordable yarns in particular Philippine cotton which is mostly exported, has resulted in higher baseline material costs for weavers. The lack of weaving support networks, lack of routes to market for sale of weaving and lack of teaching within Higher Education to support maintenance of Philippine weaving traditions, all contribute to the problem identified.

The centrality of weaving in the lives of the women of the Cordillera region must not be underestimated. Weaving and the weaving communities have protected, clothed, and celebrated this society and the endeavours of the Crafting Futures project to reinforce the central

pillars of the Cordillera Weaving Tradition are commendable. However, if the position does not change then the outlook for the Cordilleran communities is depressing and for the women and their families and children, it is frightening and predictable. For the remaining communities who do not find or secure good work within their communities, there is the fearful move, to life in a city with its inherent risk of exploitation. Centuries of tradition, culture and an autonomous life that was a paradise, is in danger of disappearing. With this in mind we have developed a Learning Tool Kit Action Plan that we earnestly hope can assist in sustaining the weaving culture of the Cordillera.

Digitizing the Cordillera Weaving Tradition Project: 4 Action Strand Learning Tool Kit/2019.

Active Practice Actions:

1. Weave learning can be made more efficient through the use of portable learning technology (in the first instance via small sample looms, but in time new innovations could be developed). This action builds upon understanding and knowledge which exists within the communities (such as the portable backstrap loom) to enable independent, quick, low resource, weave learning to take place in a variety of settings.

2. Within the oral tradition, apprentices become masters and then masters teach. The cycle is regenerated in each generation, but this is a slow process, where apprentices do not teach until they are masters. Small sample looms enable learning to develop in a constructed spiral rather than circular form. A practice-led model,

Figure 22. Learning Tool Kit Action Strands;

where learning leads to further learning development enables learners to become More Knowledgeable Others (Vgotsky 1978) so the process repeats, but in a more efficient and effective manner.

Networked Practice Actions

1. A Cordillera Weave Network is required to enable knowledge, resources and economic opportunities to be shared both within and beyond their community.

2. A professional practice development programme for groups or individuals online or as workshops would support practice beyond the traditional weaving system.

3. A co-operative hub or centre for weave education is needed. The centre could provide communication, opportunity development and enable routes for the sale of work. The centre could link beyond the weave tradition to include farming, yarn and fibre development, raw material supply and links to climate change based support agencies.

4. Family-based networks will expand as children gain their own voices and under-standings of their culture and practices. Children will be encouraged to learn in the home with their family, within their community and via the development of the K-12 curriculum.

Innovative Practice Actions

1. The development of design tools and technology which will appeal to the young (via digital tools and portable loom technology), will support weave based craft and design learning both in the community and as a part of schools & HE curriculum.

2. Weave education would be central to the CordiTex project hub, to enable weavers to participate in advanced weave development (via TC2 Loom access) to develop innovations and the journey from drafting, weaving and digital translation to be made.

3. Create a living Cordillera weave library for patterns and learning samples such as those being woven for the CSTFW project. Learning resources would be for weavers to use for free and to be easily accessible.

Sustainable Practice Actions

1. Develop K-12 weave curriculum as a future facing education paradigm to enable children to develop knowledge and skills which build upon the heritage and resources that are within the communities. By facilitating a system in which the knowledge-based capital in the communities can grow, new seedbed pedagogy, learning and innovation can emerge. Starting with the youngest children, weave learning will be a part of their education from a young age.

2. The weaving knowledge in the Cordillera resides within the communities. A bridge from Higher Education to the communities is needed to develop weave education via global textile conversations, new curriculum development, joint validations and transnational initiatives and exchanges.

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Design research for educational change: Methodologies for exploring the future of learning

Michael Kerres and Barbara Getto

Abstract

Education as a scholarly discipline – separate from Philosophy – was established as the society's demand for an educated workforce of teachers became stronger in the 18th century. Whereas Biology, Physics or Psychology relate to basic phenomena of life and nature, Education, like Eco-nomics and Law, is strongly associated with the increasingly complex institution of education: primary and secondary schools, vocational education, higher education etc.. The investment in research in the field of Education, therefore, very often is questioned as to its contribution to the solving of problems in the practical field of education.

Educational Science shares its roots with several disciplines: firstly with philosophical inquiries and historical studies, the tradition of empirical research in Psychology and Sociology, but it also relates to other disciplines, e.g. educational management and economics, technological and architectural aspects related to the infrastructure of schools. All these disciplines have long his-tories of elaborating a diversity of theoretical approaches as well as research methodologies and methods, standards for scholarly research and communication. Educational Science, then, is a situated at the intersection of all these traditions. Over the time, the focus of attention has shifted between the various reference disciplines with their corresponding methodologies: from philosophy and history, to psychology and sociology and other reference disciplines. Although still covering a wide range, the preferred research methods and standards in educational re-search have changed but without developing a unique methodology of educational science. Today, the mainstream of educational research is devoted to quantitative and qualitative ap-proaches analyzing individual learning, education institutions and underlaying social processes from an interdisciplinary perspective mainly relating to philosophy, psychology and sociology. These analyses provide models and theories to better understand how learning and education function and what are relevant dimensions to explain diversity and inequity. In the 1990s, large scale assessments were started internationally that allow to monitor and compare learning achievements in common subjects in secondary schools. For some participating states, the re-sults of the PISA and other assessments – discussed by a wider public – led to frustration: In these cases, the self-perception of a culture valuing education highly (and spending high amounts of money in education) did not match the results of these tests. This experience moti-vated a wide discussion of measure to take to improve the quality of learning in schools. Numerous suggestions were brought up by politicians, researchers as well as from the broader pub-lic and discussed in the media. Interestingly, these suggestions – based on the same results – could be completely contradictory and all starting points for change seemed plausible: school buildings, curricula, nutrition, teacher training – anything could be argued for. These discussions also showed that the measurement of learning achievements, though illuminating, does not provide sufficient information about possible mechanisms for change. Even more basic, if a plau-sible model existed explaining the causes and effects of a social phenomenon it is not obvious how to draw a conclusion about the best ways to implement change.

As a consequence of the "PISA-shock", several public measures for research have been setup. A recent evaluation of the program on empirical educational research by the federal ministry of education revealed the limited impact of this research to the public discussion and changes in the educational system. Therefore, starting in 2018 the federal ministry of education started a new framework for empirical research in education with a distinct focus on change projects, design based approaches and the analyses of success factors for change. The learning lab of Uni-versity of Duisburg-Essen is responsible for the meta-project in the field of digitalization in edu-cation, accompanying and supporting the around 50 projects sponsored in this line of research. Furthermore, the meta-project – based on a network of several university and national insti-tutes – is devoted to the joint development of a methodology of design-based research.

Design research in education

A design approach to education is based on the insight that even the most thorough analysis of learning and education does not deliver the necessary knowledge about how to develop learn-ing and education in the field. This insight might be accepted by a larger part of the educational research community, but it still is the question if this knowledge for change is to be understood as an enterprise of a new type of scholarly research or as a problem of application in the practi-cal field – beyond research. Therefore, the establishment of a design approach for educational research is still under heavy discussion, especially since design research approaches are still in its infancy: not all development projects that are somehow being implementing with partners in the field can be interpreted as design research. Furthermore, since design research still is not widely established it is difficult to receive funding for these – still developing – approaches. Therefore, also it is often criticized that we do not posses enough knowledge about change pro-cess it is not widely acknowledged that this kind of question also has to be addressed as a re-search question with a clear methodological focus. Therefore, it is of utmost importance to re-late to other disciplines that have a longer tradition in referring to concepts of design.

"Teaching" and "instruction" have been described with reference to liberal arts, an activity that cannot be planned nor explained, emerging from the encounter of person to person. This posi-tion, strongly held in a traditional view of education as "Bildung", has been opposed by a tech-nological view, interpreting teaching as an activity that should follow successful principles of teaching that have been derived from empirical research (vgl. Reiser, 1987). In this case, tech-nology does not refer to technical devices or (digital) media; it refers to the body

of systematic knowledge of a domain (e.g. the technology of building bridges).

Both positions have been abandoned. From a perspective of systems theory, Luhman & Schorr (1982) have pointed out the deficit of technology in the professional activity of teachers: The success of teaching does not rely on the quality of the teacher's interventions alone, it is a co-construction. When we refer to explaining instruction as design then we acknowledge that it should be positioned somewhere between an act of fine arts and a technology. With the first edition of "principles of instructional design" in from Robert Gagné and Leslie Briggs the design perspective on instruction was established. Initially, the seminal work of Gagné and his research group at Florida State University, Tallahassee, was based on research and development in the military – not in the school sector. Therefore, the group was confronted with a completely dif-ferent set of conditions for teaching and learning, e.g. teaching was more related to "training"; large groups of learners – spread around the world – had to be addressed; standardization had a high priority. With this background, Gagné reached out to using print media and video for in-struction in the early 1960s, setting up arrangements that combined classroom teaching with textbook materials, video instructions delivered via TV around the world to large groups of learners. Besides this initial context, the various editions of the instructional design-textbook, which have appeared since, always were broadly addressing the various context of education, but they were not restricted to the perspective of (typically: secondary) school in other ID-models. They did reflect, however, the transition of the theoretical discussion in instructional design from behaviorism to cognitive approaches. However, their approach consistently kept the focus and the starting point of all instructional design on the specification of learning results and then developing the design backwards.

Several models of instructional design have been developed over the years. Andrew & Goodson (1980) were the first to publish a comparison of different models. They found a set of similarities but criticized that the models would not indicate their scope and the operating conditions. They assumed that their design model would be applicable in all contexts, for all topics, ranges, target groups and institutional sector (Lowyck & Elen, 1994).

Dick & Carey (1985) published a model that organized instructional design following a rather generic sequence of steps with the acronym of ADDIE (Analysis, Design, Development, Evalua-tion). The textbook has been published in many editions since and is typical in viewing the de-sign process as a linear process with distinct stages. The underlying concept of a "waterfall" – as discussed in software engineering – has been questioned in the realm of software engineering: With a waterfall, it follows a strict direction and if it has passed the fall it will not be able to go back. In the development of software, it had turned out that the application of a highly sequen-tial model for organizing the development

process could impede with the success of a project (Goodyear, 1994). In a traditional approach, a requirements analysis leads to a software specifi-cation which then – in a next phase – is implemented. "Errors" in the design are not anticipated and might question the success of a project, essentially, if detected to late. "Errors" are a disas-ter, are indicators of bad planning. However, in a typical development project in the field of education, they can also be seen as insights that might open the direction to new qualities. This view, however, necessitates an organization of the design process that follows a model that has been discussed as "agile" in recent years. Surprisingly, this line of discussion heavily discussed in computer engineering is not discussed intensively, although it seems attractive to address how to systematically integrate learning in a learning development project.

Kerres (2018) explains that the design process has to be adopted to the conditions of the design project. Routine projects with tight resources, for example, will need different designs that more exploratory innovation projects. He, therefore, phrases the term "design your design": instructional designers should not follow an instructional design model they have learned. Pro-fessional designers should be able to construct of a design model appropriate for a given prob-lem. The model from Kerres does provide criteria when to follow a more sequential or a more iterative model. Essentially, this approach questions the basic assumption that instructional de-sign should follow "the one best" ID-model. It follows empirical analysis of routines instructional designers practice in their fields. The demonstrate that in most cases they do not follow a spe-cific model (and worse: some / many even never have heard of any id-model, but supposedly are still successfully performing their duties. Professionalism in the context of instructional design means creating a flexible approach – based on the state of the art and science of learning and teaching – and reflecting on the results of the routine (which might lead to a reconsideration of these routines).

Approaches to design-based research in education

In the 1990s, several educational researchers were confronted with an increasing pressure from funding agencies, foundations and education authorities to deliver more concise and practical results for the educational sector and to make a better contribution to the development of so-ciety at large. Design-based research (DBR) was an answer of the scientific community, which gained a lot of approval among the research community. Brown (1992) hat introduced the term "design experiments" relating to Stokes (1997), who was referring to "use-inspired basic re-search" and Pasteur's quadrant. The paper from the "The Design Based Research Collective" (2003) has been highly cited and the a special issue on DBR in the Journal of the Learning Sci-ences, introduced by Barab & Squire (2004), with a paper from Collins, Joseph & Bielczyc (2004), received a lot of attention.

Basically, DBR defines the process of research as an iterative course of continuous inquiry and optimization in a number of trials in differing

contexts. A DBR project should, therefore, rely on a set of consecutive trials where a certain conceptual model or instructional approach can be tested and improved. The analysis of a new concept for developing reading comprehension, for example, could be tested in a series of consecutive experiments in parallel classes at several schools. This short description shows why DBR received such a high popularity in short time, especially from researchers with a background in quantitative methodology: Proposing a con-secutive series of experiments for validating and improving a concept is not challenging a tradi-tional view of empirical research. In general, research has always relied on the idea of a contin-uous stream of studies – from different research groups – cumulating scholarly knowledge. Therefore, it might be questioned if the basic idea of DBR as an iterative process is adding a new approach to this general perspective. Furthermore, in many cases it simply is not possible to implement a research project as a series of studies, especially with projects that are developing new programs or artifacts (e.g., for digital learning) and in conditions where parallel groups do not exist (which is often typical outside of schools).

On the other hand, we have a long tradition of approaches to social research that are rejecting the idea of learners or teachers being objects of research. Learning and teaching in an educa-tional setting is a complex situation that cannot be reduced to scientific models consisting of a set of isolated if-then statements. Instead they perceive research as a complex social interaction between people in different roles. In this tradition of research, several approaches have been developed that differ in their conceptualization of the roles of the various players. In action research academia is mainly concerned with building and supporting the development of solu-tions for practical challenges (Bradbury, 2015; Edwards-Groves & Kemmis, 2016a; McMillan & Schumacher, 2010; Zuber-Skerritt, 2003). With "teachers as reflective practitioners" (Schön, 2017) and the "teachers as researchers" (Edwards-Groves & Kemmis, 2016b) approaches, teach-ers are trained and supported to setup a research study in their own field. Teacher's experienc-es and reflections are valued as constructions of their professional activity in the field. These utterances inform us about the perception of a certain part of the educational field and at the same time they contribute to the creation of the social reality they describe. Research helps to record these views and make them available to others as a source for professional development and critical discussion (Cross, 2007; van Akker & Nieveen, 2017).

To some extent, current research on teaching and learning essentially is conceptualized as "basic research" in the field of education, without addressing the underlying gap between edu-cational research and practice. But increasingly, researchers follow different paths to actively answer the basic challenge of knowledge transfer. These different approaches can be sketched around two dimensions shown in Figure 1: Researchers are more or less engaged in the field as observers or actors, and they can focus on current or new practices in the field of

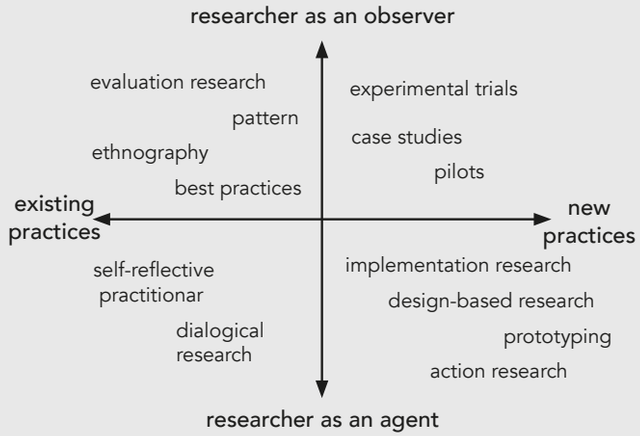

Figure 1. Dimensions of research in the field of education (allocation might vary)

education. It is important to note, that the analysis of given practices in the field do not automatically yield new directions and do not answer the question how to develop new measures to innovate teaching and learning in the various sectors of education. In recent years, textbooks have emerged that reflect on the discussion of these approaches and provide guidance to researchers in the field of design based research (McKenney & Reeves, 2018; Akker, Gravemeijer, McKen-ney, & Nieveen, 2006).

Design research in the field of research on "Educational Technology"
Research on Educational Technology has attracted a large interdisciplinary community of re-searchers bringing together scholars from various backgrounds. In this context, the discussion of design-based research does have an additional connotation since we are addressing the devel-opment and delivery of a technical artifact that exhibits certain characteristics on its surface and inside. The terminology of design, in this context, seems to have a closer relation the attributes of these artifacts. However, from the educational perspective, our primary concern are not these obvious attributes that can be "designed", we are mainly interested in the structural el-ements a) of the design process in the various stages from planning to implementing in a social environment and b) of the design patterns, models, concepts etc. inscribed into the artifacts. Meanwhile, there are some textbooks related to design-based research in the field of educa-tional technology (Spector, Merrill, Merrienboer, & Driscoll, 2007; Clark & Mayer, 2016; Euler & Sloane, 2014; Tulodziecki, Grafe, & Herzig, 2013; Savin-Baden & Tombs, 2017; Beetham & Sharpe, 2019)

At the University Duisburg-Essen's Learning Lab, our focus is on learning innovations with digital technology. "Exploring the Future of Learning" - the slogan describes the mission of our research group. With a staff of about 40 people, the lab is developing digital innovations for schools, higher education and adult education following a design-based

approach to educational research based on a dialogue of research and practice. In a previous project, the lab has been involved with meta-analytical approaches to synthetizing educational research on digital learning (Zawacki-Richter, Kerres, Buntins, Bond, & Bedenlier, 2019).
Currently, the lab has received a mandate for the 6-year meta-project „digitization in educa-tion" supporting and accompanying the various research (around 60) projects that are funded by the federal ministry of education and research in the new framework for empirical research in education. Based on an analysis of the effects of earlier funding measures, the federal ministry is aiming at strengthening the impact of funded projects in educational research to answering cur-rent challenges in the educational sector. The ministry has established various meta-projects (e.g. in the field of cultural education, professionalization or digitalization) to develop new strategies for the projects to improve exchange between research projects and to increase their outreach, to foster the dialogue between educational research, practice, administration and politics, to improve the public communication and visibility of educational research and to, eventually, increase their impact onto society. Furthermore, the meta-projects will also con-tribute to the methodological advancement of design-based approaches to educational re-search. They conduct research workshops and foster the adoption of these approaches and will develop new methods to help and guide the funded projects.

The concept of the meta-project and its relevance to develop design-based approaches

The meta-project on "digitization in education" is a joint effort of the national Leibniz-Institutes of Educational Research (DIPF, Frankfurt), of Adult Education (DIE, Bonn) and of Knowledge Media (IWM, Tübingen) with the management at the Learning Lab of University Duisburg-Essen. It con-tributes to putting the current projects of the research focus and further funding lines for "digi-talization" in the framework program "Empirical Educational Research" into an overarching scien-tific and social framework, prepares developments in the research field scientifically, identifies research gaps and promotes the networking of the scientists with each other and the exchange with educational practice. It reflects in particular on the creation of design-oriented educational research and its knowledge communication, which contributes equally to the formation of theo-ry and knowledge within science as well as to problem solving in the fields of educational prac-tice and policy. It aims to further develop the methodology of design-oriented educational re-search. "Transfer" is not understood as a follow-up activity at the end of the project, but as an integral part of the interaction of actors, which is to be organized as a dialogue between re-search projects and educational practice and policy. Results of the funded as well as other re-search projects are processed and central research questions dealt with from a meta-perspective. The activities of the meta-project are designed in a complementary way to the transfer activities that are anchored in the projects. The meta-project supports transfer activities of the projects and generates attention and visibility for the project work.

Educational practice presents itself differently structured in the different educational stages or sectors and different actors have to be included. The meta-project focuses on educational organ-izations in different sectors: primary, secondary, vocational, higher and adult education. The institutional frameworks, concepts, conditions for success and implications of digital education differ considerably in the individual sectors and the interfaces between formal, non-formal and informal learning change depending on the stage of life (even under the conditions of digitiza-tion). For this purpose, the consortium was formed for the meta-project, whose partners bring in special expertise´s to the various sectors and, consequently, to different stages of life.
At its core, the meta-project deals with the fundamental question of how educational research can exploit the potential of digitization for the various educational sectors and thus shape the future of "education in the digital world". The traditional view of project work is based on providing project results - after completion of a project - in a transfer phase "of practice". The transfer problem in the context of pilot projects oft he federal state commission was already discussed at the end of the 1980s and was one of the main reasons why funding for individual pilot projects was abandoned in favor of programme funding (Nickolaus, Gönnenwein, & Petsch, 2010). Approaches to transfer as unidirectional communication (from research to practice) are too shortsighted and do not meet the demands mentioned. Whereas the traditional views of scholarly knowledge dissemination perceive "transfer" as an activity taking place after research has been completed, the meta-project wants to foster a view to transfer as an ongoing activity interwoven in all phases of research beginning from the development of research questions, the design of a research project, the implementation and interpretation of results to the communi-cation in the field. Therefore, the major task of this meta-research is directed to the organiza-tion of communication between stakeholders in the field: identifying relevant stakeholders, developing strategies and measures to address them and intensify bidirectional communication in analog and digital settings, which contributes equally to theory building in the community of researchers as well as to the communication of experiences on solutions in the fields of educa-tional practice.

Conclusions

The underlying question is: what does it mean to conceptualize educational research as a design endeavor? On the one hand, academia has to insist on claiming for "freedom of research" – de-fining research as an important enterprise for its own sake and not primarily as a service to edu-cational institutions. On the other hand, educational research in many cases does have an inter-est in contributing to educational change and in delivering insights for theses agendas. There-fore, it becomes of utmost importance to develop and reflect on dialogical

practices of actors in the field. Over man decades, quantitative and qualitative approaches for social research have been developed and have produces a more ore less solid body of acknowledged procedures and quality measures to evaluate research proposals and results. In the field of design-based re-search in education we are just beginning to establish a debate for developing these measures.

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The ripple effects of social design

Eva Knutz and Thomas Markussen

Abstract

Policymakers and the public sector increasingly turn to social design to mitigate the urgent challenges of the welfare state. With public sector collaboration and funding follow a requirement to measure and evaluate the change effect and the impact of social design practices. Typically this requirement is premised on evidence-based ideals fitting well with neoliberal agendas and new public management. However, in this paper we argue that there is a need for developing an evaluation culture to supplement this predominant model. The evidence-based model is primarily concerned with design outcomes, while neglecting how social value may manifest itself as what we call ripple effects from the 'fuzzy front end' to the implementation and evaluation of a given design project. Using a social design case – a game-based intervention designed for family visits in maximum-security prisons – we identify a range of ripple effects leading to notably three types of values: social value for the benefit of the people we designed for and with; demand value, which refers to the value that an organization/client gains from implementing a design artifact or service, and research value, i.e. improving the research study design and direction through insights. To account for the ripple effects of social design, we shall elaborate and advance Sanders & Stappers' (2008) influential design model.

Introduction

Social design has spread as a practice across various domains (crime prevention, healthcare, education, etc.) and is increasingly moving towards long-term and more complex projects that require engagement throughout the entire design process to ensure a sustainable outcome. We are currently engaged in such a long-term project within the criminal justice system. Together with the Danish Prison and Probation Services – and various groups of prisoners, children, family therapists and prison officers – we have co-designed a serious, yet playful social game for the visiting facilities in maximum-security prisons (Knutz et al. 2017, 2019; Markussen & Knutz, forthcoming).

The purpose of the game is to make the prison visit enjoyable and meaningful for prisoners' children (age 11-18) and enable family talk about difficult matters. Initiatives such as these are designed for children to help them cope with parental incarceration; but it is also part of institutional rehabilitative schemes aimed at strengthening family relations and support inmates in becoming better fathers and citizens upon post release. In the autumn of 2018 the game was distributed to all Danish prisons. It has been translated into English, and correctional services in several countries (including the UK, US, Estonia, Australia, and Sweden) have shown a keen interest in the game's potential for improving visiting facilities and the wellbeing of prisoners' children.

However, this success story is counterbalanced by the failure of documenting the evidence-based design outcome. It was simply not possible – using the original research study design – to measure whether the game has the impact that was hypothesized and substantially accounted for in the research application.

Does that mean that we did not change anything? Or that no value was created during all the meetings and co-design workshops we held with incarcerated fathers, their children, family therapists, prison officers and managers? If value is perceived in a narrow evidence-based sense, then from that point of view the change failed to happen. But if we widen our view to include the entire process from beginning to end, then we are, in fact, able to detect various forms of change and value that this project delivered. In this paper we provide an overview of these *ripple effects* that occurred through and beyond the project by drawing upon the large amount of data that was gathered during more than three years of study.

As social designers, we align with the characteristics given by Armstrong, Bailey, Julier, & Kimbell, 2014 (p. 15). This approach essentially consists of using participatory design activities to "make change happen towards collective and social ends, rather than predominantly commercial objectives." Social ends can be defined as "small but significant qualitative changes at a human scale that are seen as beneficial for marginalized or vulnerable groups in society" (Markussen, 2017, p. 169). This is precisely what makes the design intention in social design different from other similar approaches such as social innovation or social entrepreneurship – disciplines that aim at making large-scale transformation happen either by repairing system errors or by exploiting unforeseen market opportunities.

In our work, we have proposed that the value of social design can be properly understood as a matter of caring for disadvantaged people or groups (Knutz et. al, 2017). Furthermore, we have shown that a narrative perspective can increase knowledge of how social value can be a matter of enabling families to share 'family narratives' and negotiate and navigate identities (Knutz & Markussen, forthcoming). Yet, social value is still hard to grasp, and that is a problem for foundations, policymakers, non-profit organizations and researchers working with a public sector under pressure. If we cannot assess social value, then we cannot evaluate and communicate the impact of, for instance, social initiatives that aim at improving the conditions for citizens who are traumatized, facing a life-threatening disease, poverty, loneliness or any kind of loss that many of us will inevitably face in the course of our lives (see also Mulgan, 2010, 2014; Preskill & Beer, 2012).

Initially, in this paper, we will position ourselves briefly in relation to the "social turn." Secondly, we will apply Sanders & Stappers' (2008) useful model to a case project to provide insight into the participatory design research activities from the 'fuzzy front end' of our design process to the actual implementation of the project. Here we have singled out a limited number of participatory design research activities to give the reader an understanding of value and change in the project. Thirdly, we introduce

what we consider to be the main contribution of this paper: our Ripple Effects Model. This model elaborates on Sanders & Stappers' model and includes a map of when and how a design research project activates change. It aims at capturing the value of change throughout a project as well as the difference between what a project aims at changing and evaluating and all the unplanned changes that a project might activate. We refer to these changes as ripple effects and account for the value they hold for the people we design for (and with): the organization that implements the design and the research team.

Do we have evidence of the change we claim we contribute? Not fully. Our documentation consists of both hard evidence (recordings and transcribed interviews) as well as soft evidence (observations, design ethnographic documentation and design game outcomes). For now, we will leave it up to the reader to evaluate whether this is good – or good enough (cf. Thorpe and Gamman 2011).

The Cornerstones of Social Design: Social Change and Participation

Social change and social value

Due to the pressure on the welfare state (caused by fiscal crises, migration, aging, a declining workforce, etc.) policy makers have urged the creative sector to act responsibly to societal problems and vulnerable communities in society. The design community has attempted to meet this requirement through approaches such as social innovation, social entrepreneurship or social design. Each of these approaches tries to meet social needs by fostering change based on different value norms. Elsewhere, we have argued at length that social value in social innovation refers to "what is good for society," in broad terms to benefit large populations. In social entrepreneurship, social value is tightly linked with a concern also to perform financially; and in social design, social value refers to "the fostering of a small, but decisive qualitative change in the form of redistributing identities and interpersonal relations" (Markussen, 2017, p. 169).

Yet, in discussing and evaluating what worked and what did not work in a project that aims at fostering social change, social value is still hard to account for and difficult to assess. Geoff Mulgan (2010) argues that social value, in social innovation, should be approached as subjective, malleable and variable rather than assuming that it is objective, fixed and stable. In our case analysis we elaborate on this conception by showing how social value is highly influenced by participatory practices and seems to have the capacity for adaptive change. By scrutinizing the values of our social design project, we identify a range of unforeseen changes that have affected the final outcome (the design itself), the implementation of the design, the research evaluation study as well as our interpersonal relations with participants and other stakeholders in the project.

Co-design and participation as value

A decade ago, Sanders & Stappers (2008) argued that the shift from user-centered design (user as subject) to co-design (user as partner) would enable designers and non-designers to work more closely together in the design process in order to support more sustainable design outcomes and ways of living with design. Sanders & Stappers and others concerned with Participatory Design (PD) and Co-design have convincingly described the importance of making activities and participatory methods (cultural probes, generative tools, design games, experience prototypes etc.). These activities involve construction and transformation of meaning from the explorative 'fuzzy front end' and early design ideas to implementation and post design (see Figure 1). They have also usefully visualized how user-involvement – designing "for" and "with" the user – might change throughout a project, depending on what participatory activities and formats are applied (Brandt et al., 2012; Sanders & Stappers, 2014).

But since PD has been applied to various research disciplines and contexts to reinforce user involvement, the concept of participation has been in danger of losing its core values (Vines et al., 2013). For instance,

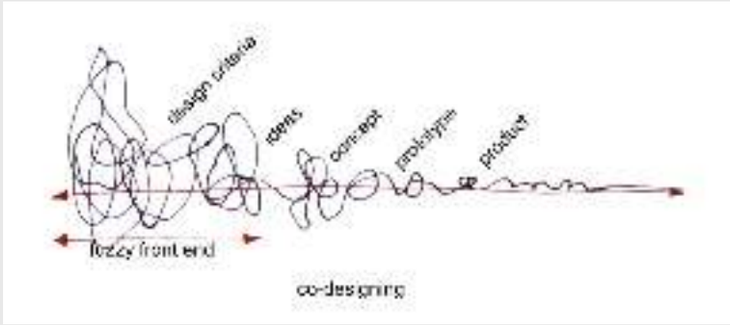

Figure 1. Sanders & Stappers' Model (2008)

the original social engagement of the approach is sometimes conflated with consumerist ideas of "democratic innovation" (Björgvinsson et al., 2010). Critical voices from the PD community have therefore called for refreshed perspectives on how design researchers conceptualize, organize and maintain participation (Iversen & Dindler, 2014). According to Vines et al. (2013), participation is never value-free. There is always someone who initiates, directs and benefits from user participation in design and therefore the configuration of participation should be critically examined. So how do we evaluate the value of participation? Vines and his colleagues (2015) suggest addressing the gap between the claimed values and the actual practice of participation again by asking, who initiates, directs and benefits from participation. Further, Smith & Iversen (2018) introduce three dimensions of participatory engagement (scoping, developing and scaling) in order to account for value at different stages. Yet, the problem remains to explain how participation might have an impact on the evaluation and the implementation of the design outcome.

Participation is often just used as a means for involving stakeholders along the process, aligning the design concept with actual users' needs to make a better and more sustainable design. But it is rarely evaluated how PD processes might change the evaluation study design in terms of hypothesis, methods and theoretical foundations. By applying Sanders & Stappers' Model to our project we will critically examine how PD processes and co-design workshops changed our evaluation and research study design along the way, from pre-design to design-after-design. In so doing, the gap between the claimed values and the values gained through participation may become transparent.

Case project: Designing games for prisons

The case project we draw upon is the Social Games Against Crime project (2015–2018). The overall aim of this project was to develop and implement a game for the Prison and Probation Service's visiting program in order to help children maintain and build upon the relationship with their incarcerated fathers. This aim is motivated by studies in criminology arguing that the facilitation of contact between incarcerated parents and their children may have a positive effect both on parenting post release (Holt & Miller, 1972; Lösel et al., 2012; Markson et al., 2015) and on the children's development and ability to cope with the consequences of parental incarceration (Arditti, 2003; Hairston, 1998). Furthermore narrative studies indicate that by allowing prisoners and their children to tell and share narratives, the bonds between them can be strengthened to the benefit of the children's well-being (see e.g. Fivush, Bohanek, & Zaman, 2011; Saltzman, Pynoos, Lester, Layne, & Beardslee, 2013).

Our final design – a board game called Captivated – is now available in visiting rooms in all Danish prisons. The game has been designed to help troubled families to share stories about their situation (e.g. the fathers' experience of prison life or the child's stories of their everyday lives), but also to re-construct and share memories of the past or wishes for the future. The concept of 'family narratives' – as a shared space for communicating stories and experiences – plays a central role in the evaluation study and the research into how families interact with the game (see below).

Participatory activities within the project

The game itself lends its mechanics from the board game Monopoly and takes its players on a journey through a prison with certain places, characters (groups of prisoners and staff) and situations that the players already know – or will learn to relate to. The game consists of 20 characters divided into five groups of prisoners and one group of prison officers. A player wins the game by collecting certain characters and by performing acts triggered by the question cards. The game has three different types of cards: story cards (stories about the prison); actions cards (that encourage physical interactions) and be-honest cards (that invite deeper interpersonal communication between the players).

During the process of designing the game, several meetings and PD activities were organized to create a sustainable foundation for both development and evaluation. These activities can be grouped into three categories:

Figure 2. The board game Captivated, 2018

- PD activities with the organization (the Prison & Probation Service; prison management and prison officers) to ensure sustainable foundation for implementation.
- PD activities with the end-users (fathers in prison; children who have a father in prison and other family members) to build a game world that aligns with the challenges of these families.
- PD activities with other specialists (family therapists; psychologist and researchers within criminology) to evaluate game content and to construct feasible criteria for evaluation.

Throughout the project, design game formats (Brandt & Messeter, 2004; Brandt, 2006; Eriksen et al., 2014) have been used as a method of inquiry to learn about the challenges of the different stakeholders, in particular children and fathers for whom the game is designed. Each activity has resulted in knowledge about the people (families) and the prison system we are designing for and has helped us in aligning the game world with the players' real world.

Table 1 shows the fieldwork, co-design activities and encounters we had with the different stakeholders throughout the design process. In Figure 3 these activities are applied to Sanders & Stappers' Model.

	Type of Study	Aim	Activities	Method & Empirical Material	Participants	Knowledge Outcome Design Outcome	
Exploring	Ethnographic Field-studies	To understand the visiting facilities and prison procedures	Field research in 5 danish prisons & detention centers	Photo, documentation, and field-notes	Talks with 4 prisoners and 7 prison officers	Insights into policies and practices of prison-systems	Activity 1
	Participatory workshops & Design Games	To understand the challenges during family-visits	Game sessions with prison officers and group-discussions.	Empirical material from design games and field-notes	20 prison officers from the Child Responsible Program of the Prison & Probation Service	Insights into perspectives of the prison officers	Activity 2
	Participatory workshops & Design Games	To understand the dilemmas of children of incarcerated fathers	Game sessions with family therapists and group-discussions.	Empirical material from design games and field-notes	2 family therapists 3 researchers	Insights into emotions (guilt, shame, isolation) related to imprisonment	Activity 3
	Participatory workshops & Design Games	To understand the children's experiences and to collect their stories	Participatory observation of therapy-sessions, game-sessions and group-discussions.	Empirical material from design games and field-notes	3 teenagers 3 family-therapists 3 researchers	Insights into children's challenges and dilemmas. Insights & stories for the construction of game world	Activity 4
	Participatory workshops & Design Games	To understand the family's experience of having a father or son husband in prison	Game sessions with families and group-discussions.	Empirical material from design games and field-notes	4 families (4 mothers and 4 teenagers) 2 family-therapists 2 researchers	Understanding mothers and children's perspectives Insights & stories for the construction of game world	Activity 5
Co-designing	Participatory workshops & Co-design activities	To understand prisoners dilemma and to align game world with real world in prison	Game sessions with fathers in prison and group-discussions.	Participatory observation and field-notes	6 prisoners 1 prison officer 4 researchers	Insights into father's challenges and dilemmas Insights & stories for the construction of game world	Activity 6
	Participatory workshops & Co-design activities	To understand prisoners dilemma and to align game world with real world in prison	Game sessions with fathers in prison and group-discussions.	Participatory observation and field-notes	6 prisoners 1 prison officer 3 researchers	Insights into father's challenges and dilemma A co-designed prototype	Activity 7
Implementing & Evaluating	Pilot-test & Participatory observation	To play the game with a family during visit in prison and to evaluate gameplay	Pilot testing game-prototype with family in prison. Group-discussion	Game-sessions and recorded talks. Field-notes	1 prisoner and his child 1 prison officer 3 researchers	Evaluation of gameplay & insights into interaction between players	Activity 8
	Pilot-test & Participatory observation	To play the game with a family during visit in prison and to evaluate gameplay	Pilot testing game-prototype with family in prison. Group-discussions.	Game-sessions and recorded talks. Field-notes	1 prisoner and his 2 children 1 prison officer 3 researchers		Activity 9
	Pilot-test & Follow-up interviews	To pilot-test EPIS-questionnaire for evaluation study	Pilot testing the questionnaire. Evaluation of responses	Questionnaires, emails from officer and follow-up interview with prisoner.	1 prisoner and child/ families with game. 1 prisoner + interview with game. 2 prison officers	Insights into the participants evaluation of the questionnaire Redesign of evaluation study	Activity 10
	Intervention & Follow-up interviews	To evaluate intervention in prison	Interviews with fathers in prison after they have played the game	5 transcribed and translated interviews with 5 prisoners	5 fathers 1 prison officer 2 researchers	Knowledge about the game's potential in prompting family narratives Knowledge about how prison families navigate personal and shared identities.	Activity 11
	Intervention & Follow-up interviews	To evaluate intervention in prison	Interviews with children in their home after they have played the game	2 transcribed and translated group-interviews with 2 families	4 children 3 mothers 2 researchers		Activity 12

Table 1: Activities in the project

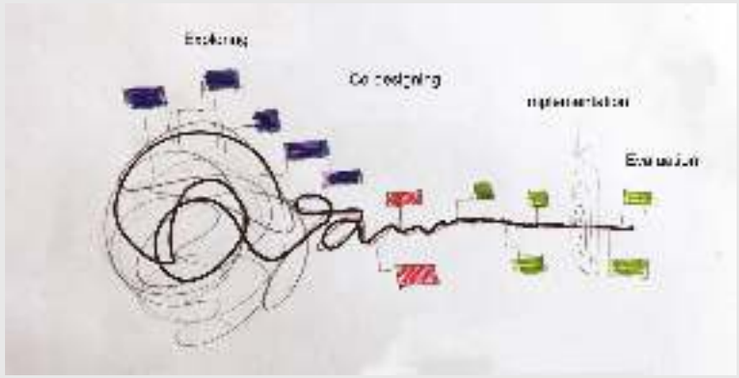

Figure 3. Activities applied to Sanders & Stappers' Model

Analysis: Identifying value and change

The aim of our analysis is to examine different aspects of change within the project by focusing on three types of value creation:

- *Social value*, defined as a qualitative change in the re-distribution of identities or interpersonal relationships. This type of value might influence the participants that we co-design with (and for) in terms of how they interact with each other (and us, as a research team) – and how identities are explored and tried out among the participants.
- *Research value*, defined as a qualitative change in terms of making a feasible research study design. This might influence theoretical foundations, hypotheses or other methodological assumptions and predetermined intentions. This might lead, for instance, to a rejection of a pre-accepted methodological approach – or to the formation of new research questions.
- *Demand value*, defined as a qualitative change in terms of making a better product or service that fits the actual needs. This will have a direct impact on the actual design (as product or service) – making the final design more sustainable and aligned with the actual needs of the people who are going to use it and the organizations that want to implement it.

For the sake of clarity we have singled out a limited number of activities that, in our view, contributed with unforeseen changes. By drawing upon our empirical material we attempt to account for how social value, research value and demand value are achieved through our participatory research practice.

Co-exploring with children

The aim of this workshop was to understand the dilemmas and challenges of children who have a father in prison (see activity 4, table 1). The workshop took place over two days spent at a center for family counseling. Three children (age 14–16) attended together with two family therapists (see also table 1). For this workshop a design game was constructed in which the participants were encouraged to formulate a so-called dream card– a future wish concerning their prison visit or relationship with their father. Furthermore, the game included the formulation of three barrier cards which illustrated the obstacles to the fulfillment of the dream. The aim of the game was to overcome the obstacles by using different fictional and self-formulated "helpers."

One of the participants, the 14-year-old Mira, had a problematic relationship with her incarcerated father who, she felt, was dominating and demanding. On her dream card she wrote that she wished to visit her father less frequently. Her barrier cards revealed three obstacles to not seeing the father: a) it was too difficult for her to tell him; b) her father did not understand her personal life; and c) he would be disappointed with her. So, her desire to visit her father less frequently was hard for her to implement in practice (Figure 4).

Figure 4. Design game results from participant "Mira"

Originally, we assumed that the game should encourage children to visit their fathers more often. Our hypothesis was partly based upon a report made by The Danish National Centre for Social Research that pointed out a need for offering better-designed initiatives for children between the ages of 11 and 18 years (Oldrup et al., 2016, pp. 5–14). However, through our design workshop with Mira and the other children we learned that children do not necessarily want to visit their fathers more often. Instead, what is important is to improve the quality of the visits by making them more meaningful. Hence we revised the project's evaluation study by removing visit frequency as an indicator to be measured. Secondly, Mira's dream card offered a new perspective on the children's needs and what our design potentially could do for them, i.e. to make visits more meaningful by enabling the players to honestly express their emotions and needs. Based on this insight, we argue that this activity contributed with social value (enabling Mira to voice her wish to see her father less often); research value (revising our evaluation indicators) and demand value (setting new guidelines for the game).

Co-exploring with families

The aim of this workshop was to understand the dilemmas of the family as a whole (see activity 5, table 1). The workshop took place at the same location (center for family counseling) and also lasted two days. Four mothers participated together with their children, aged 14–23. In all four families the father of the children was in prison and all the mothers were divorced from their husbands. This meant that other adults (e.g. family members or friends) accompanied the children on their prison visit. In the workshop, the same design game as in activity 4 was activated.

We will draw on the design game results from the two mothers "Tanja" and "Katrin." Tanja (see red cards below) wrote on her dream card that she wished that her son would get a more realistic view of his dad.

On her barrier cards she wrote that the father "is a playmate"; that he "does not take responsibility for his mistakes" and that it was much easier to "blame Mum for everything that is bad." Katrin (blue cards) expressed similar concerns in relation to her future wish. She wrote that she wished that the father "would be honest" and that he "would admit that what he had done was stupid" (Figure 5).

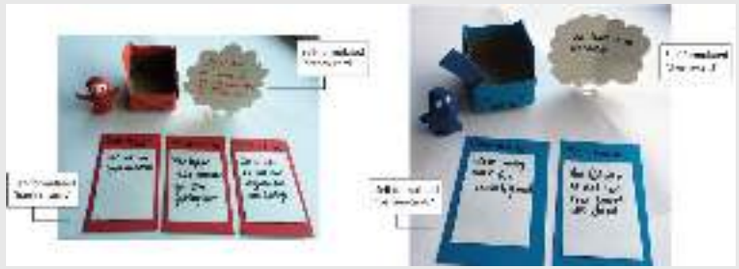

Figure 5: Design game results from the mothers "Tanja" (red cards) and "Katrin" (blue cards).

The workshop clearly showed that the mothers believed that their ex-husbands were irresponsible; that they were dishonest about the crime they had committed and they felt their children suffered from that fact. These results revealed a dilemma from the mothers' perspective: that the fathers did not assume their parenting role. Nonetheless, it also became clear that the mothers thought that their children should keep visiting their father in prison.

The workshop with the mothers changed our view of the actual purpose of our design. If the fathers were not capable of assuming their parenting role, perhaps they were in need of a different kind of game. This issue was discussed in the follow-up meetings with the family therapists, who are also in charge of the parenting program of incarcerated fathers. Therefore, even though our original intention was to design a single game to be played by father and child, an idea began to form that we might consider creating a second game to be played by the fathers only. The second game could help the fathers to look at things from the children's and mothers' perspective, increase their empathetic understanding and thus motivate them to have more meaningful conversations with their children during in-visits.

Based on this, we argue that this activity contributed with social value by enabling the mothers to express and share, with other mothers, their deep concerns about how their children experienced the effects of imprisonment. Moreover, it contributed with demand value in terms of expanding our design intention to include a second game.

Co-designing with incarcerated fathers

The aim of this workshop was to gain knowledge of prisoners' challenges of parenting and their experiences of the family visits (see activity 6, table 1). These insights were meant to inform the game world and the gameplay. The workshop took place in a prison with six imprisoned

fathers participating. All six men were serving long-term sentences and could only see their children during in-visits (unless special permission was granted). We were not allowed to use video or take photos, only to take notes. For this session we worked with two preliminary game concepts – a card game and a board game. We will use the card game activity to exemplify how value was created in this particular workshop.

The goal of the card game was to collect four cards that together formed a visual story of a visiting situation. Once a player collected a complete story, he had to recount what he thought was happening in the story and reflect on that.

Figure 6. The card game played with fathers in prison

The stories were developed on the basis of the previous workshops with prisoners' children and thus reflected the real-world experiences of these children. The purpose of the workshop was to have a dialogue with the fathers about their challenges as incarcerated parents, to co-design game content and to learn how they viewed their children's challenges.

In this workshop we played several rounds with the six prisoners and we talked about the stories and the father characters that were portrayed in the game. For instance, one story in the game is about a boy called Nick, who lives in a foster family far away from his hometown. In the story Nick goes to church and talks to the pastor who is going to confirm him (in Denmark this religious ceremony takes place at age 13–14). Nick chooses not to invite his dad for the ceremony, because his dad is a member of a criminal gang with tattoos up to his neck and Nick does not want his friends to know this. Nick's father gets very upset when he learns that he has not been invited to the confirmation.

The story was discussed in the group, and the prisoners expressed responses similar to the father character in the game. For instance, one prisoner (who was also heavily tattooed) said that he would be disappointed if he was not allowed to attend his son's confirmation and that he would probably react the same way as Nick's father.

A second story concerned a well-known problem for many fathers during imprisonment: giving presents to their children. In this story Rosa Clara's dad gives her a present appropriate for a little girl. For her 15th birthday she wants a mobile phone or a ticket to a concert, but she gets a Barbie doll. This story triggered other stories among the prisoners, stories about how to handle birthdays and other important days for the children. One father came up with a suggestion – something he wanted to do for his son's next birthday – and he shared this idea with the group.

A third story is about Monika and her dad Jimmy. Jimmy is divorced from Monika's mother, so Monika must visit her father with the father's girlfriend. Jimmy is dating two women at the same time and they do not know of each other's existence. So, one week Monika must visit with one girlfriend and the next week with the other girlfriend. This is, of course, strange and uncomfortable for Monika. To this story the prisoners reacted very harshly stating that this way of parenting was unacceptable. Nevertheless, the children's narratives were very recognizable to them and the cartoon format served as an effective conversation tool.

This workshop contributed with social value in several aspects. First, the activity enabled the incarcerated fathers to express and share their challenges of fathering behind bars. Secondly, the cards allowed the fathers to counteract the children's perspectives and come up with alternate stories of how to navigate the parent-child relationship. Thirdly, this activity created a bond between the fathers and us (as a research team). Since we all shared our experiences of parenting with them through playing the game, we were no longer divided into prisoners and researchers. This again influenced the pilot study (see section below). Finally, this workshop added demand value in terms of "thickening" stories of the father characters; expanding stories for the game world and consolidating the need for fathers to have a game of their own – a game that could help them share stories of fathering and help prisoners assume their parenting role.

Pilot testing the IPPA questionnaire

With the last activity (activity 10, table 1) we will exemplify how research value added to changes in our evaluation. At this point we had developed the board game Captivated, which was to be played in prisons during visiting hours. A second game called Dad's Round was being co-designed in separate co-design workshops. This game was to be activated in the parenting program of the prisons.

In the process of evaluating Captivated we attempted to set baseline by evaluating the existing bond between parent and child in terms of attachment. For this purpose we chose to use a psychometric evaluation instrument, the so-called Inventory of Parental and Peer Attachment (IPPA) as an evaluation tool. This tool evaluates whether children and adolescents feel attachment security in relation to their parents (see Armsden and Greenberg 1987). Our hypothesis was that the game would help children to increase their feeling of attachment, for instance, by enabling them to express emotions and to be honest with their fathers. At the same time a flipped version of the IPPA was developed to probe the attachment from the perspective of prisoner fathers.

The IPPA questionnaire was pilot-tested by a small group of prisoners and their children. The participants were both prisoners who were familiar with the game through previous workshops, and prisoners who were unfamiliar with the game. The test indicated that the prisoners did not want to complete the questionnaire. One of the prisoners, "Patrick", whom we knew from previous workshops, scratched out and withdraw his consent form (see fig 7). Further, a prison officer told us that the inmates she had talked with also thought of the questions in the IPPA as "strange." We got permission to make a follow-up phone interview with Patrick to ask him about the questionnaire. Patrick told us that some of the questions were too painful, but he also added that if we had asked him the same questions in a personal conversation, he might have been willing to answer them.

Based on our conversation with Patrick we removed the questions that he identified as being intimidating and simplified the questionnaire. It was then distributed to 550 prisoners in two Danish prisons. Within a period of 2 months we received 3 completed questionnaires.
This experience resulted in a complete redesign of our evaluation study. We decided to take a qualitative ethnographic approach and interview prisoners and their families in person. We also replaced attachment theory with theories of family narratives and we decided to use the game actively as a prompt for the interviews. Our aim was to understand what kind of narratives and playful interactions the game activated and how families shared stories.

Figure 7. The scratched out IPPA questionnaire from the prisoner "Patric"

Our interaction with Patrick and other prisoners contributed with research value in the sense of redirecting our research approach towards the participatory and social approach we started out with. It became clear to us that social design, as a caring practice, had to be part of

every aspect of the research process. Patrick reminded us that care is also about how we as researchers collaborate with participants. As a psychometric measuring instrument, the IPPA is a way of researching the social aspects in cases where subjects are kept at a distance. Family ties are of an intimate nature, and delving into this area requires a cross-pollination of research and caring practices. Even though it was planned according to our funding application, we realized that the IPPA did not align with such a practice.

Social value was achieved through other encounters. Another prisoner "Lars," who participated in both the co-design process and the pilot test of the game, contacted us after the pilot test. He had been moved to another prison and he asked if he could have his own game. Today, he and his two children have a "private" version of the game that they play during visiting hours.

Discussion

In Figure 8 we have applied both design processes to Sanders & Stappers' Model. The figure illustrates how the explorative processes led to an extension of our design intention and activated a split co-design process towards the implementation of the two games – Captivated to be played by families during visiting hours and Dad's Round to be played in parenting courses under the supervision of family therapists.

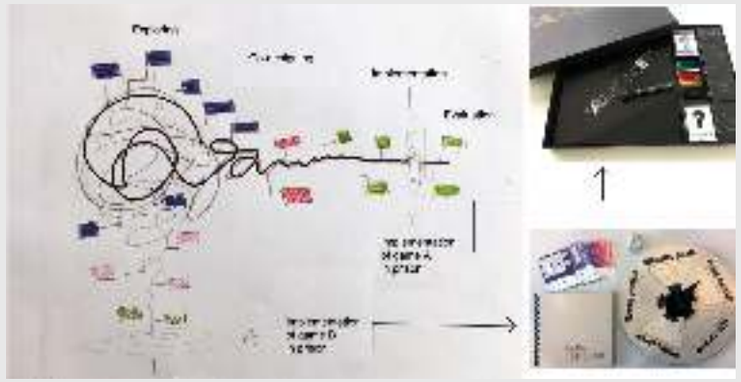

Figure 8. Sanders & Stappers' Model applied to both design processes: Top: Game A, "Captivated" Below: Game B, "Dad's Round".

By turning Sanders & Stappers' model 90 degrees and by adding the changes we have outlined through the four activities, we are able to visualize the changes that a project may activate through the participatory involvement (see model, figure 9). These changes can be conceptualized as ripples that might impact other interactions. The model aims at capturing the difference between what a project aims at changing and evaluating (the straight line) and all the ripple effects (circles around the straight line) that may occur.

Note that the activities we have outlined are just glimpses into the many interactions that we conducted with participants throughout the

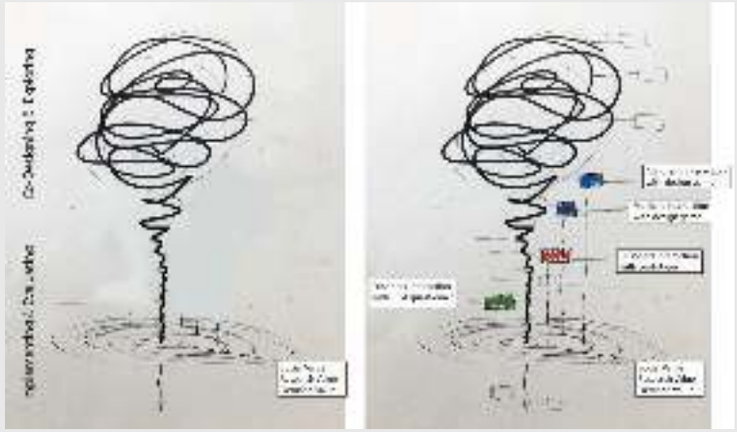

Figure 9. The Ripple Effect Model (left). The model applied to the activities (right)

project. Yet, the Ripple Effects Model illustrates that the values that were achieved had a huge impact on the entire project. Mira's and Patrick's involvement affected our methodological approach and the IPPA failure led to a complete change in the evaluation study and the theoretical foundations. The participatory activities with the families and the family therapists influenced our design intention as it highlighted a demand for a second prototype targeting parenting in prison. Our method of inquiry, the game design format, enabled playful forms of participation and enhanced the interpersonal relationships between participants and the research team, which again has strengthened our future collaboration with the prison staff, the therapists, the prisoners and the families involved.

Conclusions

With our Ripple Effect Model, we propose that the full understanding of change in social design projects relies on an inquiry into how participation might impact design, implementation and evaluation. Ripple effects are those unplanned changes that may not be foregrounded in the evaluation study design, but which nevertheless hold a potential value. We have distinguished between three basic values: social, demand and research values. These values are not in any way fixed, constant and objective but depend on a view of who initiates, directs and benefits from the participation (cf. Vines et al., 2013). By scrutinizing the values of our social design case we identified a range of unforeseen changes that have affected the final design outcome, the implementation of the design, the evaluation study as well as our interpersonal relations with participants and stakeholders in the project.

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Redesigning design for culture change: Theory in the Anthropocene

Ann Light

Abstract
Design is low on theory of transformation, which becomes problematic as the practices and outputs of design need to contribute to a culture of planetary adaptation for sustainability. In fact, design itself needs to be (re)designed to enact culture change. To make these shifts, design research can learn from cultural theory that positions culture as evolving and performative. Adopting these ideas helps to reveal the designed-therefore-designable nature of the world, which is a necessary prelude to mobilizing publics. The paper concludes with participatory collaborative thought experiments, influenced by cultural theory, that offer directions for changing design.

Introduction
The discipline of design, despite its basis in transformation, is still developing its theories of change. Although this has progressed as design research becomes a distinct domain, there is a tendency within design disciplines to consider fit-for-purpose in researching individual designs, rather than reflecting on that purpose and its social impact. Dilnot suggests that design is historically resistant to theory: 'it finds its glory in [...its] unswerving application of design to practical ends, mediated by criticism, but (often) only in minor ways by self-reflection.' (2017). Kimbell, in rethinking design, argues for an approach that 'moves away from a disembodied, ahistorical design thinking to a situated, contingent set of practices…, which recognizes the materiality of designed things and the material and discursive practices through which they come to matter.' (2012, p129).

When design research considers deliberate socio-material change (the "social turn"), silence on how design matters becomes noticeably problematic. We must understand change across many social, economic and political dimensions to enable us to develop and choose between alternatives for society. Changing cultures towards sustainable living is a case in point. This focuses effort on the knowledge needed for making cultures as well as understandings of individual behaviour and any materials we use to effect change in it.

In this paper, I explore these points in considering how to democratize futures as the need grows to ask what futures are possible with climate emergency (e.g. Wallace-Wells, 2019). I argue that understanding design as a democratic principle changes the conversation, as does the resulting obligation to equip people with a sense of the 'designed, therefore designable' (Light 2011a) nature of our world. If recognition of this era as the Anthropocene can do any good, it must move beyond understanding that human activity impacts life on Earth, to offer some collective insight into how this happens and what to do to tackle climate inertia.

To ground this paper, I draw from cultural theory. Design favours empirical testing. The commitments of cultural theory are discursive, rather than empirically tested. Nonetheless, it is timely to borrow from this legacy of analytic thinking since making change in culture has never been more important.

Democratising futures
My branch of design practice could be described as constructing possible futures in a collaborative way, drawing on a particular branch of participatory design (Binder et al 2015). 'Democratic participatory design practices' (Light 2015) is used here to mean practices that knowingly address cultural relations by collaboratively exploring, critiquing and designing tools, structures and systems, hoping, collectively, to change how lives are lived and enhance them. We see this kind of work in Ehn et al's book on Making Futures (2014), research on how older people might want to shape future life, Democratising Technology (Light et al 2009, 2011b) and Candy's Things from the Future (http://situationlab.org/project/the-thing-from-the-future/). Wilde and Anderson (2013) address 'a future fundamentally different from what we know' with embodied-thinking-through-making. RMIT's Design+Ethnography+Futures asked what uncertainty means (Akama et al 2018). Across these investigatory projects is recognition of the politics to futures in the present, and ethics to one's methodology for impacting them, which are often omitted from mainstream design discourse. These examples are far from alone.

My particular concern is for more-than-just-human collective futures and how people engage in considering them. Futurists and technology companies, policy makers and politicians all formally address futures through their actions (often without public mandate). But it is not part of education or working life for most of us. For many people, the world is a given and they do not, as most designers do, see it as raw material for a new iteration. As predictions for the planet's future darken, it becomes an ethical and practical matter to promote discussion of futures to include everyone sharing the concern and collective responsibility, even if they have little practice in considering alternatives. It is ethical because we share the outcome. It is practical because, by learning about alternatives and how to reach them, we become better able to innovate, change and avert catastrophe.

Design's dangerous developments
My ambitions to reorient design stem from concern about its power. This work becomes more urgent as the magnitude of the industrialized world's impact on life is revealed. The Global North is responsible for most of the planet's energy misuse. Yet, much design work continues with little thought to where it will lead. Even people consumed with worry about unsustainable futures go to work and contribute to that unsustainability. As Kimbell describes (2012), their agency is not a match for the wider material and discursive practices of designing. Incremental changes in the fabric of an upgrade are hailed as a major breakthrough, but the upgrading goes on. Most designing takes place

in a market where an immediate competitive edge is more important than long-term impacts, blinkered to serve a segmented production line and a growth agenda that is looking increasingly absurd. Design may help configure the future, but practices on the ground are frequently indifferent to this.

Papanek famously spoke against manufactured products that were unsafe, showy, maladapted, or essentially useless (1971/1985) exemplifying the design researcher interested in changing the discipline. More recently, discussion about how design should change has gained new foci. In 2005, Sterling commented that: 'What we really ought to fear is not "Oblivion" but irretrievable decline.' (2005, p141). He advocated greater technological innovation as an antidote to fatalistic handwringing (p13). Elsewhere, anthropologists and biologists entering design conversations argue that solutions can be the problem. Advocating Staying with the Trouble (2016), a new generation of design researchers is bringing the work of Haraway (2016), Barad (2007) and other feminist thinkers into design research as a foundation for relations. Puig de la Bellacasa's ethical treatise on care and soil has gone viral (2017). These works point to the complexity of the systems underpinning symbiosis and the need for new ways of being together. In gentle fashion, they inform how to live together rather than how to engineer the planet.

A social turn

With these tensions pointing to a role for design to redesign itself, design research has been proposing new relations with society. Fuad-Luke observes the terms circulating: 'social design', 'designing society', 'design for society, socially responsible design, socially responsive design, and design for social innovation' (2015). Design as societal transformation appears in a number of movements, e.g. Sangiorgi (2011) and Cottam (2018) on transformation design. Such movements are part of broader expansion of the designer's role in society (Maze 2014). All implicitly include culture change, some involving more systematic analysis, such as system-orientated design (Sevaldson, 2013) and transition design (Kossoff et al 2015).

Significantly, some practices include working with publics to understand together how design can transform contexts and relations. With others, design knowledge and skills sit with trained designers. This raises a distinction in how design is mobilized. While it has long been asserted that everyone designs (Cross 2001, Manzini 2015), how is this understood? Can we mobilize design as a means to transform society, not only as a series of processes, but as a way of understanding society as designable and, with this, offer increased sense of agency? Giving access to design necessarily changes design.

Theory of change

An obvious source of theory to support design's social turn comes from social science, particularly social psychology. This has not strengthened a more democratized approach. For instance, there has been growing interest, in policy circles, in behavioural insights and nudge psychology (John 2018).

Nudge is the opposite of helping people understand the designed-therefore-designable nature of the world. It points design towards a top-down, all-knowing approach perpetrated on the masses. It is 'bovine design', reducing, rather than enhancing, our critical faculties when we all need to be consciously reorienting the world towards new realities (Light et al, 2017). And nudge policies fail to appreciate their own social and political dynamics, including the state's own political-economic strategy (Leggett 2014). Yet, it is easy for even enlightened design policy to halt at this point.

By contrast, descriptive domains, such anthropology, are increasingly exploring design as a method of collaborative engagement for world-making, and not just a field of study (e.g. Ingold 2013, Escobar 2018). How does this support a more participative agenda?

Towards humanities?

Design research starts by understanding phenomena, not a theoretical position (although theory may be sought in sense-making). The world-making processes described by Ingold and Escobar come from a humanistic tradition. This is not always seen as useful.

Nonetheless, the humanities explicitly articulate theories of change, serving to put activity in context and eventually to change what discourses are ripe and how the world understands itself. A vision of ontological change – crudely, where we change what we are to change what we do – appears in different ways across different traditions, such as the political economy of enchantment (Bennett 2001). Adopting theories of change of these kinds, we move from the craft skills of making change to designing education about change.

Humanities contribute to (interaction) design research, through 'the central role of critical interpretation in humanistic thought …toward the development, clarification, and justification of concepts' and the material of social change (e.g. feminism, Marxist studies) (Bardzell and Bardzell 2015:17-8). Not only is this what mainstream design is missing, it considers what knowledge we are interested in making and, by considering epistemology, speaks about the opportunities and gaps we observe.

Designing our development

Taking this on, we can find work that speaks to design, not in terms of the next product, but its direction of travel.

Birth of design?

Philosophical literature supports a suggestion that design is integral to how humans develop. In Stiegler's (1998) expansion of Heidegger's phenomenology, we find a claim that technics ('the organisation of inorganic matter') is a process of externalisation made possible through language, technique, and culture that allows us to capture and share our existence—or the 'pursuit of life by means other than life' (1998). Through the act of organizing, we are able to constitute the world, while these acts of organization fasten interpretations upon matter and thought. Although Stiegler does not focus on the creative experimentation needed to arrive at organization, 'the organisation of inorganic matter' is inevitably a creative and collaborative process.

Stiegler suggests that: 'it is the tool, that is tehknē, that invents the human, not the human who invents the technical. Or again: the human invents himself in the technical by inventing the tool – by becoming exteriorized techno-logically' (1998:141). Although this is a form of technological determinism, it raises questions about how designing comes to be and about whether this opportunity to organize is, in any way, equally distributed or democratic in our current world. If it is a fundamental part of our constitution, why is it not a right for all? If this doing is so central to our being, what kind of designing (and making) is fit for a world with fewer resources?

The distribution of this power and the results of this organization are demonstrably political. Bowker and Star (2000) poignantly describe how categorization systems form identities for groups through increasing bureaucratization and definitions like apartheid. Types of design configure who we are and what we can become. We become committed to infrastructures – from canals, sewers and roads to internet provision and 5G.

Data, with their hierarchies and identity definitions, meets information technologies, with their binary coding and hard-wiring. This alters the flexibility and balance of control in societies. If rigid systems converge, we not only design ourselves, as Willis (2006) suggests, but we design out the potential to redesign ourselves.

Identities in flux

It would be too deterministic to say that we are human because we make. On the other hand, if we accept the ontological potential implicit in culture change, we can see both designing and identity as fluid and we can start to speculate on some interesting potential intersections. Every interaction changes how things are. Everything is designable. Greater awareness of how things are designable enables us to be more reflective about how and what is designed. We can embrace a historical perspective:

> *'A condition brought about at a certain time can be abolished at some other time. …it might seem that natural condition is beyond the possibility of change. In truth, however, the nature of things is no more immutably given, once and for all, than is historical reality.' (de Beauvoir, 1972/1949).*

We can regard ourselves as mutable, where identity is inscribed in society's constant rehearsal of behaviours (Butler 1990). Performativity presents identity as enacted: 'One is not simply a body, but, in some very key sense, one does one's body.' (1990:272). The design of the systems round us inscribes us. There are other theories of how technology and identity are interrelated, how values are shaped by what we become as well as what we choose (e.g. Verbeek 2016; Pinch et al 1985/1999; MacKenzie and Wajcman 1999).

For me, Butler's insights help consider the way that interactions with technology inscribe, prescribe and proscribe what we can become (2011a), but they also move me, through this reflection, to consider a more flexible version of the material world. Not only does performativity focus on how society is formed, but a non-essentialist view of identity releases us from contemplating patterns of societal behaviour as fixed and immovable.

Design can speed up these reconsiderations by targeting how agency is conceived and by embracing flexibility instead of aspiring to end-states (Light 2011a). A sense of agency (or the ability to enact change) is related to this. And this is at the heart of my designed-therefore-designable ambitions. Agency, our power to do, is core to identity in change: how far (we believe) we choose our actions and are able to enact change relates to who we think we are. Performativity may show how challenging it is for individuals to change what they are inscribed to be, yet it is also clear about the social nature of identity and its potential for change, how 'to remain un-centred and open to new influences' (Light 2011a). Performativity is a liberating philosophy, then, because it allows for things to be done differently: it is concerned with enactment and how conditions affect enactment and produce ways of doing. 'When we ask after the conditions of social change, we are asking both about the preconditions for transformation and about how encounters encourage us to think and feel and act, not just individually but collectively.' (Barnett and DeLuca 2019).

The performative turn in cultural theory can be seen as the correlate of the social turn in design, offering a more integrated approach to understanding how we constitute our world. 'Such a perspective has been extended to show how not only gender, but the materiality of things […] or even the man/machine distinction […] are not given a priori, but are ceaselessly produced in social performances in which their reproduction is not routine or matter of fact' (Licoppe 2010).

Given these insights, there is no final arrival point, but context, an absence of dogma and a mutability that allows new truths, perspectives and engagements to emerge through a refusal to accept definition. Designs may be completed, but identity is always in flux. Adopting this stance allows a more fluid response to technological changes, methodological commitments and the possible domains to be touched by designing. It means the nature of our encounters together is not only ethically significant; it is constitutive of our relations.

Exploring activist futures with this possibility in mind can modify how we stage our encounters to consider the designed nature of the world. It is a reflexive act. Following this logic, we design something new on multiple levels when we set up democratic participatory work in contexts for co-research and engagement. We do not just share practice and reveal the nature of our interactions, but make new ones possible. These ways of being might never occur in other circumstances, so there may be no possible other way to perceive the potential revealed (Light 2015). In other words, these practices form the basis of a new constitutive anthropology (ibid). They are a creative form of engagement, enacting cultural research through making situations for sharing, learning and changing. And they are 'constitutive' in the full sense of bringing into being. Democratic participatory design fosters new social arrangements, providing the means for new ways of being together to be born, reflected upon, interpreted, understood and supported. Performativity provides theory to show how and why these changes come into being through particular forms of design, while also providing a method for these enactments. It allows us to do more than go through motions, but to change ourselves and our futures through coming together and exploring.

Some examples

This essay has stayed at a theoretical level, discussing theory of change. This section briefly details a single kind of practice that has resulted from considering performativity as a theory of change and the designed-therefore-designable nature of the world with members of the public. Its design is influenced by these philosophical considerations and shaped by a desire to change culture towards democratized fellow-journeying in increasingly uncertain futures. This is guided by theory that reveals the non-essential, enacted and ever-evolving nature of our relations.

Three worlds for transformation

I have three workshops in circulation framed as process tools and designed to help people come together and understand themselves as agents in collaborative change. I will discuss one in more detail to show its operation, but I introduce them first as a way of highlighting three dimensions:

- World machines
  Revealing the power of the digital to connect, sense and aggregate and how the world could be joined up for greater information, understanding and feedback, people come together to discuss utopias, resistance and tools of change and make manuals for coordinating world resources (Light et al 2015).
- On some other world
  Demonstrating the way that the world has come about by looking at an alternative present with different path dependencies and outcomes, this shows how the world could have been different and therefore still could be (Korsmeyer and Light 2019).
- Worlds of/that matter
  Working with the affective, this workshop explores how we come to care for the things we value and how we might include more that is fragile in our care.

New worlds for new cultures

The challenge for participants in the on some other world workshop is to co-create an alternative present based on stimuli given as briefs at the start of the session. After introducing the need for new practices and the lack of need for accurate history, the Counter-Factual Worlds Generator (Figure 1) pumps out five globes, randomly assigned to small groups. Inside this globe is a description of a world that is not ours but bears a relation to ours. One crucial aspect is different. Each group is then invited to work through a process involving:

1. *Worlding:* discuss this world, how it works and what the present would be like if this world were ours;
2. *Chronicling:* record the key features of this world in a story for sharing, then tell this to the other groups;
3. *Creating:* make a thing/system/service that reflects (the values of) this world, with the materials provided (glue, scissors, pens, etc);

Figure 1. the Counter-factual Worlds Generator, with globes (photo credit: Deborah Mason)

4. *Analyzing:* reflect on this world and its outcomes (artifacts and/or ways-of-being) to consider:

- how values affect the design;
- how this relates to our world(s);
- what the process of imagining another world has revealed.

The workshop ends with sharing and contrasting of outcomes and a whole-group discussion of learning across cultural and socio-material dimensions.

Inside the globes, a short provocation spurs the participants to speculate on another world (e.g. Box 1). There is no other brief, but a chance to create.

The Brazilian Rubber Monopoly persists…
In 1876, Henry Wickham, on a mission from the Royal Botanical Gardens, brought seeds of the rubber tree from Brazil to the UK. At the time, Brazil held a monopoly on rubber, making the rubber barons very rich. Both the British government and the American car manufacturer Henry Ford could see that the high cost of rubber was a barrier to the expansion of the motor vehicle industry – and anything else that required pneumatic tyres as well as a number of other manufacturing and industrial processes. Ford set up his own colony in Brazil in an attempt to produce cheap rubber. The British moved the rubber plantations to Asia where the Empire could set up rubber trees in a way that made rubber harvesting efficient and economical. By the 1910s, the monopoly was broken and rubber was available more cheaply from British Empire sources.

This counter-factual world imagines that the monopoly had not been broken and Brazil had kept control of the whole rubber market. Rubber remains expensive.

Box 1: sample of a counter-factual world provocation

A new role for design

Over the last years, this scenario has been used to think through how materials, transport, political geography, colonialism, and commerce affect what happens in our world. It has pointed to alternative futures and, with the other workshops in the series, given a sense of what an alternative world might offer. It has been incorporated into further engagement processes to contribute to a shift in thinking. By itself, such speculation is merely like a game, but in combination with other tools it has the potential to lead to transformative creative practice (Light et al 2018, Light et al 2019).

But it is not presented here as a method or a discussion of speculation. It is offered to show the kind of tool that can be created if we redesign

design to be participative, inclusive and focused on new futures that do not start from our blinkered world of squandered resources and endless upgrades. If we have, in design research, a sense of cultural dynamics and the political will to democratize design, we can apply performative theory to make sense of this – both people's desire to lead creative and fulfilling lives and the options to morph into new arrangements that such enthusiasm gives us. It points towards creative practices that designers can enable and people can engage in, which enable new selves to be created.

If we wholeheartedly adopt the creed that we become what we do, then the encounters in these workshops, and others like them, concern possibilities that are not to be observed however long we watch people going about their business during extended fieldwork. They are not to be observed in inviting participants to help us co-design products. The special characteristic here is that we are collaboratively assembling the components of how to be together. When we engage in democratic participatory design practices, we are co-designing ways of being, as well as staging encounters to learn about ways of being. It is a form of research through design where the product for iteration is a process. We literally make our futures by the practice of performing them and to design for this opportunity offers a profoundly important and meaningful future for design, despite its dangers.

Conclusions

It is, in the end, unimportant how ideas come to inform design and from where they are drawn; the pragmatics of our situation merely require that change comes, both in what is designed and what design is understood to be. I have argued that performative theories of change support the instantiation of new ways of being and save designing from its damaging legacy and a loss of relevance as natural resources become increasingly difficult and/or dangerous to use. I have given a simple example of a new kind of practice, at once generative and modest in how it brings people together. I have shown how this relates to the critical activity of encouraging a sense of agency by acknowledging the designed-therefore-designable nature of the world.

At present, such reflections do not sit adequately in design, for it is still seen as operating in 'a close-present: the present of a recent yesterday, limited now and almost tomorrow' (Anusas and Harkness 2014) and this cannot be the basis of tackling the Anthropocene. Perhaps, in borrowing some theory, we can return a renewed sense of timeliness and importance for disciplines beyond our own. Certainly, we can engage in collaborative 'what if' speculation that gives those without the comfort of professional future-making the opportunity of redesigning design for a turbulent period when material consumption

and traditional characteristics of design no longer serve.

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Metaphors and imaginaries in design research for change

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Abstract

A component of design research for change that has been underexplored by designers focused primarily on changing behaviour, is the potential to use design methods to investigate how people think. In particular, the metaphors, mental imagery, and other forms of imaginaries which influence how people act and make sense of the world, individually, and as a society, are topics which design research is well-placed to explore. This paper illustrates three projects addressing these areas (relating to energy use, life and career, and generating new metaphors), and argues that by seeking to 'understand people's understanding better', design research can contribute useful forms of enquiry for informing other academic disciplines dealing with large-scale challenges such as health, environment, politics, and social issues.

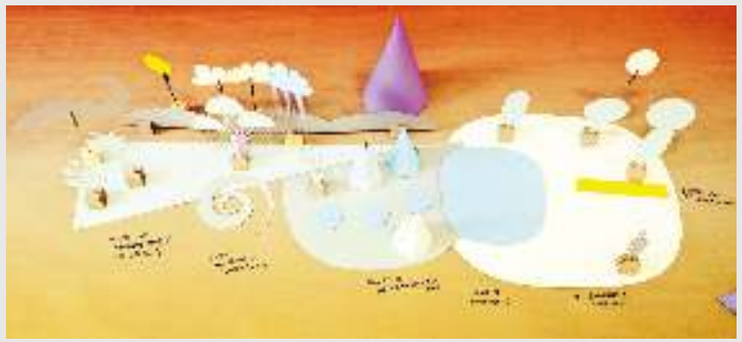

Figure 1. A metaphorical 'project landscape' built and annotated by a group of undergraduate design students to represent a collective mental model of a group project they had worked on, with its ups, downs, and emotions (Ricketts and Lockton, 2019).

Introduction: Understanding how people think, instead of just trying to change behaviour

All design influences our behaviour, from the layout of our cities, to the choices of data required by a form, to the aesthetic choices made in food packaging, to the interface design of the software which you may be using to read this paper. We are living our everyday lives within multiple intersecting designed systems, at many scales, and the design of those systems has an influence on how we act, and how we can act.

In recent years, the field of design for behaviour change (and allied areas such as persuasive technology) has emerged as a key component of a broader 'design for change' agenda (Niedderer et al, 2016), with an explicit focus on trying to change people's behaviour intentionally, for example around health, environmental impact, safety, and other social issues (in addition to many with a commercial benefit agenda). Design researchers have been at the forefront of translating and transposing knowledge from other academic disciplines such as social and cognitive psychology and behavioural economics into practically actionable forms for designers and other practitioners involved in a variety of domains (e.g. Lilley & Wilson, 2017; Daae & Boks, 2014; Selvefors, 2017; Lockton et al, 2013a). The approach has, in modified form, made its way into government policy, discussed as 'neuroliberalism' by Whitehead et al (2017), and its methods been adopted and adapted by NGOs and think tanks; there are industry conferences and even design consultancies specialising in the field. The 'behavioural design' research programme has had impact.

However, the interaction between behaviour and how people think and make meaning has been at risk of being simplified away in the rush towards a deterministic 'behavioural lookup table' model for design (Watson et al, 2015, discussed in Lockton and Ranner, 2017). Focusing solely on behaviour models people in a way which simply does not match the complexity and interconnectedness of real-life practices. People's actions, now and in the future, are deeply enmeshed with social and cultural contexts, power structures, and other people's actions, and more nuanced than any singular vision can ever capture, which highlights the inadequacy of strongly reductive approaches, appealing as these models might sometimes be. People, societies and their actions are diverse, even in the face of attempts to design this away, or treat it as reduced. Along these lines, Brynjarsdóttir et al. (2012) characterise much design for behaviour change (specifically around sustainability) as 'a modernist enterprise' (p947), focusing both on individuals at the expense of broader social considerations, and on narrowing the broad scope of sustainability into 'the more manageable problem of 'resource management'' (p948).

Beyond these critiques, though, is an area where design research can contribute further to change: investigating and engaging with how we think. Just as design influences our behaviour, the designed systems and environments we inhabit affect, and are affected by, how we think and understand and make sense of the world, individually and together. How we think about the world affects what we do. The imaginaries we have (Jasanoff and Kim, 2015; Speed et al, 2019)—the stories we tell ourselves and each other, the mental models, language, framings and metaphors we use, the associations and mental imagery that come to mind when we think about concepts—make a difference to the way we approach the issues that affect us, from interacting with technology in everyday life right up to global challenges such as climate change and the rise of extreme populism. "How do we understand?" is becoming increasingly important as we become enmeshed in complex systems of nature, technology and society, from ecosystems to AI to big data to our own health. Design working on behaviour change has so far largely ignored this dimension, and yet it potentially offers a deeper and richer understanding of the human condition within the socio-technical ecologies of our lives—although we must not forget that the 'we' in so much of this kind of work is rooted in western, privileged positions and notions of everyday life (Schultz et al, 2018; Abdulla et al, 2019). But this is an opportunity for design research to contribute to scientific, social scientific, and humanities enquiry more widely as part of just transitions to more sustainable societies (White, 2019; Boehnert et al, 2018).

Design research, including techniques and methods developed by designers for use in developing new products and services, can offer new perspectives on exploring these imaginaries and their consequences for human behaviour, complementing social and cognitive sciences with an experiential layer. Design methods can also help us go beyond characterising what we have already, and actively develop and propose

new ways to understand, and new ways to live (Lockton and Candy, 2018), supporting people's imagining and helping them conceive of new perspectives for behaviour and practices in the future.

This paper briefly introduces three projects which explore considering metaphors and imaginaries more widely almost as a 'material' for design research, a rich source of insight and a site of opportunity for design researchers to enact change with societal and environmental benefit in different domains. We use the term 'metaphor' in a broad, imprecise way, to refer to a variety of ways in which one thing can be understood in terms of another.

Energy Imaginaries: What does energy look like?

The SusLabNWE project was a European collaboration around studying and influencing more sustainable behaviour in domestic contexts, through Living Lab methodology (Keyson et al, 2016), including both dedicated Living Lab houses, and a selection of participants given a range of sensors and experience sampling equipment for their own homes. Much of the work focused on investigating energy use behaviour, which is a major component of design for sustainable behaviour research. As design researchers engaged in ethnographic research with householders (Lockton et al, 2013b), we quickly found that the design of the energy monitors and feedback systems that were intended to influence people's behaviour were not necessarily designed with reference to people's mental models (Johnson-Laird, 1983; Gentner & Stevens, 1983) of energy—notions which were diverse and with associations much broader than heat or electricity.

One of the main themes emerging was the general invisibility of energy in modern life, and the consequences of this for behaviour and everyday practices. Householders' mental models of energy itself, and energy-using systems such as heating, together with the relative importance of different energy-using systems in the home, were partly determined by what was most salient—such as lighting—rather than 'hidden' uses such as heating and cooling. By people's own admission, much of the energy 'wasted' at home through particular behaviours, such as leaving heating on when going out, or leaving lights on elsewhere in the house, was partly due to its invisibility from the perspective of where they were at the time. People questioned how they could change how they use energy when they can't easily see or feel it, or get a sense of the changing rate at which it is being used. We found confusion with the different characteristics of energy use by different appliances (e.g. the 'spike' of a kettle compared with the continuous power drawn by lighting), and units, for example between kilowatts as a measure of power and kilowatt-hours as a measure of energy.

One simple way to explore this further was to ask people 'What does energy look like?', applying what might be used as a creative icebreaker exercise in design workshops as a research method in itself. Through a series of events with adults and young people, given media including pens, crayons, inks and pastels, we arrived at a collection of 180 drawings (Bowden et al, 2015) that present a diverse and multifaceted picture of people's ideas, mental imagery, mental models, experiences and notions of what energy 'looks' like. As a way into making this often intangible and amorphous subject visible and engageable-with, the broad and sometimes contrasting range of personal definitions and conceptualisations of energy (Figure 2 and 3) illustrate participants' aesthetic perceptions and judgement of energy via metaphors, categorisations, characterisations and associations, leading to possible design implications for new forms of energy feedback or display (Bowden et al, 2015). (One direction we have taken, informed by some of the metaphors which emerged, is energy sonification (Lockton et al 2014, 2019a), which is outside the scope of this paper but has potential

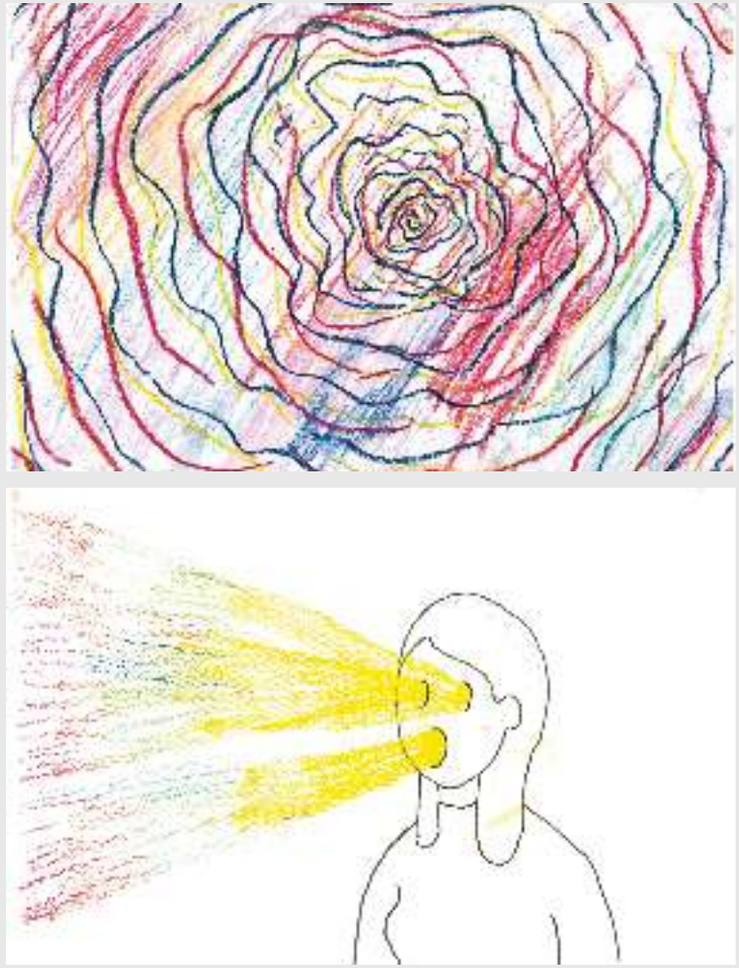

Figure 2 and 3. Two examples from 'Drawing Energy' (Bowden et al, 2015) created by members of the public.

for ambient comprehension of energy use with multiple appliances, including pattern recognition and state changes).

Mental Landscapes: Modelling imaginaries of career paths and group projects

The idea of using 'design' methods to explore the mental imagery and metaphors which people have around abstract-but-important concepts seemed applicable to many other areas beyond energy—eliciting metaphors, tacit or explicit, could be part of a self-reflection process for research participants themselves, or for researchers seeking to gain qualitative insights around people's understandings. Systems theorist Peter Senge (1993) has called for teams within organizations to work on "surfacing, testing, and improving [their] mental pictures of how the world works" to arrive at shared mental models; this approach could also be useful for people individually. However, there is no right way to externalize thoughts. As David Jonassen and Young Hoan Cho (2008) put it, we need "visual prostheses" to share our mental imagery with each other.

Figure 4. The Mental Landscapes modelling process.

In Mental Landscapes (Ricketts and Lockton, 2019) we used developed a set of visual prostheses specifically to explore how students imagined and thought about their own lives—career paths, but also more widely their own pasts and possible futures, all based around a variety of landscape metaphors. We also used the same kit to investigate groups' conceptions of projects they had worked on together. The Mental Landscapes kit comprises laser-cut card parts embodying a particular set of metaphors based on stylised landscapes and features within landscapes, such as hills, roads, fields, and weather. We have explored the kit's use through workshops where participants assemble and arrange a variety of elements to make abstracted model landscapes that on some level represent or translate their thinking, individually or in groups. Landscapes are a common type of metaphor in speech, particularly for talking about relations between parts of a whole, or mapping the structure of one concept onto another. In organizations, we might talk about moving into new territory or the stakeholder landscape, having a vantage point, mainstream and backwater, channelling our efforts, the lay of the land, descending into chaos, oceans of possibilities—even blue sky thinking. We talk about food deserts and career paths, networks and decision trees, world-wide webs and websites, sometimes directly comparing a new concept to an existing thing in a landscape, and sometimes using the idea in a more abstract way. On a more fundamental level, we might even realize the spatial metaphors inherent in perspective, field, area, stance, position, looking ahead, and, indeed, fundamental level. In developing the form of the kit, we have taken inspiration from, or paralleled, approaches including Liz Sanders's MakeTools (Sanders and Stappers, 2013), Thudt et al.'s (2018) data physicalization for self-reflection, and other work on embodied sensemaking, modeling in systemic design, and collective imagery weaves (Jaasma et al, 2017; Aguirre Ulloa & Paulsen, 2017; Chueng-Nainby et al, 2016).

In the 'life landscapes' workshop, master's students in groups of five to seven, have been given 30 minutes to visualise the questions "What do the past and future look like as a landscape?" and "Where are we going?" using the kit. The focus for most groups has been their own perceptions of their journeys before, during—and imagined journey after—graduating, but the scope has been open for groups to interpret the questions in different ways. The collaborative challenge here was to create a shared vision from what started as a disparate set of individual experiences (Figure 3). Figure 5 shows one group explaining their landscape, centred around a set of tributaries (different backgrounds) coming together with the students on a raft together (their degrees), heading—potentially via a whirlpool—for a variety of possibilities ahead, from rocky shallows, to deserts with cacti, to hills representing different kinds of careers.

Figure 5. A group explains their 'life landscape'.

Looking at how groups imagined projects they had worked on together, undergraduates worked in groups of three to five for 30 minutes, re-forming groups they had previously worked in together on a recent project. They were asked to use the elements to create landscapes representing whatever aspects they found important to emphasize: topics, challenges, project stages, roles, interpersonal relationships, and so on. Some projects started with "rocky" beginnings, represented by cones or hills. Others started with trees, rivers, and stars, representing periods of ideation, or general feelings of optimism. When projects encountered difficulties later on, many groups represented these periods with lightning, rain, and hills (e.g. Figure 6). Several groups came up with names to represent specific parts of their project experiences, such as a "plateau of exhaustion" before the project came to an end, or even in one case a "hell." In Figure 1, for example, the group illustrated how at the beginning of their project, they were in a "marsh of uncertainty." Negative feedback was represented by a "sinking whirlpool" and rain clouds. The grey, dry "desert of inspiration" represents not having a lot of ideas, but the blue circles represent the team enjoying working together. Eventually they found an "oasis of teamwork," which led to "a paradise of creation" and eventually completing the project.

Using design methods in this kind of way can make a contribution to what might traditionally have been text- or interview-based forms of inquiry. Exploring which elements of mental models are shared between group members—and which are not—and the discussion around these issues once surfaced, can give useful insights for researchers seeking to understand understanding. For example, different metaphors used by participants could inspire a new form of interface design for life planning or project-management tools. Imagine collaborative project-planning software—or even an augmented reality or tangible interface—enabling team members to shape and annotate elements in a landscape such as

Figure 6. Here, as explained by the group, initially extreme weather represents a communication breakdown; a rising sun represents the group starting to understand what was going on. The mountain and swirl of people represent the pressure and opportunity of a major career fair at that time in the project.

that shown in Figure 6, where not just the other events (e.g., the career fair) in people's calendars, but also the meaning of them to people, along with each other's perspectives on communication, different visions for the project, and so on, were visible and engageable-with.
Beyond interface design, there is also something interesting in using these kinds of methods to shed light on the unexamined metaphors and mental models that are present in our collective (or not) societal imaginaries of abstract concepts such as technology, life, career, family, and work—and issues such as climate change, our relationship with nature, resources, artificial intelligence, mental and physical health, national identities and international migration, social equity, government, new forms of economy, and quality of life. As such, our aim in developing the kit further will be for it to be useful at multiple levels, from individual reflection to community-based participatory design workshops—giving a community the opportunity to reflect on and learn about its own thinking—and expanding beyond solely landscape metaphors.

Figure 7. A group of interaction designers at the UX Lisbon industry conference use the New Metaphors cards to rethink the framing of issues.

New Metaphors: Using the power of creativity to generate new framings for big issues

Another direction for exploring metaphors within design for change is around intentionally seeking, and creating, new metaphors. In interaction design, new metaphors may commonly be considered where a new product or technology offers new affordances which require some 'anchoring' (itself a metaphor) to a familiar concept (Cila, 2013; Jung et al 2017). But there is a much bigger potential.

Many challenges facing humanity today and in the future are complex, involving relationships, systemic intricacies, and timescales which are difficult to understand and represent in simple terms. As such, humans simplify; and those simplifications can have consequences which impede attempts to tackle problems. For example, the multiple feedback loops, scale and duration, uncertainty and non-linearity of climate change may be reduced by popular media discourse to 'global

warming', a framing whose 'validity' (along with trust in science itself) is held open to question.

Often, complex issues are rendered understandable through the use of metaphors and analogies, and indeed it has been argued that these are central to human reasoning, understanding, and creativity (Boden, 1992; Hofstadter, 2001) as well as the linguistic aspects of cognition itself (Lakoff and Johnson, 1980). There are many phenomena where new metaphors could potentially enable new forms of understanding, sharing or changing mental models, or experiencing otherwise invisible processes in more interesting ways.

One simple reason for metaphors' prevalence is that by mapping features of an existing or familiar situation onto a new or unknown one, we are enabled to grasp it more quickly. Nevertheless, metaphors are not the thing itself—they are always an abstraction, a model of the situation. They can be a map to a territory, but should not be mistaken for the territory. Artists and poets may be experts in creating new metaphors, but as well as within design practice, the intentional construction of metaphors to enable new ways of thinking has been proposed by people in many fields, ranging from anthropology (e.g. Margaret Mead and Mary Catherine Bateson) to politics (e.g. George Lakoff). In economics, studies have noted how the metaphor of 'the national economy as a household budget', or even 'a container/bucket/pot' commonly employed by media and politicians, is a structural error in terms of many key features of the systems, such as fixation on 'balancing the books' or people in need being 'a drain on the system'. This leads to specific policy decisions being made that arguably cause harm. How would political discourse on the economy be different if a different metaphor were used? We can imagine ideas such as the economy is a garden or the economy is a loaf od bread being baked; the New Economy Organisers' Network, New Economics Foundation and partners (2018) tested new metaphors such as the economy is a computer that can be programmed through surveys with the British public. From global issues to local ones (e.g. engagement with local government), right down to the personal level (e.g. mental health), there is an opportunity for new metaphors to be generated, and adopted and adapted from other cultures, traditions, and contexts, and their effects on people's understanding of issues investigated. As Schön (1979) argued for the examination of generative metaphor in problem-setting in social policy, exploring the metaphors in use can condition the ways that problems are approached, and generating different metaphors can enable new perspectives.

We have created a card deck and workshop format (Figure 7), New Metaphors (Lockton et al 2019b) which aims to inspire creative approaches to designing novel interfaces, products, services, communication campaigns, ways of explaining ideas, and more widely, reframing of societal issues around technology and other issues of global importance, providing an expanded 'conceptual vocabulary',

and that a method for doing so could be a useful part of the designer's toolbox. The method is very simple: participants browse sets of image and text cards which they combine in creative ways to suggest possible metaphors (optionally going through a characteristic-mapping process), and then they think further about how a concept might be developed based around the new metaphors they have generated. This process of bisociation—as described by Arthur Koestler (1964), "the perceiving of a situation or idea… in two self-consistent but habitually incompatible frames of reference"—or simple juxtaposition of ideas as a provocation in the style of Edward de Bono (1971) is a common feature of inspiration card workshops (Biskjaer et al, 2017) and is fast-paced, intended to be a creative trigger method to generate multiple ideas quickly and then enable subsequent evaluation and development. The workshop participants may come with their own specific domain knowledge or a problem or issue for which they seek new metaphors, or they may use the cards to address topics of which they have little knowledge, but which can nevertheless provide a provocation for thinking differently. Some of the cards are shown in Figures 8, 9, and 10.

Figure 8. How could burnt toast be a metaphor for climate change? Could cracks in the paving be a metaphor for unwritten rules, or a net a metaphor for anxiety?

There are two types of cards: 'Thing 1' cards, solely textual, feature the names of an assorted selection of phenomena and abstract concepts which may be difficult to visualise, but which might be possible to do through using a metaphor. They are drawn from the authors' own noticings, and from concepts which have been suggested by students, previous workshop participants, and topics in previous projects. These ranged from invisible system relationships (e.g. power relations between people or even wifi signals) to intangible emotions, feelings or personality properties (e.g. confidence or a headache). The Thing 1 cards are 'optional' for the workshop process, in the sense that participants may already have problems or issues for which they seek new metaphors. Some of the workshops we have run have explicitly asked participants to come with domain-specific issues themselves.

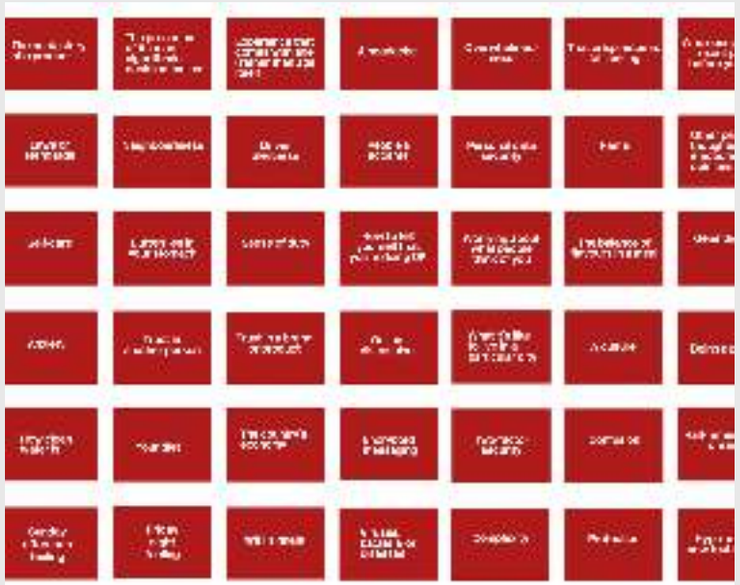

Figure 9. A selection of Thing 1 cards—some phenomena and abstract concepts which may be difficult to visualise, but which might be possible to do through using a metaphor.

Thing 2 cards show a photograph and the name of a phenomenon in the world which could potentially be an interesting metaphor for some of the Thing 1s—an arbitrarily chosen mixture of natural and artificial phenomena (and sometimes combinations of the two). The examples were partly drawn from sensory or synaesthesia-inspired ideas (Lee et al, 2019), such as sweetness, and partly from everyday phenomena that seemed interesting as potential 'design' material—particularly drawing on work around qualitative interface design (Lockton et al, 2017), indexical visualisation (Offenhuber and Telhan, 2015) and data physicalisation (Jansen et al, 2015)—from the hum of a fridgew to the arrangement of your desktop.

A set of worksheets helps guide participants through mapping characteristics between Thing 2 and Thing 1 (or other concepts). With a more focused procedure, there is potential for incorporation of a 'metaphor search stage' into design processes; alternatively, there is still potentially value in treating this as a kind of fun creative thinking exercise in itself, to help open up new ways of thinking, even if the concepts generated are not developed further. Participants' comments from New Metaphors workshops run at a range of user experience design industry conferences in France, Portugal, and the US (and student workshops in Chile and the US) included insights around how the process had worked in practice—some groups had set themselves the challenge to work with whatever juxtaposition was chosen (even semi-randomly), while others had worked through many different combinations to find ones that 'worked' in terms of structural similarity, or even in being a 'problem' that interested the group. The mapping worksheets have been useful to some groups in working through the

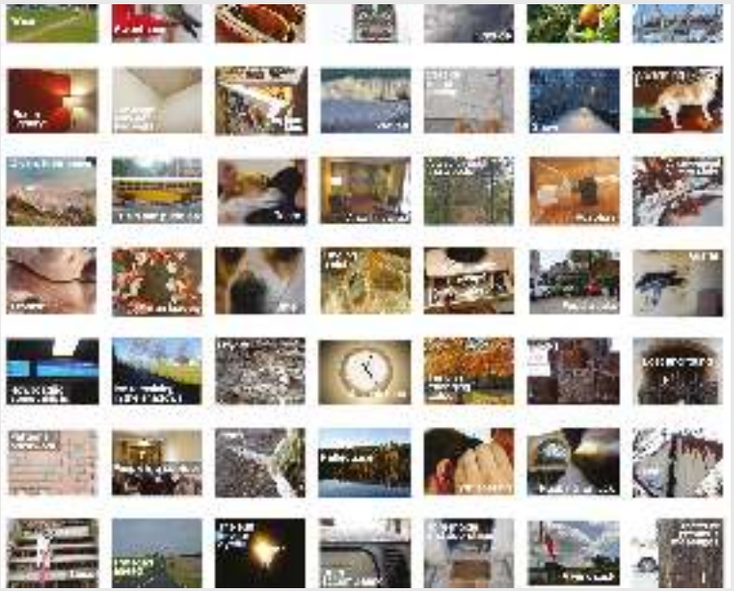

Figure 10. A selection of Thing 2 cards—phenomena in the world which could potentially be an interesting metaphor for some of the Thing 1 cards or other concepts.

characteristics of the phenomena being considered, but other groups had leapt straight to a concept.

One direction for further in-depth research here could be an analysis of how the backgrounds and experience of the participants (which we did not explicitly assess) related to the kinds of ideas generated, or whether particular combinations or attributes of Thing 1 and Thing 2 could apply to certain domains better than others. This work could lead to a much more structured, guided form of ideation process.

There are at least two directions this research could go in applying this work within design for change. One is to use the New Metaphors method and cards (suitably expanded or reorganised in content) to generate and iterate more targeted design concepts for new interfaces, products, services, communication campaigns, ways of explaining an idea, or other developments for particular situations and domains, for example new metaphors for interface design around mental health. We are interested in the potential for new metaphors to influence and support decision-making, behaviour change and new practices through enabling new forms of understanding, as an aid to help people explore their own and each other's thinking, and specifically to help people understand their relationships and agency with the systems around them. Practically, we are taking this forward with student projects where the goal is the design, and the New Metaphors method is simply part of the process of getting there.

Another direction is to apply the idea of generating new metaphors to bigger situations beyond design: to engage with reframing social,

political, or technological issues, involving stakeholders and domain experts from specialist policy and non-profit organisations, or even to use a variant of the method with teams or community groups as part of a co-design process, surfacing existing metaphors and mental imagery, and helping explore the possibilities of transitioning to different ones (Lockton and Candy, 2018).

Discussion: Enabling sharing and discussion of metaphors and imaginaries as a way to address change

Each of these three projects in some way concerns materialising abstract ideas (or at least making connections between an abstract idea and something more concrete): putting 'things' into the world that only previously existed in the mind's eye of participants, to explore and understand their role and presence, effects and effectiveness, in the 'real' world.

We believe there is potential to use these kinds of methods, suitably developed, to help people capture, express, share, and communicate the often unspoken qualitative dimensions of their experiences, to make them reified, palpable, to enable discussion or peer support, or even to facilitate group or team sensemaking. Even the process of surfacing assumptions could have value in many applications.

What are we changing, or aiming to change? As part of design for change, the aim would be that this work helps bring a different approach to programmes around behaviour change, whether related to health, environment, politics, social issues, or other areas. By seeking to understand people's understanding better, through design, we aim to contribute to design research, but also to offer design research methods as useful forms of inquiry for informing other academic disciplines—for example, the growing interest in 'inventive' methods in sociology (Boehner et al, 2012; Lupton, 2018). This could bring design research into new areas of application in domains which have hitherto only had limited engagement with 'design methods' as generators of knowledge. We are intrigued by the idea that designers could become valuable members of research teams in a wide variety of disciplines, using methods adapted from design research practice to address social, cultural, economic, environmental and political change far beyond design itself.

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Creative interventions in the juvenile justice system of India: A systemic inquiry

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Abstract
Reformation of children who have come in conflict with law happens through a traditional Judiciary system. This fairly neglected system deals with children of today, who will be contributing members of the society tomorrow. This is why reformation for the person who comes in the purview of the system is more essential than the action that brings him/her there. Keeping design at the centre of our research process we tried to study this system with a human centred approach trying to understand what drives the process of reformation inside for the children. Design, as a process, and drawing, as a tool, helped us break barriers in communication and expression with the children who have been in a closed institution during the important years of their learning lives. An important part of the study was to co-create for the system along with different individuals in the system. This approach helped to gain valuable insight into the system and also prevent actions and approaches that are unfavourable in this highly sensitive area. This study will attempt to define the method found to interact and co-create with individuals in a secure and confidential system. The study also explores the possibility to use gamification as an approach to problem solving. The exploration of reformation strategies has led to this conclusion and it is found that it promotes voluntary participation on behalf of the inmates.

Introduction
Reformation of children who come in conflict with the law has been happening through the Juvenile Justice System in India. This system which deals specifically with children remains neglected in the larger system of Judiciary. The children who come under the purview of this system get a chance to come out as contributing members of the society in the future.

Therefore, reformation is essential than the action that brings him/her there. Keeping design at the center of our research process we tried to study this system with a human centered approach trying to understand what drives the process of reformation inside for the children. Design, as a process, and drawing, as a tool, helped us break barriers in communication and expression with the children who have been in a closed institution during the important years of their lives. An important part of the study was to co-create for the system. This approach helped to gain valuable insight into the system and also prevent actions and approaches that are unfavourable in this highly sensitive area.

This study will attempt to define the method found to interact and co-create with individuals in a secure and confidential system. The study also explores the possibility to use gamification as an approach to problem solving. The exploration of reformation strategies has led to this conclusion and it is found that it promotes voluntary participation on behalf of the inmates.

Project introduction
Nelson Mandela once said, "When a man is denied the right to live the life he believes in, he has no choice but to become an outlaw." Children have impressionable minds and the perspective towards society may be shaped during the formative years. At such an impressionable age, it is very easy to take rash decisions and commit actions that are considered unfavourable in society.

Juvenile by definition is a child who, having not attained prescribed age, cannot be held solely liable for his criminal act. This means that when a person of young age commits a crime, it must be assumed that there are many other factors which caused him to commit the action that he is being held responsible for. Thus, if a child commits a crime, it reveals a larger tear in the fabric of society.

Close to 20,000 juveniles are reported to be committing crime in India itself, out of which, 7.2% are reported for repeated crimes. This number fluctuates yearly, due to the large number of unreported cases or cases that are not processed, so that the juvenile is not treated as a criminal for the rest of his/he life and gets another chance to be a responsible member of the society.

The study began with the purpose to find the most effective method of reformation for juvenile delinquents in India and later evolved into an understanding of the role of design and designers in the process of reform and rehabilitation. The attempt is to take the human centred practice of design, and apply it to a large scale social system.

India, a developing country, has only recently begun to understand the importance of design in the corporate world and thus, the practice has not yet been translated to the social sector. The findings of this study will also help determine the role of design in furthering the social cause.

The existing justice system for juveniles
The current Juvenile Justice System is governed by the Juvenile Justice Act, recently amended in 2015 (Figure 1). It handles juveniles alleged of crime and children in need of care and protection. When a child

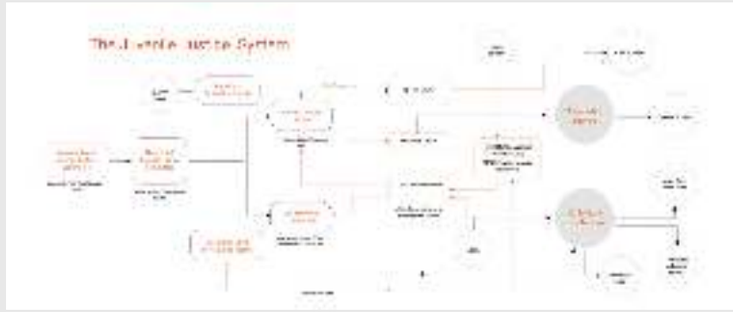

Figure 1. The current Juvenile Justice System

is alleged of a crime, he/she must be dealt with by a special part of the police force known as the Special Juvenile Police Unit (SJPU). A non-uniformed police officer not in possession of any weapons and trained to deal with juveniles should be present if a child is brought into custody. Following the recording of the case and through report by a Probation Officer, the child is presented before the Juvenile Justice Board (JJB), which is a committee comprising of the Judicial Magistrate and two social workers. The board reviews the case and comes to a judgement which is in the best interest of the child and the society; this may be in the form of a fine, probation period /social service or a term of stay in a registered observation home.

The new amendment to the act states that any juvenile, guilty of a heinous crime will be given a sentence equivalent to an adult committing the same crime. He will serve his sentence in two parts; in an observation home till he attains the age of 18 and beyond that in an adult prison.

The JJ Act defines a set of sixteen principles which have to be followed when dealing with juveniles. These principles make sure that the child is dealt a fair and just trial.

Children's homes

An observation home is a facility which houses incarcerated juvenile delinquents. These homes provide temporary stay for juveniles under trial or stay for juveniles who have been given a term of stay by the Juvenile Justice Board. The term of stay of a juvenile under trial must not exceed two months, and the term of stay of a convicted juvenile must not exceed three years. The observation homes provide food, shelter, education and occasionally vocational training to the juveniles, differing in quality from home to home. Special homes house children who have committed a serious act of crime and have been convicted. A place of safety houses the children who have committed an act of heinous crime and have been convicted. Place of safety could be an individual institution or it could also be a section inside the Special Homes. For the purpose of this study, observation homes and special homes are given a greater importance due to the environment and attempts to reform and educate the convicted juveniles.

The act specifies the correct way to deal with juveniles as being a 'child-friendly' method, where the juvenile does not feel threatened or coerced by the actions of any member of the system. Child-friendly environments are also specified in the act.

Reformation in India

Observation homes in India attempt to reform juveniles through education, vocational training and regular sessions with counsellors. Some successful methods of reform are seen in the adult prisons, examples of which are the Delhi prisons reform activities like Vipassana by Lieutenant Governor Kiran Bedi and Sabarmati Jail Interventions by the Prison Project.

Kiran Bedi, during her posting at Delhi Prisons as Inspector General, introduced several reforms to Tihar jail. These include meditation for the inmates, registered vocational courses, legal cells and even a de-addiction centre. This gained her acclaim and promoted the understanding of reformative activities in India, but the practice has yet not translated to the juvenile system.

The Prison project was an initiative driven by the National Institute of Design, India and Design Against Crime Research Centre, UK. The aim of the project was to improve the lives of inmates through creative interventions. The project introduced creative thinking to prison inmates, to exercise their minds and contribute to society. It was successful in turning Sabarmati prison into a creative hub, and improve the lives of the inmates through individual, innovative projects. The success of this approach inspired the approach of a gamified restorative approach. Gamification shows great promise in ensuring behavioural change, especially in children. While children may not respond to explicit instructions, a gamified experience allows for greater involvement and intrinsic learning. (10)

Methodology

Since the topic of study of this paper was highly sensitive and involved children, the methods commonly applied in Design Research which focus on understanding the user through shadowing, interviews, documentation, etc. couldn't be applied here. The research aimed to get a deep understanding of how the system functions and insights into how reformation happens inside the observation homes. As Design Researchers, we maintained focus on the people involved in the system and how the juveniles thrive in the process they go through Interviews with Stakeholders. The first phase involves meeting with stakeholders at different levels in the system and understanding their involvement, interaction with children and influence over the reforms taking place. Multiple individuals from various fields were interviewed so as to gain multiple perspectives and judge personal biases amongst individuals of different standings.

Fly on the wall observation

With thorough understanding of how the system functions by the law, the next phase was to look at interaction of stakeholders with juveniles on these levels in practice. This phase built a better understanding of how juvenile courts function, and the journey juvenile goes through once inside the observation home.

To understand the behaviour of juveniles, a study was conducted into the observation homes, by visiting several homes. The study had to be conducted keeping in mind the sensitivity of the topic and the information gathered. No documentation was conducted inside the homes, complying with security standards and anonymity of all the inmates. All photos and sketches were taken, ensuring no humans in the frame and with permission of the concerned authorities. Conversing with the juvenile also proved to be a limitation, as they were passively encouraged only to speak highly of the system. Only a few openly conversed in the presence of the guards. Permission to converse in the absence of guards, teachers or counsellors was not granted.

Participatory research

Since, direct interviews with juveniles regarding their perspective on reforms were not permitted due to safety concerns and restrictions, interaction with them was through curated gamified sessions. These sessions were conducted in 4 different Observation Homes across 2 states in India. These sessions aimed to understand their response to the reformation process, behaviour and aspirations.

Primary research - The stakeholders

The primary research started out in phases, familiarising with the stakeholders in the system and interacting with the juvenile children. These stakeholders helped identify some problems being faced at each level & how those could affect the process of reformation intended for the juveniles.

Police

Ms. Panna Momaya, an IPS officer and the Head of Women and Child Safety Department, helped to identify the working of the system and the measures taken by the officials to protect the children who come under the purview of the system. The officials who are trained to deal with juveniles are supposed to take special measures to protect the identity of the child and follow a strict protocol with respect to their behaviour, language and handling of them so as not to damage the person psychologically in the process.

JJB

Interaction with the Judicial Magistrate, who presides over the local Juvenile Justice Board (JJB) helped to understand some legal aspects of the proceedings and the parameters which decide the length of stay of the person in an Observation Home and the process of
Reformation he'll go through during that time period. As the juveniles are still minors, maximum preference is given to keep them with their family/guardians but in case of serious, heinous or multiple repeat offences they are liable to go through a reformation process in the Observation Homes.

Probation officers

A probation officer conducts an intensive investigation of the case of the juvenile. He re-evaluates the police report and conducts a detailed investigation to come up with a Social Investigation Report, which is a crucial factor based for the JJB hearing. Probation officers
have the task of looking at the family background of the juvenile, which is essential to figure out whether the child was under the influence of the family or someone in the locality. This often leads to identification of other factors influencing the decisions of the child.

NGOs

Even though the JJS is a well-guarded system, there are some Children's Homes which are working closely with NGOs to bring a more child-centred approach to the reformation process. The current system faces some challenges with staff availability, resources available,
individual attention for a thorough reformation, behaviour and attitude towards the juveniles, etc. The NGOs and organizations working with make sure some of these challenges are addressed and focus on the socio-emotional development of the child inside. They also act as feedback agents for the directed system and emphasize for a child-oriented reform over the system oriented one.

Research through design

Visits were made to 4 institutions in India, to understand the environment and overall atmosphere that the convicted juveniles are kept in.

- Observation Home, Khanpur, Ahmedabad, Gujrat
- Place of Safety, Mehsana, Gujarat
- David Sassoon Industrial School, Matunga, Mumbai, Maharashtra
- Umerkhadi Children's Home, Dongri, Mumbai, Maharashtra

The visits to the campus gave important insights into the infrastructure of the space, but not the childrens' perspective. Directly approaching the juveniles proved to be a challenge as asking questions, interviewing them and taking notes made them conscious of their situation and their words and actions were restricted.

Participatory approach

A new approach needed to be developed to approach the children in a way where they would be comfortable. Gamifying the whole process helped to keep the children engaged in the process as well as express themselves well beyond hesitation and language barriers. To go forward a set of games and activities was devised, inspired from ice breakers and kindergarten activities (Figure 2).

The activities were as such, in this particular order:

Task 1	Arranging yourselves by Age: It was done to start a conversation among the children and for us understand the age group.
Task 2	Draw your partners portrait: To connect to other children and for us to gauge their skills and interest.
Task 3	Draw your Hobby: To make them think about themselves and for us to grasp their personality and background.
Task 4	Group according to similar hobbies: To see internal dynamics and see what common pattern emerges.
Task 5	List 5 things in common within the group formed: To see how well they know each other and initiate consensus building.
Task 6	Two truth and a lie: To make them think consciously about themselves
Task 7	New skill I want to learn: To build aspiration and see possible intervention
Task 8	New thing I learned in observation home: To see inmate-staff relation and peer to peer relation.
Task 9	One thing liked about the place: Adjustment in place and outlook towards the system
Task 10	What to do next: Interest level in activities.

Figure 2. Children's sketches

The activities were conducted in three of the Observation Homes, Mehsana, Matunga and Dongri. All the boys who were interacted with were Children in Conflict with the Law within the age group of 14-21 years with 1-2 cases of above 21 in Mehsana, Place of Safety. Only in Dongri we had a chance to interact with girls who were mostly Children in Need of Care and Protection with 3 cases of convicted juveniles. Through the activities, we were able to come up with some observations. Please note that any and all identities and personal information divulged has been omitted for security reasons.

Case Study 1: Mehsana Observation Home and Place of Safety

Mehsana Observation home for boys has both observation home and a Place of safety. It has about 50 children in conflict with law (CCL) within the age group of 16-21. The Place of safety is for children convicted for heinous crimes. The children convicted for these crimes are supposed to be kept separate and given special attention for reform.

- Children showed enthusiasm for all the activities
- Some children were hesitant and refused to participate in each group.
- Interest in sports, music and dance was seen commonly across groups.
- The groups were amicable as a whole.
- There was a willingness to learn new skills to beat boredom and preferred over classes which students didn't attend largely.

During the visit, mention of a student at Mehsana came up as he was a talented artist and the Home and officials worked to promote his talent. This provided us with a solid example of how redirection of energy and talents could help in the child flourishing even in the hardest conditions.

Case Study 2: David Sassoon Industrial School

The David Sassoon Industrial School is a certified Special Home. It is a formal education and a vocational training centre with a focus on character development of children there and reformation of juvenile delinquents. The sanctioned vacancy of the home is 400 boys (200 Children in Conflict with Law and 200 Children in Need of Care and Protection) between the age group of 12 to 18 years of age.

- Children were slightly hesitant to draw initially but as they were grouped, there was a stronger collective sense of initiative to finish first and better.
- Quick, prompt response to tasks given was seen.
- Interest in sports like cricket, volleyball and dancing was common across the group.
- Children were more enthusiastic and outspoken.

Case Study 3: Dongri children's home

The home at Dongri is children's home and observation home; meaning that it houses both children in conflict with law and in need of care and protection. One of the biggest observation homes in Asia, the Umerkhadi home currently houses about 230 children in need of care and protection; 150 boys and 80 girls; and about 60 children in conflict in law; about 3 - 4 of which are girls.

In Dongri, we conducted separate sessions with the boys and girls as the sections were divided.

Girl's Section

- Girls drew more detailed sketches rich with patterns and information
- The girls were open and eager to learn any activity that we could teach them
- The girls showed most enthusiasm in jewelry and zari making.
- The girls while performing the tasks pushed to do it on their own terms over the instructions given. There were traces of groupism in the overall conduct

Boy's Section

- The boys often ended up copying the given tasks from each other
- There was evident groupism, there were juveniles who were dominating other kids
- The language barrier was exploited by the students and made fun of each other
- The juveniles were keen on learning "cool" things, like bike riding and tattoo art

Reflection and analysis

Though there were different observations noted for each place that we visited, this study helped us see some common trends across places with respect to the behaviour of children, their interest, interaction with peers inside and the kind of things that troubled them.

One of the most evident things that came across was that the children inside were more inclined to learn life skills than education in formal sense. The children who stayed inside these observation homes were from varied age-groups, regions and languages. For most children, earning a living was higher in priority that getting a formal education. Sitting in a class and not connecting to the content made it difficult for them to pursue it with interest.

Since they spent most of their time in a closed campus, many showed great interest in some sort of physical activity. To keep the children safe inside they are not allowed access to almost anything that could be harmful. Learning dance, exercising and sports were among the few things everyone had in common inside and created a common ground for breaking the ice with each other.

The period of isolation from society gives them time to reflect on the actions but the lack of facilities, resources for aiding the further process of reformation puts them in a very vulnerable spot inside.

- There was a lack of communication among peers as well as staff and the children
- There was a lack of system in place which could keep teenagers engaged and motivated during the period they were inside
- There is a need for positive reinforcement

Limitations

Lack of documentation in any form of the interactions inside the premise of Observation Homes was necessary to protect the identity of children.
The Juvenile Justice system in India is not a well-researched theme in the design community.
Convincing the guards and officials in the system of the possibility of design interventions proved to be a difficult task due to a lack of precedents of projects.

Application - Restorative justice

Restorative Justice is focused on rehabilitation of offenders through reconciliation with the victim or community. This approach of bringing justice brings to table the damage caused because of the act of crime, the accountability of the action for the offender and way forward for better reform. The approach focuses on reformation of the person to restore them as a contributing member of the society. Restorative justice is also applicable to offenders who have already been convicted. It seeks to understand the circumstances around the person and triggers that lead to the act of crime and thus applying that in the reformation and eventual re-integration of the person in the society.

One of the most effective ways of addressing restorative justice is through restorative circles. A restorative circle brings together the three parties to a conflict – those who have acted, those directly impacted and the wider community – within an intentional systemic context, to dialogue as equals. The restorative circles practised here in the observation home opens discussion among the kids. Due to the complicated and varied social structure of our society, a lot of children who are inside the observation homes have been normalised to things, actions and thinking which isn't considered okay by the larger society. There is a difference in understanding of right and wrong. Restorative circles aims to open up this discussion and make them see things from different perspectives, bringing to the table the full picture. It aims to instill a sense of empathy, socio-emotional learning among the children and work on how to control, express emotions.

Gamifying Restorative Circle

A very important part of restorative justice is active participation by the juveniles who are part of the process. Unwilling participation of the individuals involved was observed during the visits to the juvenile homes. Repeated questions from guards and teachers saw signs of disinterest such as; talking back, hesitation to answering questions, sarcastic or demeaning comebacks and unwillingness to answer. This derails counselling sessions and fails to provide preferable results in change in behaviour of the children.

Another challenge that was seen to bring the concept of restorative circles to observation homes was a lack of trained facilitator to conduct one. The facilitator needs to be well versed in the method of conducting a restorative circle and also be able to handle any difficult situations that may arise while the circle is in session. It certainly may be difficult to train people to conduct circles, to learn the kind of empathy required to handle troubled children and listen to their problems without judgement. What is much harder is to convince people to put in the time and effort required to conduct a restorative circle. Since the effects of a restorative circle are not immediately seen, officials do not see the benefits of the process. Thus the conclusion was reached that the juveniles needed to be the initiators and conductors of the circle themselves.

One of the most compelling methods is 'gamification'. Gamification is the method of applying aspects of games; like competition, point scoring and rules of play; to non-related tasks. This is done so as to improve productivity, or in online marketing as a strategy to ensure participation. It uses the pretext of achievement and rewards to encourage the participant.

Figure 3.
Gamification prototypes

An attempt to use gamification to ensure preferable results in a prison setting is seen in a project by the students of Central St Martins, UK (Figure 3). The game is loosely based on Monopoly and provides a safe space for prison inmates to interact with their children who they have not interacted with during their stay in prison. The game helps the children to let down their walls and interact with their estranged and imprisoned parents. Successful tests of the game in the London Prison show how the element of enjoyment and gratification can help the participants to be genuine in their gameplay.

Figure 4.
ResQ

The game, with slight modifications was tested in the Khanpur observation home at Ahmedabad (Figure 4). Further test plays were conducted on students of NID, who were not otherwise part of the project.

ResQ

ResQ attempts to provide counsellors, inexperienced in the method of conducting a restorative circle, a way to conduct a restorative circle, and children to be able to sustain the practice on their own without the need of a facilitator.

As in a detention restorative circle, each game is based on a certain topic and the aim of the game is to discuss the topic, the severity of the issue and methods to resolve it. In the game, the board holds the counters of the players and dictates depending on the color of the piece on which the counter lands what card the child gets. It helps maintain the narrative from activities to reflection and not vice versa.

The game consists of a board with path made of 3 colors referring to the color cards – blue, orange, red and boxes noted for cards to be placed

- Cards: Blue are the activity cards, orange are the question cards and red are the resolution cards. Also there are theme cards to start off the game
- Counters representing the player
- Talking stick
- Points: 2 for participation, 1 for answering your turn

On the board, first half of the circle ring had mostly activity card colours in the tiles, the middle part had question card colours and the last part had resolution card colours. The child has to pick up the colour of card of the colour of the tile on which he had landed and complete the task associated with it or answer the question associated with it. On completion, there will be an evaluation done by all the players, if everyone agrees that it was a good attempt, he would get a token worth 1 point.

Participation is encouraged in the game to bring new perspectives to the table. If he offers to do the task on somebody else's card or with somebody else, he would get participation token of 2 points. Participation coins ensure attention and participation from other interested players. To make sure everyone gets a chance to talk, a talking stick is introduced. Anyone who holds the stick talks and those who wish to contribute ask for the talking stick. At the end the child with the most amounts of points would win.

Conclusions

When the game was introduced to the juvenile home, it garnered a mixed response. Even though the game mechanics were resolved, it took some time to get the gameplay established. Just like any other game a sense of competition took over soon, and the biggest challenge was to make the children curate the content of the conversations.

Once the game was in motion active participation was seen in all the tasks involving physical activities. All the questions made children to open up about a certain topic that's when the main improvement was seen. Especially for children who had recently joined the juvenile home, it not only made them open about what they felt, but also helped create a bond with the other children as they could relate to the emotions. During these conversations the children showed regret over their actions and the consequences of their parents were facing.

The officials also showed interest in being part of the game, and promote conversation. While this was an emotional and thoughtful journey for the children playing, it gave the officials insights to change or improve the action plan for the child's reformation. The balance of the fun playful activities and serious nudges was much appreciated by the officials and the children.

The game is a design practice which provides:

- Possibility of a safe space: Where children can express themselves without the fear of being judged or noted
- Story telling: Encouragement of sharing personal experiences and providing them with a platform to express
- Conversation: Encouragement to add on others view and stories
- Look ahead: Rationally looking at their past and being able to see a better future for them ahead
- Understanding social evils: Understanding cause and effect of social vices and how to possibly tackle them. Giving a clear definition of right and wrong
- Relationship building: Building a conducive environment to understand each other
- Building consensus: Voicing their opinions and build a consensus on each topic they encounter in the game
- Positive thoughts: Nudging the children towards positive thinking where they are able to see a better future for themselves
- Restorative thinking: Nudges to make them able to reflect more on their own behaviour
- Empathy: Giving them a chance to explore multiple points of view
- A laugh: Last but not least, the game doesn't compromise on having light-hearted activities at each turn to keep it enjoyable and dynamic

The outcome of this project is a board game, currently given to put in practice at the Dongri observation home and the Khanpur observation home. Regular feedback from the officials and teachers at the homes will determine the further improvements and steps to be taken to improve the success of the game.

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Material design innovation: Fish leather, a new environmentally-friendly material

Elisa Palomino and Gustavo Adrian Defeo

Abstract

This paper explores the material design innovation process during a cross-disciplinary project working with fish leather. The Fishskinlab project aims to generate a deeper understanding of fish leather as an alternative to conventional leather to encourage more sustainable fashion practices. The objective is to create aesthetically relevant fish leather products that illuminate sustainability thinking as a driver for innovation. The project looks at the strategies implemented by practice in the field of material design innovation fed by new technologies, addressing changes in interactions between humans and with our environments.

The research draws on findings gathered through a partnership between the researcher, the Icelandic tannery Atlantic Leather and the Italian analytical laboratory Ars Tinctoria connecting fashion designers, scientists and leather technicians from the UK, Italy, and Iceland to advance material innovation by using new technology (water-based ink digital printing methods) on fish leather. This led to the development of a collection of digitally printed fish leather bags.

The skins were sourced at Atlantic leather, the researcher developed the prints and followed the technical process while the digital printing was produced and tested at the Italian analytical laboratory Ars Tinctoria.
This paper presents the journey of the mapping process, illustrating the key stages of the research, which led to the discovery of new material properties and finishes applying digital printing processes to a food industry by-product material such fish leather.

The methods and practices of the project included dynamic interaction between the researchers facilitated through the cooperative framework of the project. The feedback of the work presented during Brussels Industry days and Milano Design week offered the researcher an information flow that influenced the development of the final prototypes and the ultimate presentation of process and outcomes.
The findings identify that new materials, processes, and techniques are often the result of the successful union of fashion and technology to help drive the industry towards a more sustainable future.

Introduction

The project explores existing traditional knowledge of fish skin processes and applies the analysis of this learning using state-of-the-art practices and developing new technologies while addressing specific challenges of the use of fish leather for the fashion industry. The research maps best practice and knowledge transfer of water-based ink digital printing technologies for fish leather.

The research has brought together sustainable methods from fashion design, material science, and analytical chemistry to foster international knowledge exchange that will develop the capacity for research and practice in these fields.

This design research is about innovation, design, and sustainability paving the way for the future of fashion by using unique leftover materials such as fish skins while illustrating shifts in material values and resources.

The paper is divided into seven parts. The first part covers an introduction to the project and main objectives. The second part examines the historical context of fish leather. The thrid part covers the environmental context. The fourth part describes the methodology used. The fifth part develops the design research through practice: the Fishskinlab research case study. The sixth part explores the digital printing methods used and chemical tests done. The final part describes the findings and conclusions.

Figure 1. Atlantic leather fish skin tannery. Picture by Nathalie Malric (2018)

Historical context

The use of fish skin for clothing is an ancient tradition in Arctic societies along rivers and coasts and there is evidence of fish skin leather production in Scandinavia, Alaska, Japan, northeast China and Siberia. Before synthetic fibres were invented, people clothed themselves with natural materials available in the surroundings where they lived, including fish skin (Jiao, 2012).

People in the Arctic coastal regions sourced their materials from animals that were necessary for their survival, such as salmon and they used their skins for clothing and accessories (Hatt, 1969).

The shortage of raw materials and omnipresence of modernity have challenged the preservation of the fish skin craft (Lin, 2007). Better access to the modern world meant that Arctic people were able to

access textiles like cotton and silk to create their clothing, leaving fewer people to develop the traditional fish skin craft. Overfishing and water pollution have caused fish stocks to drop and many Arctic aboriginals have turned to farming to make a living, abandoning their fish skin skills (Lin, 2007).

The use of fish skin by aboriginal Arctic people has recently been assimilated as an innovative sustainable material for fashion due to their low environmental impact.

The Atlantic Leather tannery, located on the north coast of Iceland, has been one of the main agents in the renaissance of the fish skin craft. Processing fish leather since 1994, based on the ancient Icelandic tradition of making shoes from the skins of wolfish (Figure 2). The tannery has brought this historic eco-luxury material back into fashion, simultaneously reviving ancestral tanning techniques and providing jobs for the local community (Figure 1). Their fish leather is a by-product of the fishing industry, exploiting fish not bred specifically for their skin, that would otherwise be discarded. All the fish skin used by Atlantic Leather is sourced from sustainably-managed farms in the Nordic countries (Figure 3). Special attention is given to the new technologies used on their fish skin production and to address challenges such as energy, environment and climate change. The entire process of producing fish skin at Atlantic Leather relies on the power of nature using geothermal water and is non-impactful on the environment. The manufacturing of fish skin leather works with three aspects of sustainability: the economic benefit of creating value from waste; the social benefit of reconciling sustainability with fashionably exotic fish skin; and the environmental benefit of producing skins without damaging endangering animals. Atlantic leather is the winner of the "Tannery of the Year Europe Territory 2016" award, taking in consideration how the tanning process

Figure 2. Icelandic traditional shoes made of wolffish skin (right). Picture by Nathalie Malric (2018)

was executed, how the staff was treated, the factory's surroundings and how the small community around the factory is benefiting from it.

Environmental context

The fashion industry is currently going through a significant change in its approach towards sustainability and luxury brands need to think about the natural resources they rely on and come up with innovation on alternative sustainable materials and processes. Fashion needs to invest in technologies able to reduce environmental impact to enhance the materials and create products that respect the environment (Pavione, E. et al.2016)

FishSkinLab research concentrates on promoting a new category of raw material for fashion: fish leather. Fish skins are sourced from the food industry, using what is now considered waste, applying the principle of circular economy, combining research and innovation to enhance the well-being of the earth and its people through the entire life cycle of the product.

Global production of fish has steadily increased over the last decade and more than 50% of the total fish capture remaining material results in 32 million tonnes of waste. (Arvanito, Kassaveti, 2008). While to date, the European Environment Protection agency allows seafood processors to dispose of fish skins in marine waters, this is expected to change as the decomposing organic waste can suck up available oxygen from marine species and introduces disease to the local ecosystem. (EPA, 2012).

Figure 3. Salmon fish skins through the tanning process. Picture by Nathalie Malric (2018)

The processing of fish leather avoids throwing the fish skins into the ocean and can significantly reduce marine pollution and sustainably protect marine ecosystems in order to achieve healthy and productive oceans. Consequently, the promotion of fish leather could be of great environmental benefit as well as profit for the coastal economy.

The use of alternative materials such fish leather has the potential not only to serve to our material needs but also reduce resource consumption of other over exploited materials such conventional leather and it could lead to more locally sensitive production, more regional sourced materials and more local jobs (Fletcher, 2014).
By growing, sourcing and processing raw materials close to home shortens transport routes, lowers carbon footprint and increases transparency across the supply chain. By using local industry waste such as fish skin, nearshoring material production can provide exciting opportunities for the community whilst minimising environmental impact, both locally and globally (Banathy, 1996).

Fish leather being recoverd as waste, requires limited resources from the sourcing of the raw material leaving a lower carbon footprint than the one associated with raising cattle. Fish leather requires no extra land, water, fertilisers or pesticides to be produced and it has a lower environmental impact than conventional leather (Jacobs, 2018).

In luxury fashion, innovation, new materials and traceability are critical. Many luxury brands are actively researching into new materials to make sure the next product is better than the previous one. Luxury fashion brands in the future will be forced to view sustainability as a business imperative; sustainability, in fact, represents innovation and generates competitiveness in the global luxury marketplace (Pavione, E. et al.2016). Any luxury brand which understand these issues and uses fish leather will be regarded at the forefront of the developing innovative market.

According to Williams, new conversations about the materials that we choose, the products that we make, and the ways in which we work as designers can be responsive and make a positive contribution to the world around us as the premise of all good design. (Williams, 2013)
This research draws on the field of Design for Sustainability with scholars such as Stuart Walker drawing attention to design as a process of re-consideration of the present as part of the creation of shared futures (Walker,2016). Walker has suggested that when people begin to appreciate the level of skill and the massive investment of time involved in making a piece, it is valued more highly. High fashion conundrum valuing handmade products versus low end disposable fashion are also part of the fish leather discussion. The highly qualified skills necessary to produce fish leather makes it a unique luxury material for fashion.

Methodology

A preliminary round of research was conducted to understand the status of the field in terms of research coverage and gaps, and towards a better definition of the research objectives and their scope. The analysis covered studies on historical and contemporary use of fish skin, sustainability aspects and alternative digital printing methods.

Figure 4. Fishskinlab project: Wisteria digital printed fish skin clutch by Elisa Palomino. Photo by Giacomo Iezzi (2019)

The research looked into demonstrating the contemporary relevance of fish leather as a new sustainable material identifying fish skin's positive ecological impact and its potential for application in fashion. The methods included prefiguring avenues and sketching strategies for developing new printing techniques for fish leather within the fashion luxury industry.

The methodology of this research identifies risk-taking and co-experimentation of materials as essential strategies as the key stages of the research process: Mapping new terrain of sustainable materials, fish leather material investigation, public feedback and critical evaluation. This paper presents a journey of the process, illustrating the key stages of the research.

Observational and participatory methods were utilised to obtain data. This involved talking to the general public during the presentation of the project at Brussels Industry days and Milano Design week. Feedback from the general public during the design fairs supported the progression of the project applying design thinking to the journey.
The key findings from the general feedback verified that the public would be likely to buy fish leather items as an alternative material for fashion.The information influenced the development of the final fish leather prototypes and the ultimate presentation of process and outcomes.

Design research through practice: Fishskinlab research case study

Leather remains a vital material for most luxury fashion houses, even more so when it is an exotic skin. Thanks to the use of new technologies, the luxury industry offers a vast array of appearances and finishes among conventional leather, while both the use and creative development of

fish leather has been largely neglected. The aim of this design research is to pilot and develop non-polluting technologies for fish leather finishes to advance the development of future manufactured fish leather products. The results can bring a fresh look at how fish leather development with new technologies can underpin and reshape luxury fashion accessories.

This research draws on the researcher Elisa Palomino's experience working in the fashion luxury industry back in 2002, designing for John Galliano fish leather garments and accessories sourced at Atlantic leather. The researcher has experience running network projects linked with fish skin (e.g. EU Horizon 2020-MSCA-RISE Marie Sklodowska Curie: Fish Skin a Sustainable Raw Material; and she is the recipient of the UK-US Fulbright Scholar Award: 'Arctic Fishskin clothing traditions' at the Smithsonian Institute)

In 2018, the author collaborated with Atlantic Leather in the development of 'Fishskinlab', a Worth Partnership Project, funded by the European Commission, EASME, under (COSME 2014-2020) with access to financial funding, market exposure and mentoring to produce a collection of bags made of fish leather developing new embellishments and eco-friendly digital printing which has informed this practice-based research.

Phase 1
With her knowledge on textile and leather printing the main aim for the researcher was to see how fish leather would be transformed under digital printing, compared with the relatively well-known process of textile and leather digital printing. The first round of tests, as seen in Figure 7, resulted in findings that the water-based inks did not adhere easily to the fish leather when the designs had full coverage.

Phase 2
The first review of the digital printed tests identified the need to expand the selection of designs to include designs with less coverage (Figure 8) that could withstand the even coverage and produce new results. As the author became more specific in her design choices and experiment with a number of design combinations the final results were very successful.

Phase 3
Prototypes of small bags were created with the print samples to exemplify the materiality of fish leather for luxury fashion accessories.

Phase 4
The author decided that, in order to gain feedback on the project, it would be advantageous to build in a participatory knowledge exchange. In 2019 the Fishskinlab project took part in Milano Design week and EU Industry Days in Brussels (Figure 6) under the theme of industry

and sustainability. Both exhibitions provided an excellent opportunity to engage with a diverse audience representing a variety of industrial sectors from all over Europe. A key element of the participation on the Brussels Industry days was to facilitate a venue that could inspire consumers and EU policy makers to engage with materials through closed-loop thinking, to share their ideas with the designer and to obtain additional professional feedback. The aim of the participation was to push the boundaries of material design practice to identify how it can be used as a tool for citizen engagement, for both: the designer, and the public who wished to engage with the product to identify opportunities to improve both its environmental and social impacts.

The feedback outlined the successful elements of the project, the value of sustainability and use of waste materials and highlighted the qualities that a waste approach can bring to accessories design.

The element that emerged was the close link created between the sustainable approach and innovation. The public was surprised of how something that is considered waste in many countries is given a much higher value through the action of design. Seduced by its beauty, the public was aware of the material being the skin of a fish and inspired about the value of everyday materials. The high visual standards of the final product fits with luxury fashion and becomes a benchmark for redefining the beauty of sustainability. (Figure 5) The project is a fine example of an innovative way of linking the preservation of traditional knowledge and culture and the development of relevant fashion items taking in consideration the sustainable limits of the planet's natural resources.

Fish leather digital printing

The researcher is an expert in the field of textile design, familiar with digital and analogue printing methods but there are no previous attempts known to the researcher to print fish leather. There are different methods that could be used: silk screen printing and digital print.
Textile digital printing emerged in the 1990s as a prototyping tool and a vehicle for printing small batches of fabric for niche-market products (Provost, 1994). Inkjet printing involves the propelling of tiny droplets of dye or pigment onto a fabric electrostatically. The selected dyes or pigments are dosed on demand and avoid print paste residues at the end of each run and if pigmented inks are used (rather than those based on dyes) no solvent which associated volatile organic compound emissions is required to dissolve the colourant. (Fletcher, 2013) Recent decades have seen the growing popularity of preparing water-based ink-jet inks for textile printing.

Water-based ink-jet inks for digital textile printing were used on fish leather for this project. Fish leather printing can be difficult since ink generally does not bond well to a non-uniform, organic, complex substrate. The non-uniformity and surface roughness of the fish scales

Figure 6. Fishskinlab project: Pagoda digital printed fish skin clutch by Elisa Palomino. Banner for the Brussels EU Industry days. Photo by Giacomo Iezzi (2019)

was one of the main obstacles during the process. (See Figure 7). The significant variation on a single fish skin as well as between skins of a batch was also a challenge. Techniques for printing on fish leather may suppress at least one usual property of fish leather, e.g. appearance, feel and/or absorption. Printing onto the surface of fish leather could be disadvantageous if the ink is weakly bonded and it could be easily removed during normal wear and tear, or if the print cracks when flexed. (Pantelis, 2013)

During the test phase, the printing of fish leather included the application of an ink base coat directly onto the surface of the fish leather. The experiments show that a selected combination of pressure and temperature is required. Success was achieved when the transfer of ink into the fish leather occurred across the leather sample with good penetration (See Figure 8). In unsuccessful tests, the transfer of ink into the leather had a non-uniform penetration (See Figure 7). The digital printing was produced and tested at the Italian analytical laboratory Ars Tinctoria.

They are specialised in colour, light and organic analytical research. Based in Santa Croce sull'Arno, heart of the Italian Leather production cluster, the laboratory is equipped with the latest generation instruments and is active in several fields, including synthesis, analytical research and the study of molecular structures of dyes, the search for hazardous substances, and measurement and standardization of colour and light. Gustavo Adrián Defeo, its CEO is an industrial chemist, active in the leather field since 1985 with multinational chemistry groups with expertise in dyes kinetics, psychophysics, colour perception, light and colour measurement, industrial waste recycling, ecology and analytical methods for the leather sector.

The physical and rheological properties of the inks were measured for the evaluation of ink stability and suitability for ink-jet printing. The tests were found to be suitable. The prints were subjected to light and rub fastness tests and colour measurements. Colour consistency and fastness results, especially after fixation, are comparable with those on conventional leather, which paves the way for the production of environmentally friendly water-based ink-jet inks for the digital printing of fish leather.

Figure 7. Non uniform penetration of ink on the Pagoda digital print sample.

Figure 8. Good penetration of ink on the Wisteria digital print sample.

Fastness properties of wisteria digital printing

Fastness properties were analysed following updated ISO standards.

Figure 9. Migration into polymeric materials

ISO 15701:2015 (IULTCS/IUF 442) Leather - Colour fastness to migration into polymeric material (for this test migration was tested on standard PVC layers: This test helps to understand if there will be potential colour migration into plastic materials, and eventual stain of polymeric finishings applied, by contact with neighbouring materials.
Results obtained which can be observed on Figure 9 were excellent (rate 4,5 /5 on grey scale, where the value 5 represents the highest standard). Such a result allows combining the print obtained with any other neighbouring material without risk of stains.

ISO 11641:2012 (IULTCS/IUF 426) Leather - Colour fastness to perspiration (on multifibre): This test was developed to understand eventual colour fading or migration into different textile fibres with artificial acidic perspiration (Figure 10). A multifibre fabric composed, from the top, of Acetate, Cotton, Polyester, Acrylic and Wool was used in this test.

A part of a light stain on Acetate (rated 4/5), all fibre types showed excellent performance. Also in this case staining was rated against grey scale where perfect values are represented by rate 5.

The final test was ISO 105-B02:2013 Textiles - Tests for colour fastness - Part B02: Colour fastness to artificial light: Xenon arc fading lamp test: This test emulates weathering of a colour sample by exposition to natural solar light. In this case samples' colour fading is rated against a blue scale on fabrics representing the values 1 to 8, where rate 8 is the highest standard. The light fastness obtained (Figure 11) is > 6, which is an excellent result considering the naturality of the finishing.

Chemical tests

Wisteria printing on Salmon leather was analysed to verify the eventual presence of Substances of Very High Concern (SVHC) after European REACh protocols.

Figure 10. Colour fastness to perspiration

Figure 11. Xenon arc fading lamp test

Results shown the absence of any substance of concern, such as Aromatic amines derived from Azo dyestuffs, Hexavalent Chrome (Cr VI), Reach Annex XIV and Annex XVII listed Phthalates, Alkyl phenol and Alkyl phenol ethoxylates, Free formaldehyde and Chlorophenols.

Conclusions

This paper portrays the journey of a collaborative research project between the authors Elisa Palomino, designer, educator and researcher at BA Fashion Print at Central Saint Martins and Gustavo Adrian Defeo, industrial chemist CEO at Ars Tinctoria. The project started as an open-ended research investigation combining design with science and technology exploring fish leather material testing in the hope to develop new finishes and techniques.

Material research has rapidly expanded into a more interdisciplinary practice and designers need to broaden the disciplines in which the methods and concepts of sustainable materials are taken as a vehicle for new collaborative ways of making. This paper suggests methods and processes to invite more sustainable material research and investigates how knowledge about materials can be integrated and communicated within the framework of research.

Current research is now looking into the development of low environmental impact processes to offer new sustainable production methods for the fashion industry. More than ever before the task of design is to articulate the right directions in material development to move towards more sustainable choices.

Understanding materials, production processes, viability, and desirability are key to the fashion industry. New materials and techniques are often the result of the successful union of fashion and technology to help drive the industry real change in terms of sustainability.

The Fishskinlab project was designed to experiment with new techniques, generate a deeper understanding of the fish leather processes and open up further opportunities for research with other disciplines.

This project wants to bring more attention to urgent international matters such as sustainability in the leather industry by using nature-given resources and upcycling leftovers from the food industry. The paper reflects ethical values linked to research on sustainability and renewable sources, destined to become the driving force for the future of high-quality fashion.

The paper outlines an investigation between design and chemistry and the space in between them.

The potential use of water-based ink jet printing for the production of environmentally friendly fish leather prints was investigated. The results were excellent, and this paves the way to challenge more manufactories to sustainable and innovative visions in existing production processes. We were able to measure challenges and possibilities of a design framework based on sustainability values.

The project has enhanced the creativity and innovation in the UK and Italy's leather sector, building stronger connections between the researchers and creating opportunities for future exchange. The fashion creative industries are critical to industrial and commercial success in the UK and Italy. This Anglo-Italo-Icelandic network has blended the skills of Italian leather technology and their passion to create high-quality products with Icelandic sustainable technology and British cutting-edge sustainable design.

The project will have an economic impact by putting fish skin leather on a new level of excellence capable of conquering new markets globally. By bringing the field of fashion design from Arts and Humanities in contact with Science and Technology, this project has the potential to bring benefits to a wide range of subject areas. It will encourage the joint development of scholarship and collaboration across these disciplines, and it will support the cross-referencing of methods to advance scientific and artistic knowledge of fish leather as a more sustainable alternative to conventional leather.

The outcomes of this project will enable an informed discourse on sustainable thinking for creative practitioners, fashion designers, fashion students, leather manufacturers of luxury goods and retailers across a broad contemporary landscape.

The research developed in this project will benefit scientists coming from a polymer and chemical backgrounds from the research know-how in transforming fish skin, a biological residue, into fish leather – a workable raw material. Chemical scientist at the tanneries will benefit from the transferring of the bio-digital printing results and technology. Practice-based academics from fashion higher education and fashion designers will benefit from the new possibilities for visual and physical attributes for fish leather for the purpose of creating a rich library of effects relevant for the fashion industry.

From a research perspective, this project has enabled the work of the researcher as Fashion Print pathway leader at UAL, to inform future design for sustainability practices in industry and education.

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Wearing your recovery: 3.0

Laura Salisbury, Chris McGinley and Rama Gheerawo

Abstract

People frequently use clothing to highlight, erase, identify and even 'correct' parts of their bodies, using clothing as a means of slimming, sculpting or shaping. What are the implications of this phenomena when our bodies do not function as they might have previously done? This paper asks how garments can build on their inherent qualities that impact behaviour, mood and function of the body, to question and position the role clothing might play on some of the major issues with upper limb stroke rehabilitation to date; specifically motor training of the upper limb.

When stroke disrupts the ability to use our finer motor control within our hands, activities of daily life (ADLs) that enable us to live our lives and frequently participate in become affected. Clinicians are acknowledging the importance of self-administered care saying 'it's not what happens when we are there, but what happens when we are not there [that is crucial]' (Kings 2017). Yet patients are having trouble self-administering rehabilitation, often having to prioritize training over other aspects of their life which can affect mood. It is the position of the authors that quality of life should not be reduced in order to get 'better', especially when recovery can take many months or even years.

Introduction

Using a materials approach in research through design as a particular way of thinking (Frayling 2015) and by thinking through the making process (Ingold 2017), 'Wearing Your Recovery' presents a response to work conducted concrescently and directly with stroke survivors and 'care-givers' to offer a post-critique of the implications and opportunities of using textiles as platforms for care.

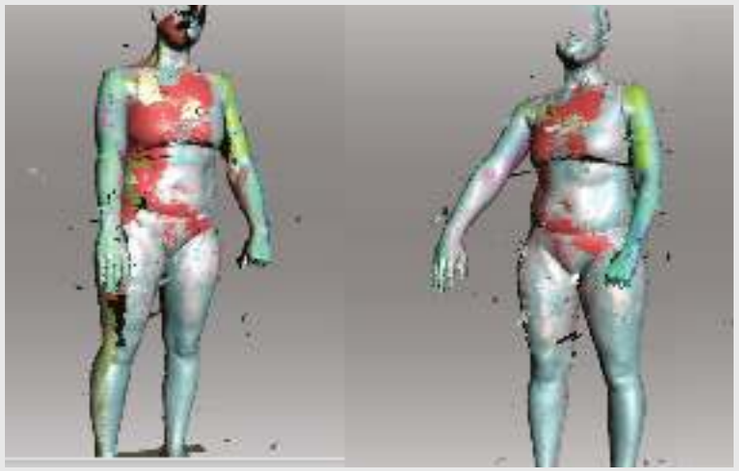

Figure 1. 'Under Development': Visualising the body post stroke: Body Scans; RCA.

Samples in this paper unpack the moments of 'thinking through making' and examine the difference between the role of the 'care-provider' and the use of objects as 'platforms for care'. Methods of visualising the post stroke body span from the use of garments to embody experience and behaviour, to the use of body scanning (Figure 1) in order to meticulously analyse the differential behaviours between the affected and unaffected limb, and that of the garment. By envisaging textiles as a route to achieve a 'second skin' that works in parallel with us, the internal body becomes extended beyond inherited forms and moves into that of another non-typical form, thus disrupting the course of recovery.

Garments are both functional and expressive objects which hold the ability to move with and be in direct contact with the human body throughout prolonged periods of the day and night. When considered in relation to needs for motor training, which Wade identifies as needing to increase in intensity by 240% (2017) in order to meet guidelines set out by the Royal College of Physicians (2016), garments provide incredible opportunities to support developments in stroke rehabilitation. On one level, an opportunity arises if we think in terms of frequency and consistency of performing physiotherapy, opening up alternative methods to do this, such as with guidance (via the textile) within public contexts. Yet further qualities of the garment, including its tactility are considered within this paper, which become useful when we consider how learning, behavior and thus re-wiring, or 'recovery' occurs post stroke. The multi-sensory role of the textile in these contexts are considered, along with the implications of the garment occupying this space.

This research questions how design can extend support to deliver the needs identified in stroke literature and clinical guidelines, and further consider the extended emotional needs, through the considered implications of use of types of tools and approaches within the highly diverse lifestyles of individuals who have suffered a stroke. A number of insights gained from phase 1 of the ongoing research are included, developing a conversation as to whether rehabilitation is a pursuit for all or whether there comes a time when individuals choose to no longer participate. Why is this? And what could the re-positioning and re-thinking of methods of rehabilitation do to become more inclusive to a diverse audience, through understanding emotional needs and purposes in life. To unpack this, garments were used as design tools within workshops conducted over a one-year period (Figure 2).

Within the following paper garments are used both as a tool for understanding experience, identity, behaviours and emotions of stroke survivors, support workers and clinicians as a research method. Additionally this use is extended and identified as a tool for re-thinking rehabilitation. As such, three concepts are presented to detail early explorations within the research.

Figure 2. The garment as a research tool (Headway, 2018; 2019).

The stroke context

Post stroke, approximately 87% of survivors experience upper limb paresis (Parker, Wade, Langton Hewer, 1986 in Conforto et al. 2018). This 'loss' becomes worsened by non-use. Learned 'non-use' occurs due to the brain's association as a 'use-it-or-lose-it' organ (Doidge 2016, p.86). Within the context of stroke, neuroplastician, Edward Taub discovered that patients 'learn' not to use their affected arm thus relying on their functioning arm instead, compensating for what they had lost by finding ways around tasks. As a result of this learned 'non-use' muscles begin to weaken. Some individuals experience the emergence of synergies and spasticity (Figure 3). Jackson and Walsh suggest the dual nature of hemiplegia is a combination of the loss of voluntary movement due to damage to the cortex, and an intrusion of positive phenomena that we call spasticity and synergy. Synergies are generated from the co-activation of muscles despite an attempt at single point movement, making it difficult to move the limb in the desired way. To improve this, one must use the limb, and so a greater focus is placed upon the active self. However, observational studies mapping patient isolation in hospitals following a stroke conducted in 2005 (De Wit et al.) and again in May 2017 (Chouliara et al.), found that patients spend around a third of their day sleeping and lying with no activity. This highlights a desperate need to re-think methods to support rehabilitation at an early stage, especially when we consider findings from Biernaskie, Chernenko and Corbett (2004) and Zeiler et al. (2016) who have identified a postischemic sensitive period, showing a correlation between increased levels of recovery and earlier re-training.

This need to persistently train with constant exercise is unfamiliar to many who have not exercised to such levels of intensity pre-stroke and

so begin to live lives that are not in line with their personality, behaviour and identity. The time taken to participate in rehabilitation detracts from rebuilding one's life which is perhaps best summed up in the following quote:

> *"I do have a life outside of rehabilitation you know, life does exist outside of rehabilitation."*
> *Patient quote in 6 week follow-up appointment - Observation study: 3 week Upper Limb Programme, Queen Square, London 25/01/2018*

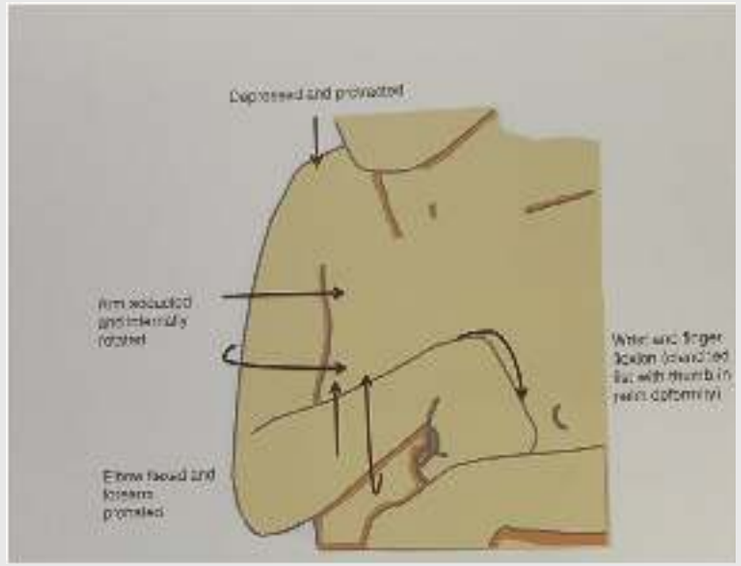

Figure 3. A Visualisation of Synergies and Spasticity in the Upper Limb: UCL Partners (Krakauer, 2018).

It is further suggested that current approaches to rehabilitation often emphasise the success of task function over the quality of movement that is achieved (Krakauer, 2018). A study conducted by Murata et al. (2008) establishes the importance in distinguishing between quality of movement and success of the task in therapy. It is known that if quality movements are emphasised with a large amount of practice, there are dramatically time dependent improvements (Krakauer, 2018). Some of the major barriers that can prevent this are lack of resources, an increase in the demand for assistance from highly trained specialists (Belforte et al. 2007), fatigue and lack of motivation by stroke survivors which may result in the use of compensatory techniques or complete non-use of the limb. The development of games and VR (e.g. Neuroball and GripAble) incorporating rehabilitation have attempted to address motivational decline in the participation of training, as well as some providing guidance via a virtual therapist. Yet such approaches are not universal and have a limited attraction to a specific demographic of people. Haptic robots combined with gaming in SMARTS II (Krakauer, 2018) are seen to be breaking ground for training quality movements in

the future of stroke rehabilitation. All of these concepts retain the static and the situated nature of therapy, which is often held in the confines of a therapy room. This provokes the question-, what methods can we use as an extension of this, to impact the everyday routines of life, beyond private settings, whilst considering the impact of consistent training?

Approach

It is argued that designers now have a responsibility to ensure that such products and services 'fit into everyday life' (Fitzpatrick in Moller and Kettley, 2017), when it comes to stroke rehabilitation, the importance of this cannot be overstated. The need for 'participation' and promotion of self-efficacy for using devices or even simply being involved in self-administered training could not be stronger (Ward, 2018). By using the intuitive nature of garments, in their ability to work with movements and behaviour of the wearer in a manner that works alongside everyday activities, encouraging or supporting the use of the limb.

Hence one begins to question the potential of utilising a garment as a 'platform for care' by investigating the extent of material agency over human ability as the garment enables the routine nature of rehabilitation to be embedded into the routines of the everyday.

The rise of smart materials and their extension of intelligence from passive states acting as sensors to their environment, to active states in being able to respond back to the environment and additionally being able to 'learn' and adapt to context and circumstance (Zhang 2001 in Langenhove et al. 2007), provides opportunity to re-evaluate function and form of our bodies. Within garments we may observe continual states of reaction and dialogue between the self and the garment. Whether behaviour is resisted, through irritation of seams, surface texture and similar, or embraced, there exists a feedback loop throughout the time of wear. The entanglement of self and garment through the constant participation of contact shows intimate influence of a material with the body. Throughout time, and through continued use, our garments become 'records of lived experience' (Sampson 2018); carried with us through different contexts, situations, time, space and place. They have the ability to comfort, protect, conceal and, or present ourselves.

Learning is a critical element in the process of rehabilitation. O'Leary explains how, as learning occurs, the amount of neurons involved in achieving the activity increases. New branches between neurons are created and thus the area of the brain increases in mass (Johansen-Berg, 2019). Learning is not necessarily a simple repetitive process, but one that becomes constantly adapted and refined through enhanced experience. Throughout the day, each mental act use 'slightly different combinations of neurons communicate with one another. Thus, as a person goes through the day, their brain is forming, informing, and reforming new neuronal networks as part of its basic operating

procedure.' (O'Leary (2019). Hence a group of neurons will be used for different purposes at different times, but just how might a textile respond to such behaviour and help support learning to move once again?

As behaviour post-stroke directly affects the course of recovery, it was essential to understand the varying levels of experiences of individuals that shape their behaviours. This was captured within a three-phase approach; firstly, by using garments as tools for the exchange and embodiment of experience (Figure 2); secondly, a digital analysis and documentation of the post stroke body using body scanning (Figure 1); and finally, supplementing this with raw film to capture movement and responses to textile prototypes 'in the moment' (a still from a film can be seen in figure 4).

Figure 4. Knowledge exchange through the act of wearing (Headway, 2019).

The use of toiles (Figure 4) aimed to provoke and question the implications and opportunities of wearing textiles that alter or disrupt the movement of our bodies. Or alternatively, of supporting or aiding movement. Bodily reactions and responses were captured via raw film footage. The 'feeling of what happens' becomes captured in the moment (Damasio 2000).

> *"This is just calling me at the minute. I don't know why... I like how it moves. There's so many ways this thing moves. It's like a spring isn't it? Knowing what it does, brings a tear to my eye. I don't know why I'm crying but I am. Probably because [pause] it can help me."*
> *Anonymous participant ("A"), Headway East London, 2019.*

Deleuze discusses the composition of forces that make up the body which renders it capable of forming dialogue with other bodies, those which are both human and non-human (Buchanan, 1997). The embodied experience within the process of wearing clothes is inherently 'fleshy' (Ruggerone 2017) and a felt experience, taking on notions of the philosophical sub-discipline of Aesthetics. Aesthetics, not restricted in

the more common sense of the word, to the visible alone, but relative to the other senses including the tactile, the felt. For the bodies are, as Ruggerone suggests, 'clusters of connections between a variety of material and immaterial elements: molecules, neurons, cells but also ideas, signs, cultural symbols etc.' all of which constantly impact the 'affective potential' of the body, and so through encounters, the body 'becomes'.The act of 'becoming' can be experienced through the dialogue with our clothes or with objects that we wear. 'Person A' wears a shoulder support that enables their body to become fulfilled to a greater capacity. The act of wearing it, over time, becomes second nature as 'Person A' describes the feeling of it becoming unnoticeable and lost to thought. That is, until someone draws attention towards it through conversation.

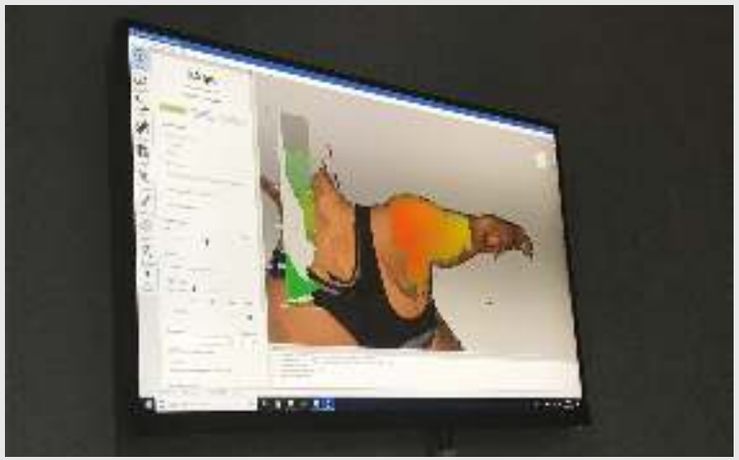

Figure 5. From fMRI to Body Scanning; The body as a research tool: RCA.

Physical disability, just like cognitive disability (if one were to separate the two), can be hidden. 'Person A' chooses to conceal the shoulder support and even, not wear it at all in order to resist people questioning why they are wearing it. The ability to distinguish a wearable aid to our clothing can affect mood, through the recollection of disability, and affect the choice to wear it or not. Such embodied encounters 'make up the material texture of our daily practices' (Ruggerone, 2017); practices which are continuous. Through movement we 'become', and therefore a stifling or lack of movement stifles or restricts our 'becoming'; restricting the potential to live life. In order to visualise movement and function required, in line with the physical placement on the body and the visualisation of this, body scanning was used (Figure 5). The act of looking and of making, was not limited to the maker onto the user, but enabled the user to look and make onto their own body, thus providing an opportunity for further self-reflection; bringing the notion of 'going for a scan' to a whole new context.

Findings

The use of the body within active and passive states in rehabilitation are often thought of in isolation to the garments that exist on the body. Except in cases where they are used as tools to practice dressing in occupational therapy, or as compression suits/socks or gloves (Figure 6) to provide musculoskeletal support, control oedema or increase sensory and proprioceptive feedback. These are synonymously difficult to use, due to their difficulty to dress in, and can often be uncomfortable. Saebo and others offer finger extension rehabilitation gloves which aim to improve precision grip yet look most un-human. This may be appealing to some, yet the clear visibility of wires, battery packs and 'hardwear' that also exist in FES devices, can draw attention to the existence of disability and present the body as being different to others, causing the attraction of the gaze and questions, as 'Person A' described earlier. Furthermore, the use of the glove as the type of wearable, is one that has a distinct existence within particular social and seasonal contexts. Take this out of context and this additionally adds to public speculation of one's identity and ability. Not least, to mention the striking 'fleshy' colour of the glove, which seeks to conceal itself with the 'natural make up' of the skin of this particular individual, yet by doing so, becomes ever more 'unnatural'. Perhaps there is a balance to be gained between the 'hyperreal' and the 'hyper unreal', as seen in Pullin's 'Hands of X' (Pullin, 2019). We see as a result, the element of choice is generated for the wearer to weigh up the advantages of wearing on their recovery versus the emotional stigma that may be involved.

Figure 6. Oedema glove (given to 'Person C': stroke survivor)

This particular line of enquiry examines the role that a garment could play, by incorporating function into familiar forms, using yarn behaviour to accommodate this and in doing so evaluating the relationship between the nature of garments to be able to restrict movement as well as enhance, extend or even navigate movements. The functionality is contained within the yarn and the type of weave, knit and colour can all be changed according to personal preference, within the parameters of particular types of textile structure which is seen to affect the efficiency of function of the garment.

The research therefore questions how can garments change the way we move in real time and the way we respond to particular types of stimuli? In this way, the study asks how can we work with the natural behaviours of the individual and aim to support, guide or even influence routine actions that may not be obtainable through current states of ability. Is it possible to relieve the pressure of keeping up with rehabilitation training and thus change the quality of life during this period of time, which for some remains with them for the rest of their lives.

Within the following samples, a garment's participation of embodied experience is extended, beyond the emotional connection we may have with our clothes, our capacity to integrate with objects that surround us becomes one of supporting and guiding the movements we intend to perform. Understanding garments which 'negotiate internal and external realities' (Winnicott 1953; 1971; 1989) via the physical change in shape and form to the more subtle provocations elicited through the emittance of stimuli.

CIMT

The first experiment explores the integration of a known and perhaps controversial rehabilitation technique, Constraint-induced movement therapy (CIMT), within a familiar form that is 'used' everyday. Where complex individual cases are seen throughout the rehabilitation process, which may not only be affected by their medical condition and other associated conditions, but other variables including geographical location of residence, family and lifestyle status, techniques that may seem controversial and ineffective to one person may be life changing for another. It is for this reason that a range of approaches have been included in this study.

Figure 7. The process of shrinking: contraction of form: Eurecat, Barcelona.

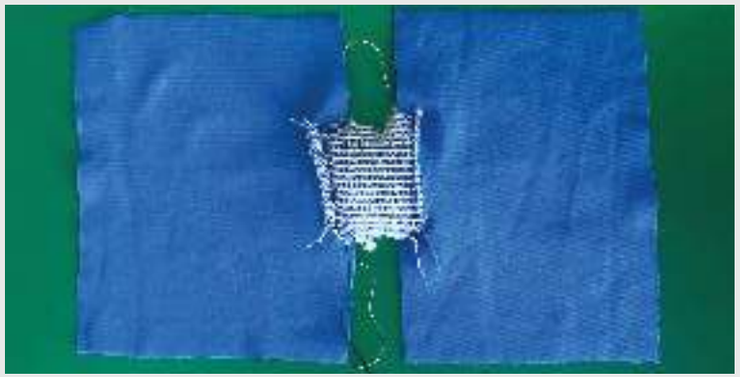

Figure 8. Post Shrink: Eurecat, Barcelona.

CIMT is a method which works by restricting the use of the unaffected limb in order to force the affected limb to be used. The 'good' arm becomes 'cast' into a splint, in order to prevent its use, and thus force the individual to use their affected arm instead and found that this technique can work even many years post-stroke. Brain scans showed that during this treatment, neurons adjacent to the injury began to take over from the damaged or dead neurons thus redirecting the behaviour around other existing architecture in the brain. Methods of achieving restraint are seen in forms that often restrict the individual from performing this method beyond the confines of a private room; a mitt, for example, is used to anchor the arm down to the table in a study conducted by Kwakkel, Veerbeek, Van Wegen and Wolf (2015). As such, the body not only becomes associated with the tool for rehabilitation but surrounding objects within the room as well; the table in this case. Where this may have been used purely to achieve the task of restraining the unaffected limb, the series of experiments below consider the integration of this on a moving body, into public spaces.

Samples shown here began to investigate the interpretation of this theory by using yarn which holds the capacity to shrink (Figure 7 and 8)

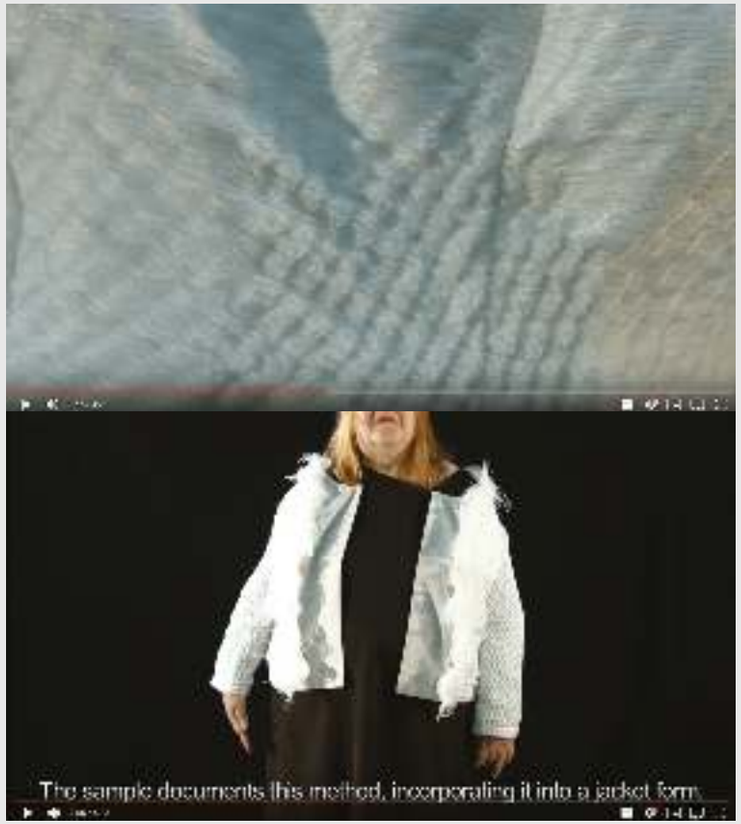

Figure 9. Stills displaying the embodiment of the concept into a jacket: A concept film, RCA (Salisbury & Raczynska, 2018) Above: the process of contraction occurring; Below: the jacket.

and therefore restrain and restrict movement in the limb by reducing the sleeve's circumference. Within the concept film (Figure 9) this method is displayed at a full scale through its incorporation into a sleeve of a jacket. The jacket's visual composition was created purposely for the film to exaggerate the change in behaviour of the textile, as well as giving a nod towards the flamboyant personality of 'Person C' and their pre-stroke career. The textile tightens its 'hold' on the body, effectively 'inflicting' a behaviour upon the body - rather than working with it, it works against it. The tightening can cause some discomfort ('Person C', 2019) but this can be controlled; either at source, through the controlled emittance and distribution of heat (seen later in 'Isolating Stimulus'); or by altering the textile composition. Figure 10 displays three alternative compositions: by adding elastane or spacer yarns like wool means that the tactility is softened, the rigidity becomes dispersed through the textile. Whilst the wool 'softens' the surface, the use of elastane can generate a degree of stretch, reducing the overall rigidity of the textile and allowing for some 'ease'. Where the ease can affect the degree of restriction imposed by the textile on the body, this can be controlled enough to facilitate comfort by not completely restricting the movement in the arm whilst retaining hold of the limb in a particular position. The main purpose of CIMT is to prevent the use of the 'unaffected' limb and encourage the use of the 'affected' limb. This does not necessarily mean that movement in the 'unaffected' limb has to be totally reduced, but reduced enough so that it is not used.

Figure 10. Left to right: with elastane, with polypropylene, pure Pemotex: Eurecat, Barcelona.

Navigating movement

Where CIMT may force the affected limb to be used, this does not necessarily mean that compensatory strategies are not used. In this series of samples, we ask how we might use the garment to navigate movement away from compensation, towards 'quality' movements. So

how might the shape of a garment provoke particular movements? In particular, how might the change in behaviour, when transitioned from a flexible, free-flowing form to a more rigid, less flexible form, provoke or disrupt a particular movement, by drawing attention towards the 'error' made by the individual. Would that enable them to recognize and 'correct' or attempt to correct such movement? How does this affect the experience of the garment and thus the mood of the individual?

Figure 11. Early Examination of Material Composition for its Deformation using Heat: Polypropylene and Nylon Monofilament: Eurecat, Barcelona.

Figure 12. Freeing the limb via alterations in garment construction: Eurecat, Barcelona.

The use of nylon monofilament was initially used as a 'support' or 'skeleton', utilising its properties and ability to also be manipulated by heat to 'support' the deformation of form (Figure 11 and 12). However, the adaptation of its inherently linear form, to a coiled form instead, may manipulate this further, enhancing its ability to expand and contract (Haines et al. 2016; Haines et al. 2014). Baughman's work presents opportunities where the process of construction can provide strength to a material, changing its behaviour, and therefore ability to support the human body. When this is applied to this line of enquiry, we may see the establishment of 'soft robotic garments' or 'soft skins' (Figure 13). The use of heat within this study aimed to explore the potential of working with the thermal torsio effect (Haines et al. 2016) - where an increase in temperature causes the reversible untwisting of

Figure 13. Leverage of form: Tests to understand the structural requirements of the ribbon to affect the base textile: Eurecat, Barcelona.

the fiber due to the fiber having greater radial thermal expansion than axial thermal expansion properties. Thus the study is interested in the use of heat to manipulate form and function of 'smart polymers' such as nylon monofilaments amongst others (Baughman, 1996; Shahinpoor et al. 1998; Pelrine et al. 2000; Shahinpoor & Kim, 2001; Brochu & Pei, 2010).

In other studies the combined use of smart fabrics and pneumatic actuators may have seen the rise of pneumatic artificial muscles which are deemed to provide an alternative and even reduce cost and strain on the lack of resource associated with 1:1 In-clinic physiotherapy (Belforte et al. 2007). Their ease of installation as well as lower maintenance requirements and ability to operate 'without the need for electrical signals [thus] eliminating electromagnetic interference that may be experienced' (Belforte et al. 2007) is certainly an advantage. Yet in comparison to emerging work with thermal torsio effect, pneumatic actuators are more complex and challenging to integrate into smaller-diameter fibers (Haines et al. 2016).

Isolating and controlling the stimulus

Where we may want to control the degree of deformation and reformation of material form, we may choose to apply the textile in particular areas of the garment. This may be done by methods of panelling (Figure 14) or alternatively by isolating behaviours within the textile itself. This choice can have implications on the visual aesthetic of the garment. Choosing to control the changes in behaviour of the textile means that one must consider how this might be achieved. Here we explore a number of experiments which strive to incorporate yarns which are able to conduct heat and electricity into the textile, thus using electrical stimuli to 'deliver' heat to areas where the conductive yarn is placed. In addition, our clothing can both restrict or encourage engagement in activities as well as limiting or expanding the ability to form relationships with others. Just as the function of the textile is important in the process of care, so is the aesthetic connection with the individual; enabling connections to be built, life to be lived and a quality of life to be improved.

> *"Brain injury changes you - you have to relearn yourself all over again. And I really didn't want to be a new person at 42."*
> *Annonymous Participant: Stroke Survivor Headway,13/07/2018*

The transformative nature of movement through embodied encounters extends needs beyond the ability of being able to raise an arm, of

Figure 14. Visualising movement: Eurecat, Barcelona.

success in achieving a task; which is often the focus of rehabilitation; to the affective feeling and the emotional impact of 'becoming' as a result of participating. The impact of free movement, rather than being restricted on how one moves. The restriction on the quality of movement can impact the 'capacity that a body has to form specific relations' (Buchanan 1997, 80) with others. As discussed previously in section 2, it becomes important to consider the appearance of the textile its visibility to the mind of the wearer, and that of the public. Where is this textile worn? The scope of the paper isn't enough to cover this in detail but this cannot be ignored.

Within the series of experiments investigating the impact of structural changes on the ability to navigate movement of the body, the implications of function within the textile can be seen to affect the surrounding shape and therefore silhouette of the garment (Figure 14), deformation (Figure 15) as well as the structure of the textile itself (Figure 16) but may also be rendered invisible by its integration into the familiar structure of the textile (Figure 17). The visualisation of movement in a garment which isn't a result of the forces of the human body (creases, fall, folds etc.) but as a result of the responsive forces of the textile itself (Figures 18, 19, 20) can be considered unusual and unfamiliar to the experience and observation of wearing clothes. This may therefore highlight an added difference between the body of the stroke survivor and those who have not suffered a stroke who therefore do not need to wear clothes that support function.

The integration of function into familiar form (Figure 17) seems to provide an option which becomes more inclusive in enable stroke survivors to participate with others, in social and public scenarios, through the process of recovery; supporting the body in performing voluntary movements whilst maintaining a familiar aesthetic. This brings

Figure 15. Deformation as a result of movement: Eurecat, Barcelona.

Figure 16. Structural changes: Eurecat, Barcelona.

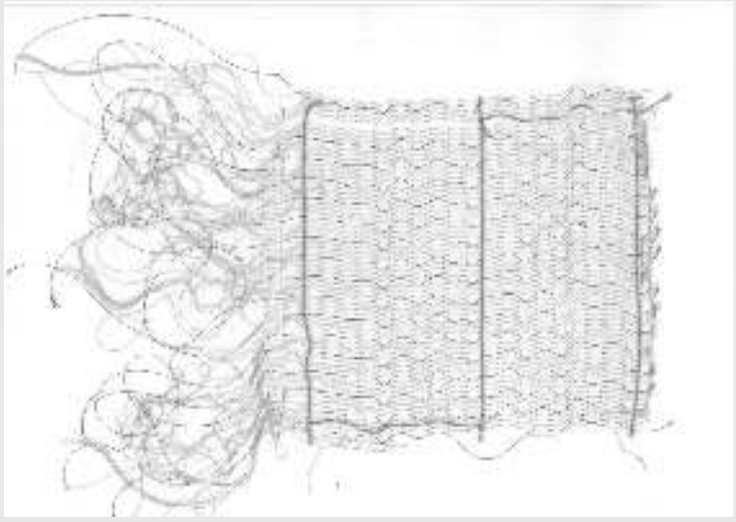

Figure 17. Integrating movement: Eurecat, Barcelona. (Salisbury, 2018).

Figure 18. The development of movement: Part 1: Eurecat, Barcelona.

Figure 19. The development of movement: Part 2: Eurecat, Barcelona.

into discussion the association of body and culture, where one is seen to 'fit in'. Does the visualisation of the body restrict social connections? Support worker 'Person E' recalls discussions with a stroke survivor about wearing 'tracksuit trousers' for an interview. Suit trousers were particularly difficult to dress into and so restricted ability to both dress in and afterwards, function in, limiting the capacity for the individual to attend the interview. Yet whilst tracksuit trousers enabled this, their aesthetic can be deemed inappropriate to this setting, indicating a lack of effort, care and even ability. There is often a desire where "the personality is at one with itself and the world" (Darmon and Frade 2012, 204) yet there exists "plurality of roles and social spheres" (Ruggerone, 2017) and so the existence of ones self and ones identity changes accordingly, meaning that where tracksuit trousers would be accepted in a meeting of friends, they may not be at an interview. Garments in the wrong context can generate feelings of embarrassment, awkwardness and unease, translating into the communication and function of our bodies. As clothing may be seen as a platform to serve people in the processes of self-intervention required in various contexts (Finkelstein, 2007), it may be briefly understood that the visualisation of function can feedback to impact function itself. Where this occurs generally in the

Figure 20. The development of movement: Part 3: Eurecat, Barcelona.

Figure 21. Embroidering movement: RCA.

culture of clothes, this may be exaggerated when an added function is attributed to the garment that is associated with disability.

Either by integrating it into the pattern of the weave (Figure 17) or by using embroidery techniques (Figure 21) the functionality became integrated and intertwined with the visibility of the resulting functionality. It is important to know that the density of the weave would impact the aesthetic and application to regularly used clothing -requiring a more tightly packed pattern to discourage it from being easily pulled. But for the purposes of this research, this was loosened to enable easier identification of behavioural attributes and demonstrate the function more visible to the naked eye (Figure 16). The sample shown in figure 20 has the potential to be both its own textile, with continued development of colour, insulation (see Figure 22 and 23) and changing the feel of the conductive yarns , or used as a layer between textiles, and so is not 'directly' felt or seen. Whilst the use of embroidery techniques mean that the qualities of the textile in Figure 20 could be translated directly onto the surface of a more 'familiar', pre-existing textile.

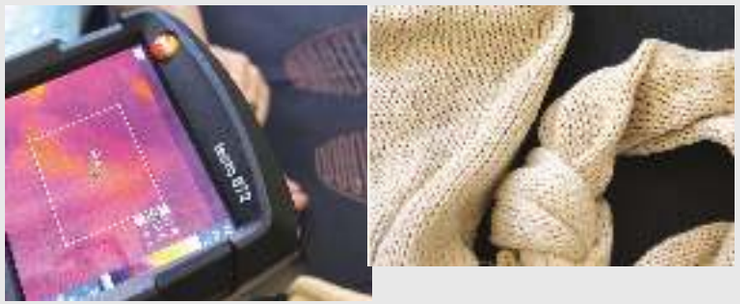

Figure 22. Insulating to reduce heat transfer to the body: Eurecat, Barcelona.

Figure 23. Comparative study showing the effects of exposed conductive yarn and the heat emitted from the source: Eurecat, Barcelona.

for the integration of techniques into textiles is considered in the manner of providing support to the upper limb in order to enhance voluntary movement so that training or movement becomes easier to access. This is done specifically by working to alleviate 'high forces' present that restricts the ability to perform voluntary movements; the increased weight of the limb as a result of non-use. Contrary to earlier investigation 'Navigating Movement', this final study doesn't seek to suggest particular movements, but rather aims to facilitate the ease of being able to perform voluntary movements by removing a barrier that is seen to reduce the ability in doing so.

Studies conducted by Krakauer et al. (2018) display the effectiveness of alleviating the 'high forces'; in this case SMARTS II uses haptic robots to do so. We may begin to question how the integration of this method into textiles might enable this to be carried with the body. Therefore, the textile allows for the expression of the body's own behaviour to facilitate movement alongside daily life. Training therefore occurs within ADLs.

Fitzpatrick (2011) in Moller and Kettley (2017) acknowledges a shift of care from clinical settings into "patients' hands and homes". This expanding space for design is altering the patient: clinician relationship and the transition of the context within which care is situated in, especially for complex, ongoing cases like rehabilitation. Roles and responsibilities are becoming questioned, including within this research where the behaviour of the individual, in both conscious and subconscious states influence and become influenced by the garment on a greater internal level. The body becomes extended beyond its form but also in a way where its own form is passed through a 'non human' material form within such a close proximity to the body. The use of the changing shape of the textile is therefore seen to support the limb, by shortening and thus pulling across the top of the shoulder, and lengthening beneath, acting as an artificial muscle via electrothermal methods. Within the film (Figure 24), a hairdryer is used as a visual symbol documenting the presence of heat on the textile.

It should be suggested that the use of heat stimulus requires care to be taken when applying this next to the body, but also isolated from other heat stimuli in the surrounding contexts to the body, thus limiting the effects to the stimulus within the textile. Interference would undoubtedly disrupt the process of 'care'. As such, an insulator was tested (Figure 22 and 23) and embedded within the garment to induce haptic support. Not only would this restrict the intrusion of external stimuli, but contain the internal stimulus within the textile, thus not passing on the effects of increased heat to the body which may result in discomfort. Figure 22 displays the successful application of an insulator around the internal yarn formation. In direct comparison where this isn't controlled, Figure 23 shows the presence of heat emitting from the source to the surrounding environment. Where temperatures range from 41°C to just over 100°C in the uncontrolled sample (Figure 23),

Figure 24. Alleviating high forces through intelligent textiles: A concept film, RCA.

temperatures remained at environmental temperature between 29°C to 32°C in the insulated sample (Figure 22).

Conclusions

The pursuit of this work is to change the quality of life of those affected by stroke, in particular those who have suffered a stroke and struggle with the pressures to pursue recovery. Where this paper presents an ongoing body of work, and details accounts of the very first experiments, feedback from each stage of the research has been pursued. What became apparent was the need to avoid thinking that a garment would only appeal to a particular demographic. One of the most surprising parts of the study was in the interest of wider ranges of demographics

including 'Participant A' suggesting that identity and social inclusion is of greater importance than was anticipated. And so to finish, raw conversation is detailed below, documenting a sample of the feedback gained from the early lines of enquiry showing discussions held with 'Participant A':

Support Worker:
'Would you wear this?'

Participant A:
'My shoulder [is injured]. I have a sling. I bought it online. You can either slide it on or open it with the velcro, but the velcro is a pain in the neck. So I've [prepared the velcro and] got it how I want it. Then I put it on and pull it so it brings this shoulder [upwards]'

'Acupuncture helps but I wear this to bring it in. And I wear it but I don't like wearing it here [support group] because people go "ooh what's that you got" and I'm like ugh [do I have to answer those questions].'

'I have a double one [sling which holds both shoulders] because it helps to bring it in [which I wear] under the clothes, but the other one [single sling] I wear over the clothes'

Used to help participate in other lesson. Used to be able to access other activities.

Support Worker:
'So if you could put on a t-shirt (made of this textile) that did that function of pulling the arm up…'

Participant A:
'...yeah I actually wear that [the sling] to do that but it's not great but it does it's job.'

Support Worker:
"What if that could look 'normal' or 'fashionable'?"

Participant A:
"That's tears what you're saying right now. It's like I really want to cry"

Support Worker:
"So it's that important to you?"

Participant A:
"Yeah because inside I'm hurt, I'm hurt inside places that nobody knows. I don't want to show it. It's not that I'm frightened of it,

it's just that constant "ooh" [sympathy]. I've had four years of it, I don't want it anymore. I'm in that thought that I'm not right and I don't want to think about that'

The support worker discusses the visual colour and questions whether it should be worn underneath clothing.

Participant A:
"I don't think you should disguise it. With what it does and the pattern. Would I wear it? Hell yeah!"

Support Worker::
"The blue almost radiates, glows"

Participant A:
"And the black sets it"

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The Fair Energy Mark in the making: Framing a citizen-led campaign by participatory design

Laura Santamaria

Abstract
There is a growing understanding that design can positively contribute towards highly complex social, economic and environmental problems we face today. One key area is citizen empowerment to change built-in systemic inequalities and exploitative practices. This paper presents a design intervention that explored citizen empowerment in the context of The Fair Energy Mark campaign, a citizen-led action aimed to raise practice standards and address power imbalances in the energy supply sector. The project-based investigation explored the tensions emerging between expert–diffuse design in the process of elaboration of campaign branding and communication strategy. The researchers experimented with new tools that enabled an open participatory process of campaign framing, but also facilitated fluid knowledge exchange between participants through experiential learning. The investigation contributes some conceptual constructs to discuss strategic design management practice in the socio-political sphere. Furthermore, the research identified that a closer integration of design and communicative action theories, and participatory design and community organising methodologies present promising opportunities to amplify the impact of design research for social change.
Keywords: design for social change; citizen empowerment; expert & diffuse design; strategic communications

Introduction
In times of energy resource scarcity and ecological extinction, accessibility to affordable energy becomes an increased concern for citizens globally. While environmental and climate justice movements organize and mobilize for radical changes by pressuring industries and political leaders, the conceptual tools and frameworks of energy justice and fuel poverty generated by academic scholarship seems slow to attend to. Meanwhile, of the 14 million people living in poverty in the UK, 8.5 million are food insecure and 2.5 million live in fuel poverty (Barnard *et al.*, 2018). Despite the perception of the UK leading the fuel poverty agenda, politicians would have the public believe that reforming the energy market is outside the realms of possibility (Middlemiss, 2017). This disempowering situation reveals not only the importance of supporting initiatives to reduce poverty, but the potential for design to amplify impact by creating innovative vehicles to even power dynamics engrained in the energy sector through leveraging various interests.

With design research taking responsibilities and standing up for energy futures (Fuller & McCauley, 2016; Jenkins, Sovacool, & McCauley, 2018), we stress the importance of engaging at all levels – i.e. not only via sociotechnical innovation and policy groups, but more importantly with civil society organisations, activist networks and citizen-advocacy groups (Delina & Janetos, 2018; Jenkins *et al.*, 2018; Shove, 2018) who work tirelessly towards addressing injustices and empower the most vulnerable and underrepresented peoples and issues.

Beyond project making, as researchers working within a broad-based civil society organisation, we identified the opportunity to consider on how power is managed in *expert* and *diffuse* design in participatory processes, and elaborate conceptual constructs that help us reflect and improve strategic design practice in the contexts of design for social change.

Research background
In 2017, Citizens UK set a challenge for postgraduate students at Loughborough University London to develop innovations to address fuel poverty, environmental and economic injustices in the energy market. Working within a Design Thinking process, students generated a set of 'Fair Energy Standards' which served as the basis to develop the Fair Energy Mark. During the following 12 months, a steering committee of founding partners was formed with various stakeholders who met monthly to further develop the kitemark, engaging the with local authorities and energy experts. In 2019, consensus was reached about the contents of the mark. At this point, the researchers, as design experts, were asked to lead the development of the campaign branding and communications' strategy. The task was to shape the contents of the mark and develop strategies for its deployment and implementation. This presented an opportunity for design research for change intervention.

Figure 1. Fair Energy Mark development timeline

The Fair Energy Mark campaign: Making fuel poverty a design for change issue
Campaigns are an undeniably effective vehicle for paradigm change. Conceptualised as a form of activism grounded in communicative action theory (Habermas, 1984), they aim to disseminate knowledge and ways of understanding that empower people to take individual actions that, collectively, generate benefit for society as a whole. Historically, Citizens UK has initiated very successful nationwide campaigns such as the Living Wage which resulted in pay rises for over 150,000 workers and their families. Equally, the FEM campaign represents an opportunity for

design research for change whereby the framing – or reframing – of complex issues around energy becomes key to influence practices in the energy market at individual, local and national level.

The concept of framing is an important topic at the centre of power and influence (Goffman, 1986) because it focuses attention on certain events and then places them within a field of meaning and relevance . Framing theory suggests that how something is presented to the audience (called 'the frame') influences the choices people make about how to process that information, and therefore creates biases that influence beliefs and behaviour (Kahneman & Tversky, 1984). Frames are essentially 'schema of interpretation' of values negotiated politically between actors over unfolding issues (Goffman, 1986). Typically, values that are legitimised through framing strategies are manifestly bound up with the cultures and agenda-setting practices of elite actors (Scheufele, 2000).

In design, framing is understood as a meaning- and sense-making process, intrinsic and inseparable to the design activity (Dorst, 2015). As design represents and legitimises meanings and values (Kolko, 2011; Krippendorff, 2006) – influencing tastes, beliefs, prejudices that can change people's views and behaviours – design is political by definition. However, unlike in media or strategic action where framing is used *explicitly* to influence and advance agendas, design influence is *implicitly* bound up within expertise and there is a lack of knowledge on how political and ideological dimensions are managed in the social sphere, due to limited integration of theories of social change within design research (Willis, 2012). 'Design is always a silent but hard-working part of our history. Design is one of the most powerful routes through which our beliefs and views of the world flow' (Zingale & Domingues, 2015, p.9). In this, learning from others can advance a more legitimate and transparent practice.

Strategic design in the social sphere

In order to obtain the change they seek, citizen movements and organisations can often be driven by strategic action agendas – i.e. action oriented toward success, pursued regardless of the interests of others (Jacobson, 2003). In contrast, strategic design seeks to use 'design principles and practices to guide strategy development and implementation toward innovative outcomes that benefit people and organisations alike' (Calabretta, Gemser, & Karpen, 2016).

Common across strategic design practice for social change are co-production and collaborative principles, where a wide network of stakeholders are considered as co-creators of public value. Co-creation is strongly connected to notions of "participatory design", "co-design", "design attitude" and "design thinking" (Bason, 2010, p.7). Within Participatory Design (PD) *design* operates as a participatory process for "design-for-use" and "design-for-future-use" that is "infrastructuring" (Le Dantec & DiSalvo, 2013). Infrastructuring, as developed within PD, refers to ongoing designing in which the designed projects/products are designed in such a way so that they can be redesigned, and serve to build capacity and learning that positively impacts the agency of the stakeholders involved – i.e. 'knowledge is power'. Conceptualising PD as empowerment (Ehn, 2008) has located PD within the wider community as it approached societal issues as ongoing infrastructures (Björgvinsson, Ehn, & Hillgren, 2010; P. A. Hillgren, Seravalli, & Emilson, 2011; Le Dantec & DiSalvo, 2013).

This means that beyond delivering specific project outcomes, expert designers seeking infrastructuring interventions aim to grow the design and change capabilities within individuals, organisations, communities or multiple stakeholders. This is translated in forms of training initiatives such as participatory and co-creation workshops, and/or collaborative pilot projects. Formalising design processes and methodologies to be transferable is part of this strategy (Sangiorgi, 2015).

Strategic action: Citizens UK and community organising

The work done by Citizen's UK has been conceptualised as a 'broad-based community organising' in the UK, a political methodology ontologically rooted in civil society and epistemologically based on the concept of power' (Bunyan, 2018).

> *"For Citizens UK the word power is really central to our fuel of change. Some people feel very uneasy with that, but we recognise that power is essential if you want to make real change. And we unpack power by talking about organised people and organised money." – Community organiser (Citizens UK)*

The strategic vision for change employed by Citizens UK is based on a view of society that is "comprised of three distinct sectors: 1) the state, the governments and the regulatory boards, 2) the market, companies, corporations, and 3) civil society" (Citizens UK). From a community organising perspective, this means that civil society holds the state and the market accountable of the practices and values they represent. At the core of their methodology lies creating permanent alliances between different civil society group to address worthwhile and winnable issues. While such issues might not achieve radical change in the community, the ultimate goal for Citizens UK is capacity building for participation in public life. This is done through relational meeting/one-to-one sessions and listening campaigns that seek to identify and train citizens to be leaders who mobilise their communities to take action on issues they care about.

Citizens UK logic of non-partisan organising strategy with capacity building for leadership as an objective sets Citizens UK apart from the sporadic nature of social movements, and is parallel to strategic design principles of empowerment through infrastructuring and building

powerful alliances that create value for all (Hillgren, Seravalli, & Eriksen, 2016). Table 1 summarises the similarities in both approaches.

	Community Organising	**Strategic Social Design**
Empowerment through knowledge	*Capacity building* through relational sessions, listening Training for leadership	*Infrastructuring* through participatory projects Formalising methodologies
Organising strategy	Non-partisan civil society alliances	Stakeholder partnerships
Agenda/goal	Citizen participation	Co-production of 'expert-diffuse' outcomes
Vision of change	Rebalancing power (pressure)	Innovation (value creation)

Table 1. Comparison of principles adopted by Community Organising and Strategic Design for social change

These synergies present a resourceful and genuine territory for developing joint methodologies that can potentiate empowerment in citizen-driven societal change.

While it is clear that PD practices have enhanced the democratisation of the design process, what is less clear is how the power conferred to the designer as 'expert' is managed in these settings, and how we – as design research scholars and practitioners – should attend to the tensions emerging in the *production of expert-diffuse designs as vehicles for change*.

The concept of 'expert design' refers to the discipline and profession that emerged at the beginning of the last century (Manzini, 2015). In these settings, however, this means someone who is expert in the various ways of stimulating and supporting wider, more complex co-designing processes for the non-experts (Manzini, 2015). The design expert is expected to integrate and promote the design abilities of the others; 'diffuse designing' of everybody – i.e. design as a diffuse human capability. This view implies that the expertise of the designer transcends the traditional technical capability (for example, to design a campaign logo) and extends into the capacity to enable community empowerment to design their own vehicles for change, to articulate and frame their significance and meaning, and to implement them in a way that makes sense to them. Thus, design becomes a collaborative effort where 'the design process is spread among diverse participating stakeholders and competences' (Björgvinsson, Ehn, & Hillgren, 2012) – i.e. the expert and the community – and is envisioned and explored in hands-on ways characterized by human-centeredness, empathy and optimism.

Habermas holds that 'the negotiation of definitions of the situation is an essential element of the interpretive accomplishment required by communicative action' (Habermas 1984, p. 286). Thus, the 'definition of the situation' can be usefully conceptualised as a framing activity that can be facilitated through participatory methods. For this reason, as expert designers, we see our role as 'staging the process' wherein elaboration of strategy can happen democratically. On the other hand,

design expertise in communication strategy is a valuable resource that equips us to deploy, professionally, the mechanisms that work best to influence public perception and action towards the desired change. This gives rise to our research question(s):

How is power negotiated in the *diffuse–expert* design relationship?

- How does the 'empowering of others' (diffuse design) and 'self-power' (expert design) relation balance?
- How can we open participation in the framing and strategy elaboration process?
- How can the expert designer enable and empower?

We see these questions contributing to literature on community-based PD and within that to the discussion on *PD for useful systems and PD as infrastructuring* (Ehn, 2008; Le Dantec & DiSalvo, 2013).

The study

The aim of the project was to co-design the materiality of the campaign that could speak to and mobilise wider public(s). This involved facilitating participation in framing process for drawing together 1) the communications and marketing expertise of energy companies with 2) the leadership and human resource mobilising for collective actions capacity from Citizens UK, and 3) lived experience and knowledge practices from local citizens.

Our methodology for the study sought to develop a format that would be familiar enough for diverse stakeholders to co-articulate the FEM campaign. This included experts and non-experts in design and strategy who, although diverse in their practice, share a vision of change for the energy market.

Workshop design

We designed the workshop around the metaphor of the local newspaper, as a relatable and familiar framework . The activities were inspired by drawing framing techniques from leadership and organisational

Activity	*Technique* (Fairhurst, 1996)	*Purpose*
WORKSHOP	Metaphor	To frame a conceptual idea through comparison to something else
Activity 1 *Stories and personas*	Stories	To frame a topic via narrative in a vivid and memorable way
Activity 2 *Brand values* *& Visualisation*	Artefacts	Objects with intrinsic symbolic value – a visual/cultural item that holds more meaning than the object itself
	Slogan	To frame an object with a catchy phrase to make it more memorable and relatable
Activity 3 *Communication Strategy* *Activity 5 Headlines*	Spin	To present a concept in such a way as to convey a value judgement (positive or negative) that might not be immediately apparent; to create an inherent bias by definition.

Table 2. Framing workshop activities

communication literature (Fairhurst & Sarr, 1996) which best suited the context and the purpose (Table 2).

The venue

Our campaign partner, St James the Great Clapton (London) provided the venue, as this was considered a welcoming and inclusive community space (Figure 2). Invitations were circulated strategically to reach energy companies, citizens advocacy groups and community centres, but the setup remained open for anyone interested to drop in and join.

Figure 2. FEM Participatory framing workshop

The process

Communication strategists and graphic designers from Bulb and Octopus Energy, community leaders from Foodbank, Citizens Advice, Citizens UK, and the local church and citizens with lived experience of fuel poverty participated actively in the workshop. Guided through the five activities, participants articulated the brand – that is issues, values, vision, language of FEM – and put forward strategic actions to mobilise publics.

Activity 1 focused on deconstructing the stories of lived experience of fuel poverty. We then moved on to visualise and construct the brand by thinking about the benefits, values and the promise of FEM (*Activity 2*) and synthesising a visual language in a poster. *Activity 3* focused on

Figure 3. Activity 1: participant's representations of unbalanced and unjust power relationships

developing the communication strategy by thinking about calls to action that a) would invite new energy companies to join the mark, b) raise awareness among energy advocacy groups mediating between citizens and energy companies, and b) mobilise the wider public to switch to energy providers that represent the values of the mark. Together we then mapped campaign tactics to spread the word on various platforms (*Activity 4*). The last activity aimed to frame the narrative of the cause and the campaign by coming up with headlines that would speak to the press and the public (*Activity 5*). In the following sections we provide an overview of the these in more detail.

Activity 1 – Stories and personas

This activity was designed to enable narratives to emerge from the experiences and tacit knowledge of the participants.

Through writing and representations, participants expressed the lack of reciprocity in the supplier-customer relationship (Figure 3). The recurrent themes in the data were fuel poverty, lack of support, debt lock, unfairness, lack of accountability and transparency and poor service.

There is a call to action for the industry to step up in its responsibility towards customers, developing more ethical business practices, and for the powerholders to "play your part in reducing people living in poverty." This could be particularly important when the campaign has the intention of disrupting the status quo.

Strategically, this also poses an opportunity for companies to gain competitive advantage by improving customers service to strengthen relationships with customers. Service innovations that allow for customer empowerment and could be viewed as opportunity to improve supplier credibility and retain customers.

Figure 4. Activity 2: Brand articulation and representations generated by participants

Activity 2 – Visualisation and brand representation

The language that dominated the workshop was 'fair' and 'care' – there can be no doubt that the participants intend these value messages are to be communicated loud and clear through the promise and benefits of the fair energy mark. Figure 4 summarises the activity findings.

Activity 3 – Communication strategy

Figure 5 evidences ideas generated for communication strategy directed to the various stakeholders – energy suppliers, strategic partners and the general public.

The call to action further articulated the brand benefits to various stakeholders. The results provide a social learning opportunity for industry to understand that citizens are demanding change and if industry does not respond, they will miss out. The empowerment of the participants can be evidenced by the changing language when given opportunity to role model.

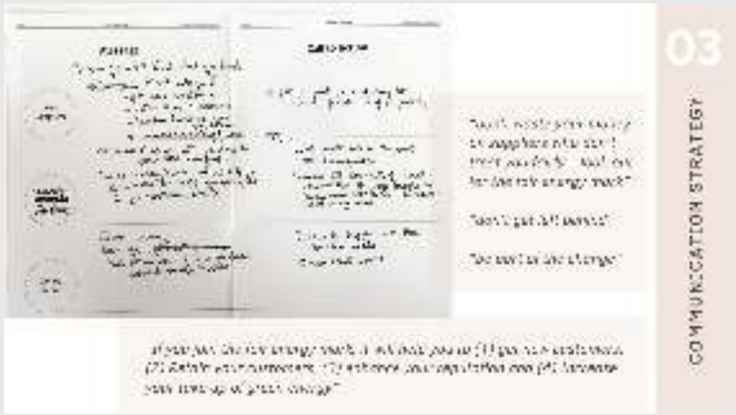

Figure 5. Activity 3: elaboration of communication strategy

It is also worth noting the implication in the language that there are credibility issues with some industry players ("enhance your reputation") and the power is shifting to the citizen calling for more consensual relationships through the campaign language "be part of the change".

Activity 4 – Campaign tactics

In response to the energy literature (Willis, 2019; Middlemiss, 2017) which highlights the need to understand how we engage with energy systems in order to solve the problems we face, participants generated 'campaign tactics' (Figure 6), and were prompted to identify the target audience of the campaign (who), and propose deployment ideas (how).

Contrary to energy saving campaigns, the tactics that emerged here point to the need for energy literacy – e.g. "pop-up open day and discussions with energy experts who can help find the best deals."

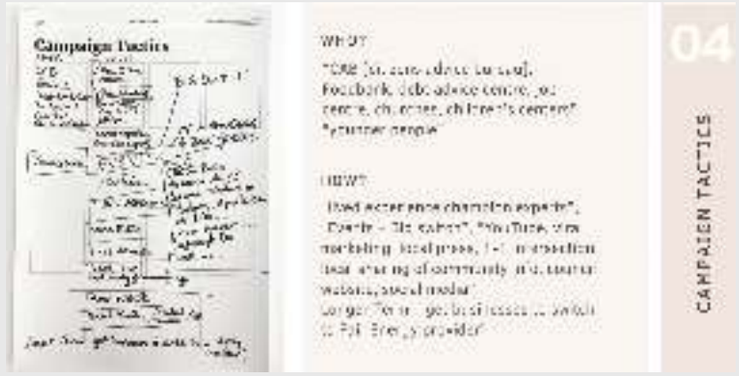

Figure 6. Activity 4: co-created strategies for campaign implementation

Activity 5 – Headlines

The last activity was aimed to encapsulate the cause by coming up with newspaper headlines that would communicate persuasively to the press and the public. The activity provided an opportunity for participants to take an outsider point of view, and decide on 'how others should see us.'

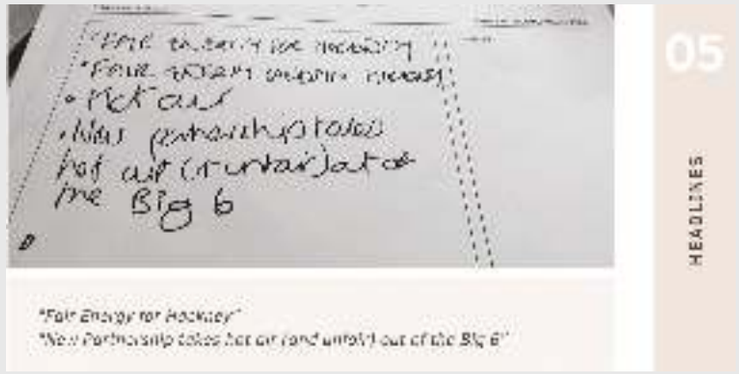

Figure 7. Activity 5: newspaper headlines produced by participants

The statements take a hopeful tone, announcing a 'change of dynamics' to bring relief at last from unjust market practices.

Discussion and reflections

While there is much literature on participatory design and co-design applied to the development of tools to facilitate citizen-led innovation on one hand, and the role of design in the development of branding to support campaigns on the other, what this investigation set to interrogate and challenge is the implicit nature in which expert design assumes and manages power in such collaborative practice arrangements.

Through project-making, the study provided a twofold opportunity for design research for change:

1. To observe the political and power dynamics of expert–diffuse engagement in the context of civil-society activism, and identify constructs that can help bring to light the implicit understandings of engagement; and 2. To facilitate expertise exchange between two strategic approaches to social change (design and community organising) and formalise the generated knowledge into methodologies that amplify capacity building for agency towards change.

Conceptual constructs to discuss power in expert–diffuse design

Three broad concepts stand out from the literature as relevant to discuss the expert–diffuse design relationship: expectations (Manzini, 2015), accountability (Habermas, 1984) and agendas (Scheufele, 2000). These concepts appear fundamental to the implicit 'engagement contract' for establishing a working partnership between the expert and the community based on openness and mutual trust. We put them forward as helpful constructs for structuring discussions and locating power relationships.

Expectations

In the first place the designer is empowered by the group, by being recognised as the most expert member of the community to further the cause at that particular stage: a good communication strategy requires skills in persuasion, which a communication designer can deliver. However, in a conventional branding and strategic communications exercise, it would not be standard practice to consult with 'non-designers' or open up the process to participation, but rather the expert would take charge and ownership for project development as 'expert in the field'.

From the expert design practice perspective, this involves risk and making more courageous, experimental choices (Manzini, 2016) and remaining flexible and open throughout a dynamic collective sense-making process. Delivering on these expectations meant that:

1. we had to design tools fit for the purpose, familiar and inclusive – e.g. newspaper format – to enable citizens to collectively elucidate, articulate and strategically frame issues (Figure 8);
2. we interpret the data collected through the workshop into professional standard communication materials. This implied refining the design outcomes while keeping legitimacy towards the set of embodied knowledge we generated together (Figure 9).

Accountability

The trust placed on the expert's ability to lead the community through this process prompted us to consider issues of accountability and reciprocity.

Figure 8. Interpreting outcomes of the workshop for brand development

Figure 9. Final brand communication visuals

Working as an embedded member of the community, it can only be sensible for the designer to adopt and build on community organising methodologies, principles and best practice. In this case, it meant sharing power through consultative decision making, and being accountable to the group for the kind of operative mechanisms we created to enable inclusivity and participation. It also required setting aside a 'problem solving–outcome oriented' mindset and adopting a 'learning–infrastructuring' mindset. For example, rather than a mechanism to 'harvest data', workshopping was considered a capacity building opportunity that provided an inclusive way of grasping new understandings, bringing transformation and empowerment through experiential learning and creative self-expression.

Agendas

Drawing framing strategies is a highly political dimension to navigate as designers. Like with all stakeholders involved, it required exercising self-reflection frequently to identify the motivations behind our views, decisions and actions, and disclosing them openly.

Questions such as 'What decisions am I taking on behalf of others? Are we preselecting or progressing certain choices without consulting others? Are we highlighting or prioritizing certain aspects over others?' prompted reflection for ourselves and others, and kept us on check to ensure that the power and responsibility entrusted to us as experts was exercised responsibly and we did not get ourselves in the way while striving to achieve strategic goals legitimately.

	Community Organising	**Strategic Social Design**
Empowerment through knowledge	*Capacity building* through relational sessions, listening Training for leadership **Moving from the debate to materialisation** **New methods for creating stakeholder ownership** **Identifying areas of opportunity for innovation**	*Infrastructuring* through participatory projects Formalising methodologies **Good practice in inclusive, relational strategic leadership for social change**
Organising strategy	Non-partisan civil society alliances	Stakeholder partnerships
Agenda/goal	Explicit. Motivated by citizen participation **Understanding that creating value for all stakeholders advances the cause via higher buy-in instead of pressuring.**	Implicit. Motivated by co-production of 'expert-diffuse' outcomes **Setting up mechanisms for motivation disclosure, accountability and transparency in decision making that affects representation of all** **Reflect on tacit contractual terms of engagement.**
Vision of change	Rebalancing power (pressure)	Innovation (value creation) **Participation and co-creation mechanism as enablers for capacity building and mutual empowerment.** **A learning vs facilitation mindset** **Detachment of subjectivity and choosing most effective strategy for achieving legitimacy and impact.**

Table 3. Transformative change through project-based learning

Participatory activities as platforms for learning

Beyond the importance of co-creating framing and strategy with the people and businesses the project will impact (stakeholders and project outcomes), bringing participatory design and the community organising logic of Citizens UK together in the workshop provided mutually beneficial means for knowledge exchange that extends capacity building – or empowerment – for change in many ways. In Table 3 we illustrate how the project enlarged and enriched areas of practice and understanding through this collaborative partnership, with new learnings highlighted in bold.

Conclusions

In this project, we engaged with paradigm change through design in civil society activism context. Through a project-based research aimed at participatory co-creation of campaign brand and strategic communications, we explored the political aspects at play in the expert-diffuse design relationship and contribute a useful construct – expectations-accountability-agendas – to discuss the contractual engagement in practice-based interventions with citizen empowerment at its core.

By enabling expert knowledge transfer through issue framing activities, the research achieved transformative effects at individual level, empowering citizens as agents capable to create their own vehicles for change. At collective level, the changed achieved through this design research collaboration is evidenced in having moved the cause a step forward – that is, from the critique and issue debate space into materialising actionable pathways to make the issue visible, but most importantly a persuasive and winnable cause.

Although this paper presents the experimental stage of the project, it is worth noting that considerable public funding for advancing the FEM campaign as a larger, long-term project was subsequently secured, on the basis of the strong alliances and robust results produced at this stage. At disciplinary level, the research identified important knowledge gaps in strategic design management in the socio-political sphere. A closer integration of design and communicative action theories, and participatory design and community organising methodologies pose significantly promising avenues for accelerating the impact of design research for social change.

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Why knitting now? Textile design research as a driver for educational change

Jane Scott, Elizabeth Gaston and
Zoe Dennington

Abstract

Design education in the UK is under threat. Research conducted by the Crafts Council has identified a significant decline in both A Level and GCSE art and design subject entries since 2010. For textile design this has led to falling student numbers and a reduction in skilled graduates. This is significant. Textiles are ubiquitous; from the macro scale of the geotextiles that support national infrastructure, to the microscale of implantable medical devices, textiles encompasses a lot more than clothing. This requires an understanding of not only the fundamental properties of textile materials, but also the production strategies to design and make in 2D and 3D.

This research presents a design intervention developed to respond to this educational challenge. Working with the Crafts Council's Make Your Future programme, and directly with schools in Yorkshire, researchers at the University of Leeds developed and implemented a project designed to engage with the opportunities offered by a creative curriculum. Using knitting as a tool for designing and making across a variety of scales, the project worked with teachers, pupils and school management to reposition textiles as a vehicle to respond to global challenges. Specific approaches applied biomimicry to the design of complex forms and considered new applications of colour theory as a means to respond to the environmental problems of textile colouration. Outcomes of the project have been significant. The team worked directly with sixteen schools and delivered workshops in five schools within the Yorkshire region during 2018-2019. The paper reflects on the impact of this intervention for pupils, teachers, school management and the wider community and considers how this experience can lead to lasting change in education. The ambition of this work is not only to re-skill school pupils and teachers in specific textile making processes, but also to renew the opportunities for design and craft education as a means to develop creative thinking and essential problem solving abilities for all pupils.

Introduction

Textiles are pervasive. As a material system, textiles are highly complex; balancing strength and flexibility through the organisation of fibres, yarns and fabric structures. The applications for textiles extend into every aspect of life, from conventional applications in fashion, to engineering, medicine and architecture (McQuaid, 2005). But there is a problem; the quantity of textiles consumed globally, and the complexity of the manufacturing system has a huge environmental impact, and change is required to reduce the impact of the global textiles industry:

> *"Textiles [is] fourth in the ranking of product categories which cause the greatest impact, just after food and drinks, transport and housing" (European Commission, 2013:1).*

The effect of textiles manufacturing can be significantly reduced by decisions taken at the design stage (Charter and Tischner, 2001:120), therefore the role of the designer is critical to the future of textiles (Fletcher, 2008, Black, 2013).

As a textile process, knitting produces fabrics within unique levels of extensibility and formability; it is a production process that can enable the fabrication of two dimensional shaped panels or three-dimensional forms (Spencer, 2001). Successful knit design requires knowledge of materials, process, technology and aesthetics. In knitted fabric design unique combinations of this knowledge are literally built into the designed product and used to generate fabrics and forms with diverse, and highly specified functions. Knitting is a sustainable option for textile manufacturing because products can be manufactured directly in 3D reducing material consumption through waste. In addition low impact, natural materials are important materials for knitting. For example smart textiles research has developed systems to transform linen and wool into environmentally responsive material systems for architecture and fashion (Scott, 2017).

Knit Design Research at the University of Leeds is a research led design studio directed by Jane Scott and Elizabeth Gaston that explores how textile design research methodologies and practices can be used to inform a range of theoretical, practical and pedagogical challenges. Knit Design Research examines the potential to ask questions of this unique body of knowledge to answer wider societal problems and to determine a range of solutions through knitted fabric design practice. Using diverse methodologies including biomimicry and Performance Craft (Gaston, 2016) the group produces research outcomes that challenge the conventional thinking of knitting as fashion. Instead, using experiential approaches, knitting is positioned as a way of thinking to develop materials for art, architecture and engineering.

In 2017 the research team were approached by the Crafts Council to act as a Yorkshire lead for the Make Your Future programme, and to participate as maker-educators; focussed on introducing knitting as a tool for thinking and making into secondary schools in Yorkshire. This research paper reports on the background to the Make Your Future programme, and evaluates the programme of workshops developed to engage pupils with Knit Design Research.

Context

In 2014, the Crafts Council launched Our Future is in the Making, the evidence-based education manifesto that sets out the case for every child having the chance to develop craft skills and achieve their full potential (Crafts Council, 2014). The manifesto highlighted the crisis facing our current education system, stating, 'In the last

five years participation in craft-related GCSEs fell by 25% and the number of higher education craft courses fell by 46%.' (Crafts Council, 2014). Nearly five years later the picture has worsened.

In August last year analysis by the Cultural Learning Alliance showed further declines in entry numbers for arts GCSE and A Levels most significantly a 57% decline in Design and Technology GCSE entries between 2010 to 2018. (Cultural Learning Alliance, 2018). This is compounded by a continuing decline in arts A Levels: entries down 24% since 2010 (with a 6% decline in Art & Design and a 41% decline in Design & Technology A level entries in the same period).

In addition to the decline in pupils selecting design subjects research highlights that there have been cuts to lesson time, staff or facilities in Design and Technology A-level subjects over the past two years (ASCL, 2018). This situation is further compounded by trends including a shortened key stage three (2 years rather than 3 years), shorter lesson times and an arts 'carousel system' with arts subjects being given only one, or half, term on the timetable.

The wider issue of teacher recruitment and retention is particularly concerning for our art & design teachers (In 2018 only 73% of the Art & Design target, and 25% of Design & Technology were recruited) (Cultural Learning Alliance, 2019). Alongside the factors above, a lack of access to relevant CPD in art and design is damaging. Significant numbers of art and design specialists in all phases 'rarely or never' receive CPD. 55% of art and design teachers across all schools sectors said in the last five years they had considered leaving or had left the profession (NSEAD, 2016).

Make Your Future

Make Your Future is a response to this landscape: initiating networks of schools, Higher Education Institutions (HEIs), and makers in London, Birmingham and Yorkshire, to develop sustainable working models for craft education.

Make Your Future's long-term aims are to create conditions where:

- Schools offer students high quality craft learning as part of the curriculum.
- Young people from diverse backgrounds have improved their well-being by engaging with craft-making activities.
- Local and national craft education networks support high quality craft opportunities in schools.

The programme is distinctive due to its focus on hands-on craft skills in the secondary classroom and the exploration of craft as a cross-curricular bridge which draws together science, technology, and creative subjects. Teachers are at the heart of the Make Your Future model: CPD sessions at the partner HEI teach new craft skills which are reinforced through collaborative delivery of sessions in their classrooms alongside professional maker-educators. Maker-educators work closely with teachers to pass on skills to Key Stage 3 students and give young people an insight into craft careers.

The focus of Make Your Future in Yorkshire is inspired by Yorkshire's rich textile heritage and has seen schools paired with The School of Design at The University of Leeds and Leeds Arts University. Learning from the project's pilot year has fed into the development of Make Your Future's STEAM approach; makers worked with teachers to design sessions that illuminate the science and technology inherent to 3D making processes.

Why knitting now?

Knit Design Research was approached to facilitate CPD and school-based workshops focused on knitting as a making process and as a tool to integrate craft and design into the wider STEAM curriculum. The role of maker-educator also provided a vehicle to disseminate the design outcomes of knit design research with a new audience, encouraging debate about the positive environmental change that can be achieved through textile design research. In addition this included the importance of creativity for employability, and twenty-first century skills such the ability to take risks in work and the importance of communication skills. Perhaps most importantly, the project aimed to remind pupils about the joy of making.

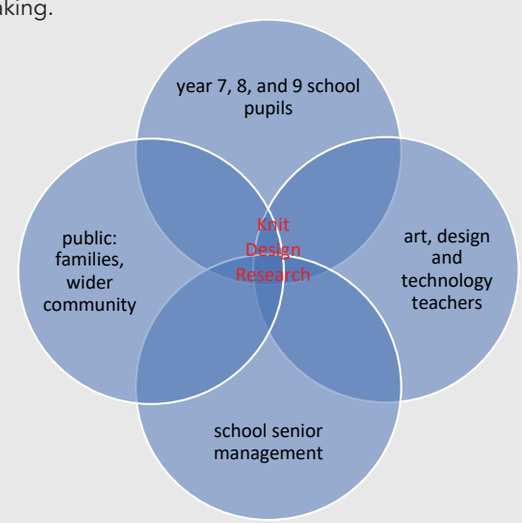

Figure 1. project participants

Project participants.

The project participants (figure 1) were selected from Yorkshire based secondary schools with a high pupil premium. This was further divided into four distinct but related areas: year 7, 8 and 9 pupils, art and design teachers, senior school management and the wider community.

Year 7, 8 and 9 pupils were important participants; the project took place before GCSE subject selection, to make pupils aware of the benefits of studying a design course. The second group of participants were art, design and technology teachers. One key finding from research was the lack of professional development opportunities for teachers, so a stand-alone CPD programme was developed to enhance subject specific skills in knit design. As this is a specialist area within textile design, the intention was to introduce a variety of approaches that could complement existing teaching. In addition CPD introduced interdisciplinary science and design methodologies to support a new STEAM educational focus.

The third group of participants were the school senior management teams. One ambition was to engage with schools at a management level, to change the perception of design as a subsidiary subject, and demonstrate the value of thinking through making as a core of the curriculum. Finally, it was important to engage with the families of the pupils involved. Parental influence is key in subject choices and so the project had to communicate the relevance of design in the wider curriculum but also the potential of employability within the textiles industry, which remains an important employer in Yorkshire.

Over the course of two years teams of teachers from sixteen schools across the region attended CPD at The University of Leeds. Make Your Future's maker educator team delivered workshops in all sixteen schools, with knit-focussed work taking place in five schools, Thomas a Beckett, Wakefield, Guiseley School, Beckfoot Upper Heaton, Bradford, Leeds City Academy, and Allerton Grange, Leeds. These schools offered textile design as part of the key stage 3 Design and Technology curriculum however none of the school delivered any knit content within the textiles curriculum and not all of the schools achieved the pupil numbers required to run a GCSE textiles programme. The major challenge highlighted by schools was the ability to engage pupils with a creative curriculum beyond the traditional product-based approach. As design researchers we were keen to work together to offer alternative methods to introduce knit and develop resources that could adapt and evolve within the schools.

Make Your Future delivery

The project was delivered in three strands, CPD for teachers, in-school workshops with pupils and a regional exhibition of work produced by all participating schools.

CPD activity

A programme of knit specific CPD was held at the School of Design, University of Leeds over three sessions. Prior to the first session teachers were asked to complete a skills audit. Analysis of the skills audit highlighted that although most of the participants were educated to a first-degree level in design, few had experience of knit and most stated that they had little time to participate in personal development of textiles skills. Firstly, teachers learnt how to use the hand operated and CNC industrial knitting machines in the School of Design. Through this practice-based approach the participants were introduced to the unique properties of knitted fabrics. Whilst the participating teachers enjoyed the session, they could not see the relevance of knit on their teaching practice at this stage. Despite this it was important to ensure that teachers had this understanding of knitted fabric and it also generated an excitement for the materials and techniques.

Further CPD sessions demonstrated how these concepts could be used in the classroom. Two colour repeat patterns were produced on domestic, hand operated knitting machines. An equipment audit of participating schools highlighted that although some schools had these machines available, no staff members had the skill to use them. The repeat pattern project was structured so that it could be delivered to pupils over several sessions. A design was created using collage, and this was tested as a repeat using a quartering method. The design was transferred to a punch-card and finally knitted through to create an all-over repeat fabric.

In the final session only hand processes were used. Teachers were taught a freehand loop construction process which created "ropes" of knitted fabric. The importance of material choices was demonstrated through the experimental use of yarns in this process. Working in groups, the ropes were knitted together, again using hand process, to form large scale textile canopies, using integral shaping and tensioning to create three-dimensional form (figure 2).

Figure 2. CPD with teachers exploring form using free-hand loop construction processes.

Throughout the sessions the use of knit as a thinking process were stressed and explicit links to other areas of the curriculum were made. The concept of knit as a product was avoided.

In-School workshops

Whilst the CPD session were planned and facilitated by Jane Scott and Elizabeth Gaston, the programme of workshops delivered in schools was much more flexible. The content was co-designed by the teachers who were looking for activities that were be achievable over a short period of time and that would integrate aspects of the wider curriculum. The workshops were developed around research questions central to the work of Knit Design Research, and this flexibility provided a significant opportunity to change thinking through knit as a medium.

Workshop 1: Colour, light and pattern

The workshop investigated the effect of incident light quality on the perception of colour viewed and consequently the effect of colour on pattern perception (Gaston, 2016). Pupils were introduced to knitting using freehand loop-construction processes and produced lengths of knitted rope. During this session students recorded the effect of material use on the properties of the knitted rope. The knitted rope was used in two ways, demonstrating the effect of changing manufacturing parameters on fabric quality. Working in pairs, pupils produced self-supporting knitted vessels. Larger groups of pupils used the same material create an open, large scale knitted canopy. The importance of colour in design and how the perception of colour changes in different lighting conditions was analysed by pupils using coloured light to explore the difference in the patterns created (STEAM connections to physics).

Figure 3. analysing hand-made knitted ropes as a group.

Figure 4. Working together to Design and make forms.

Figure 5. Knitted outcome

Figure 6. Assembled Canopy

Figure 7. Pupils testing light effects of tensioned canopy in the dance studio.

Workshop 2: The nature of knitting

This workshop applied biomimetic principles derived from plant growth models to textile design using knit process. With direct links to the biology curriculum, the workshop began with analysis of how plants grow from individual cells into complex and varied forms. Using an indoor greenhouse with a selection of plants, pupils analysed the forms of leaves and flowers, and in groups they considered how the forms could be interpreted in 3D using knitting.

Plant morphology, through the process of differential growth has significant connections to the way that a knitted fabric is produced; stitch by stitch, and course by course (Scott, 2018). A knitted fabric is generated from an individual loop of yarn, inter-looped with those around it through repeated patterns of knitted stitches to produce a continuous and interconnected surface. This process is inherently sustainable. Rather than cutting out shapes from lengths of fabric, knit design enables each shaped piece to be produced to the correct dimensions, with no waste. Using knitting, material can be placed exactly where required to produce the necessary form and drape for the outcome.

Over two days the year 8 pupils worked in small groups to reconsider textile design using the differential growth models observed in plants as a programming tool to explore the potential to design complex 3D forms using conventional knitting techniques (figure 8 & 9). Students undertook analytical studies and interpreted their findings into fabric. Outcomes of the workshop included a range of knitted samples, many of which closely resembled the plant forms that acted as inspiration (figure 8, 10 &11).

Workshop 3: Knit manufacture; 4 days 4 technologies

Moving from hand knit processes to CNC knitting this workshop introduced pupils to a variety of ways to produce fabric, resulting in the digital design of three installation pieces incorporating self-portraits inspired by Julien Opie (figure 12 and 13). This workshop was process

Figure 8. Images of botanical source materials, visual analysis of growth and form, final design response.

Figure 9. Thinking through making in the Classroom.

Figure 10. Developing 3d Knitted forms.

Figure 11. Assembly line; fabrics assembled to cactus form inspired by indoor greenhouse.

driven, emphasising that whilst different levels of technology could be used for production, the knitted fabric outcomes had the same properties. Three days of the workshop took place in school, working from the simplest freehand loop production properties to machine knitting using domestic knitting machines. The final day of the workshop took place at the University of Leeds and the students experienced industrial hand and CNC controlled knitting machines. This enabled the workshop to integrate a range of STEAM content relating to materials, manufacturing and digital design.

Figure 12. Workshop 3. CAD Self-portraits.

Figure 13. Workshop 3. Detail from Knitted Installation.

Exhibition

The work from the workshops was presented at a professionally curated exhibition at Leeds Arts University (2018) and the University of Leeds (2019). Pupils, parents and senior staff were invited to a private view where pupils received certificates of participation. In addition pupils attended a day of textile workshops which in 2019 focussed on a design/technology interface. The knitted fabrics were exhibited as installations and hanging as a collection of vessels in the exhibition (Figure 14, 15 and 16). This provided an additional view on knit presented in an artistic

Figure 14. Biomimicry knitting on display at exhibition

Figure 15: Canopies exhibited as large installation

Figure 16: Vessels exhibited as hanging exhibit

and spatial context. Feedback from the exhibition was very positive with attendance from pupils, teachers, parents and families and school senior management teams.

Evaluation

Make Your Future is evaluated using a Theory of Change model developed by the Crafts Council and Flow, an external evaluation agency. The evaluation framework employs a range of data collection methods to assess the impact of the project on teachers, students and wider school networks.

What changed as a result of CPD?

A teacher survey was administered before, during and after the project to assess the impact of the process on teachers. In addition to this, the impact of the project can be demonstrated through informal conversations, emails and through the actions taken following both CPD and the school workshops.

The teachers were clearly engaged with knit as a process, within 24 hours of the CPD sessions, researchers received images of knitting in the classroom. All teachers reported an increased confidence in using knit within the curriculum and could see how the skills delivered through the CPD sessions were directly applicable to a classroom. Re-engagement with textiles practice was evident in much of the teacher reflection. A baseline score of 5/10 as a response to "How confident are you to teach a textile craft" before the CPD increased to 8/10 after the sessions.

> *"I would just like to say how good the CDP has been at Leeds University. It has been very inspiring on a personnel and professional level. Thank you for the high standard of preparation and teaching to enable to succeed in the tasks in such a short space of time" (Textiles Teacher, Thomas a Beckett School, Wakefield).*

An unexpected but welcome outcome was the formation of a network of textiles teachers who shared practice through an email chain, furthering their in-school support.

What changed for the pupils?

Each workshop began with pupils asked to draw a response to the question 'what is knitting?' The drawings included hats, scarves and jumpers. By the end of each session each group had been presented with a completely different perspective of what knitting is, and why it is an important making process now. Final feedback demonstrated how much they had learnt from the experience. At the end of each session pupils responded to one or two individual questions such as:

- What did you do that was creative?
- Did you use maths in your work?
- What did you do that was innovative?

Pupils answered articulately and confidently, demonstrating a high level of technical understanding:

> *"I have learnt how to use the knitting machine and how to hand knit. I even learnt the different designs like Fair Isle and jacquard and materials such as acrylic." (Pupil, Year 8.)*

However informal feedback also demonstrated that students could see the benefit of a creative education in careers such as medicine and law. The development of twenty-first century skills such as collaborative working was also evident from the feedback:

> *"I enjoyed the canopy the most because it gives us all a chance to put our work into a school project" (Pupil, Year 7.)*

Similarly, with risk taking, initially students wanted to control their own work but as the projects developed, they were happy to cede control to the group to produce a more impactful outcome.

The visit to the University of Leeds was very impactful, during a tour of facilities one student spontaneously stood at the front of a lecture theatre and delivered a lecture on what she had learnt during the project. Several students indicated that they would now consider higher education and a career in textiles.

An unexpected outcome for the teachers was that pupils who are behaviourally challenging engaged with the project and demonstrated persistence and concentration. At one school the project enabled an autistic pupil to engage in a mainstream school activity, to the surprise of his teachers.

What changed for art, design and technology teachers?

Teachers could demonstrate their improved skills in textiles and confidence to try new approaches to learning in the classroom, critical in widening the taught curriculum and demonstrating what a STEAM curriculum could be.

> *"The pleasure was all ours, what a great week and fantastic outcomes! Thanks so much for all the hard work, planning and time you both put into it. It really was a success because of your great ideas and knowledge, so thank you!" (Art Teacher, Guiseley School).*

Changes in one Yorkshire school as a result of the project included the reintroduction of GCSE textiles and A level textiles in the year following the project due to increased numbers.

Again, there were unexpected outcomes. One teacher commented that she had enjoyed working for an extended period of time, in a less

formal setting, with the same pupils. It had allowed her to get to know her pupils better and gave her an improved insight into their needs (Art Teacher, Allerton Grange School). Feedback from pupils also demonstrated that their relationships with their teachers had improved.

What changed for families?

Many pupils asked to take materials home so that they could demonstrate their new skills to their families, returning the next day with work produced by siblings and parents. This increased engagement from families has the potential to influence the uptake of creative subjects at GCSE and A level. One school reported that the project had created a buzz around the school and they had an increase in uptake of the GCSE textiles option and could run an A level textiles course after not having enough pupils at either level the previous year.

The main impact for families was evident during the final exhibition. Approximately 50 parents attended the private view of the exhibition each year. Families travelling from Wakefield, Guiseley and Bradford to view the student work. This is significant not only due to the distance travelled from Wakefield and Bradford, some families had never visited Leeds city centre before, but also because the exhibition happened several weeks after the workshops. This demonstrates that sustained interest and excitement in the project can be maintained beyond the classroom through additional voluntary participation. High quality work was displayed to professional standards. This allowed parents to understand how creative thinking can impact product and widen their experience of design.

What changed for School Management Teams?

In all cases the School management team engaged with the project. In the planning stage there had been indications available contact time would be limited, however in practice all schools gave their pupils as much time as needed on the project. At all schools, members of staff from different subjects came to join in and in one school the pupils taught the head teacher to knit using freehand loop construction processes. This head teacher saw the value of the project and proposed to develop an annual arts week for all pupils and create arts ambassadors. In another school a biology teacher demonstrated a full-scale, working model of a knitted digestive system. Knit was important in its manufacture as it allowed the production of a continuous three-dimensional tube using different materials. It allowed pupils to understand the scale of the digestive system and its position in the body and demonstrates a perfect example of a STEAM curriculum.

Make Your Future programme outputs.

Nationally the Make Your Future programme has succeeded in engaging with the delivery of art and design education through craft and making processes at key stage 3. The success of the project has seen the number of schools participating in the project increase from 16

schools in Year 1 to 23 schools in year 2. The demographics have been diverse; with an average of 44% pupils in receipt of Pupil Premium, and engagement with 4 special schools including 1 SEMH (Social, Emotional, and Mental Health SEN), 1 specialist autistic school and 1 School for the Deaf.

The CPD programme was extremely well attended, providing a total of 494 hours of CPD across the country in year 1 and 690 hours of CPD in year 2. The total number of pupils that participated in the project increased from 915 in year 1 to 1756 in year 2.

Future Craft Education strategy

The delivery of Make Your Future has provided the Crafts Council with a series of important partnerships and rich knowledge of delivering craft education with schools. Applying the research from Your Future is in the Making has been critical and implementing the findings though the Make Your Future programme has delivered a measurable change to art and design education in the participating schools. However to demonstrate a lasting change in the art and design curriculum, Make Your Future must underpin the development of a broader strategy for craft education across all phases. This will include:

- Testing the Make Your Future model in three new geographical areas, considering, for example, what new challenges we might encounter delivering the project in a rural setting, and what measures are required to ensure the same impact? What happens when we change our regional partner from a HEI to a different type of organisation? How can we link Make Your Future into other significant initiatives? Does this type of strategic implementation make a difference to the project's sustainability or approach?
- The development of a Make Your Future franchise model, for potential management by regional partners
- The growth of Crafts Council's Artmark Partner offer
- The relaunch of our Your Future is in the Making, and associated digital offer
- The development of a broader CPD offer for craft educators,
- A more robust craft careers offer, linked to the national Creative Careers Programme

Impact in Yorkshire

As a result of the exhibition Elizabeth Gaston was approached by Leeds City Council to develop a similar project in collaboration with Leeds Arts University for delivery at primary school level. Initial research has included an information gathering day of craft practice with primary teachers leading to a funding application.

Conclusions

Can reintroducing craft into the classroom change the perceptions of textile design by repositioning making as a tool for thinking? Evidence from this intervention developed by Knit Design Research as part of the Make Your Future programme would suggest that it can. Each group that participated in the project demonstrated new knowledge and a greater understanding of textile processes as a result of both the CPD for teachers and the workshops for pupils.

For Knit Design Research, working with secondary schools and the Crafts Council offered a new perspective on their research. The application of diverse methodologies including biomimicry and performance craft as methods to introduce the subject of sustainability from alternative perspectives was very successful. Students were able to see how science, art and design could inspire each other, and techniques such as the indoor greenhouse (workshop 2) provided direct contact with source materials to work from.

As design researchers, knit is a way of thinking about materials, technology and scale, not restricted by technology or limited to a specific outcome. By bringing this open and experimental approach in schools, and to CPD sessions, thinking and making formed the central activities, and discussions and ideas were able to evolve from this active process. For lasting change within the art and design curriculum, craft processes offer a method to reintroduce skill, risk and problem solving into the classroom. The global challenges presented by the textile industry require creative solutions, however these problems present a huge opportunity for innovation when supported by deep understanding of materials and making processes. Make Your Future provides an excellent short term model for intervention at key stage three, engaging secondary school pupils, their families, teachers, and school management in reactivating craft and making in school as a change agent across the curriculum. It will inform the development of a longer term solution that must include government strategy.

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Intervention without imperialism: An equitable approach to design research

Nneka Sobers

Abstract

Design, as an act of intervention, has the power to either perpetuate or dismantle systems of marginalization. Although the design's intention may be to help those in need, the act of helping may repackage structures of neo-colonialism. A person who has the power to help vulnerable communities possesses inherent privileges that directly or indirectly may create a relationship of control, dependence, and exploitation. Although the unbalanced power dynamic may be unintentional, it is the role of an equity-minded designer to consciously transfer power by supporting vulnerable communities, rather than saving them.

This paper examines a hybridized and anti-exploitative design research methodology that is unpacked through a case study of a community in Accra, Ghana. Through equity, self-determination, deep dialogue, and context-sensitivity, the design research approach resulted in the co-creation of a grassroots organized waste management system. In addition to achieving a collaborative design solution, the case study reflects on further notions of the role and mechanics of dismantling systems of oppression as a socially-conscious designer.

Introduction

Rooted in the idea of community and camaraderie, humanitarianism is the act of members of a community to assist another community that is unable to help themselves (Barnett 2011). Although intervening to help a vulnerable community may seem altruistic, help that is provided by a community of privilege may be a harmful exercise of dominance. The traditional approaches to intervention are rigidly top-down, lack inclusive and authentic local engagement, and resources may not be adequately disseminated due to a lack of accountability and coordination. This model of humanitarianism increases exploitation and unsustainable resource dependency of the recipient, which ultimately reinforces a paternalistic power dynamic. The indirect, subtle, or unintentional reinforcement of the interventionist having more power than the aid recipient(s) is a form of neo-colonialism. Since design is grounded in responding to human needs, holding design accountable as an intervention and rethinking its role is essential in making positive change without repackaging structures of neo-colonialism.

With the 2000 revival of Ken Garland's "First Things First Manifesto", there has been a shift in design emphasizing social context, rather than producing commercial outputs (Abdulla 2014). Since design research contextualizes the system that a design intervention is embedded in, this systematic inquiry provides an opportunity for designers to challenge and restructure systems of power embedded in design interventions.
In order to dismantle unequal power relationships between marginalized communities and those considered as the "expert", design interventions should be held accountable based on how it achieves opportunities for equity, self-determination, deep dialogue, and context-sensitivity. Illustrated in Arnstein's Ladder of Citizen Participation (Figure 1), there is a gradient of the quality and equity of design interventions.

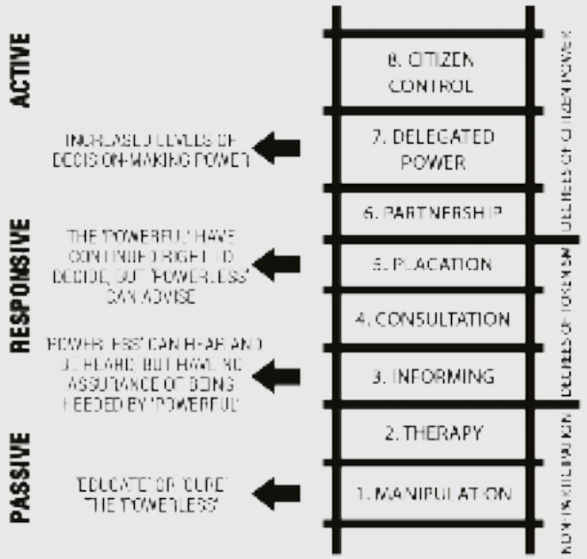

Figure 1. Arnstein's Ladder of Participation (Models of Participation)

Interventions that are the most transformative harness the power of those who are marginalized by creating a process where the community in need is authentically valued and engaged. Rather than perpetuating invisible systems of power through non-participation and tokenism, encompassing citizen power is the ultimate way of applying justice to an unbalanced system of power.

By emphasizing process over product and supporting rather than leading, design research can restructure new relationships between communities in need and those with the power to help. A new anti-exploitative design research paradigm, can challenge the presumptions of the privileged and dismantle the root of systemic issues, rather than simply responding to proximate causes of societal injustices.
This paper explores the principles and tools that create a new paradigm for anti-exploitative and equity-driven design research. The principles and tools introduced through my anti-exploitative process will be examined in the story of the Ayawaso East community of Accra, Ghana.

Due to a history of informal settlement patterns and limited municipal capacity, Ayawaso East's residents lack adequate essential municipal services, such as waste management. Tired of waiting for inadequate top-down interventions to improve local waste infrastructure, the residents of Ayawaso East would like to harness the power of local human capital and grassroots organizing to improve their waste management system. Although top-down stakeholders dismissed Ayawaso East's informal organizing endeavors as insignificant, Ayawaso East's community action is drastically helping residents reduce their risk of displacement and environmental degradation. Inspired by the passion of Ayawaso East's residents, I explored how design research catalyzed positive social,

economic, service, and environmental change, which resulted in the co-creation of a grassroots-operated waste management system for one of Accra's most vulnerable communities.

Ayawaso East: Case Study

As a way to explore the intricacies and potential of design as a tool for dismantling systems of oppression, I will reflect on my 2018-2019 work in Accra, Ghana.

Home to 4 million people, Ghana's capital city of Accra has experienced exponential economic growth and social progress in the past 20 years (Overview 2019). As one of the world's fastest-growing economies (McDonnell 2018), Accra houses the country's most powerful institutions juxtaposed to some of Ghana's most vulnerable communities. As Accra continues to grow, the city struggles with navigating how to improve the quality of life for its residents, while mitigating negative externalities of urban upgrading. Consequently, such rapid urban growth has resulted in controversial development and institutional voids that have disproportionately impacted marginalized communities, especially Ayawaso East.

Occupying an area of 2.5 km2 and housing over 95,000 residents, the Ayawaso East Municipality is the most densely populated community in Accra, especially Zones I, II, and III (Figure 2). Ayawaso East contains several neighborhoods, but its most identifiable neighborhood includes "Nima", which is referred to as a Zongo, which translates to "traveler's camp" in Hausa. Today, Zongos have become a vast network of settlements across Ghana's urban centers; however, Nima is reputed to be the most notorious Zongo in Accra due to its population size, low income, perceived high crime rates, and large-scale waste management problem.

Figure 2.
Regional Map

Contrary to the initial aspirations of Northern Ghanaian migrants temporarily moving to the zongo, many migrants permanently settled in Nima. Due to their religious and cultural differences, Nima's migrant population faced social and economic discrimination. As residents were excluded from participating in the mainstream economy, residents of Nima started establishing their own local business, which has contributed to a robust insular economy and active community organizing.

Figure 3.
Land Use
Map

Due to the population increase and informal settlement patterns (Figure 3), Nima being characterized as the densest and haphazardly built neighborhood in Accra (Kang 2010). As a result of the irregular development and street network that has extended from Nima to Ayawaso East, accessibility is extremely limited. The network of narrow alleys makes it difficult for residents to traverse through their

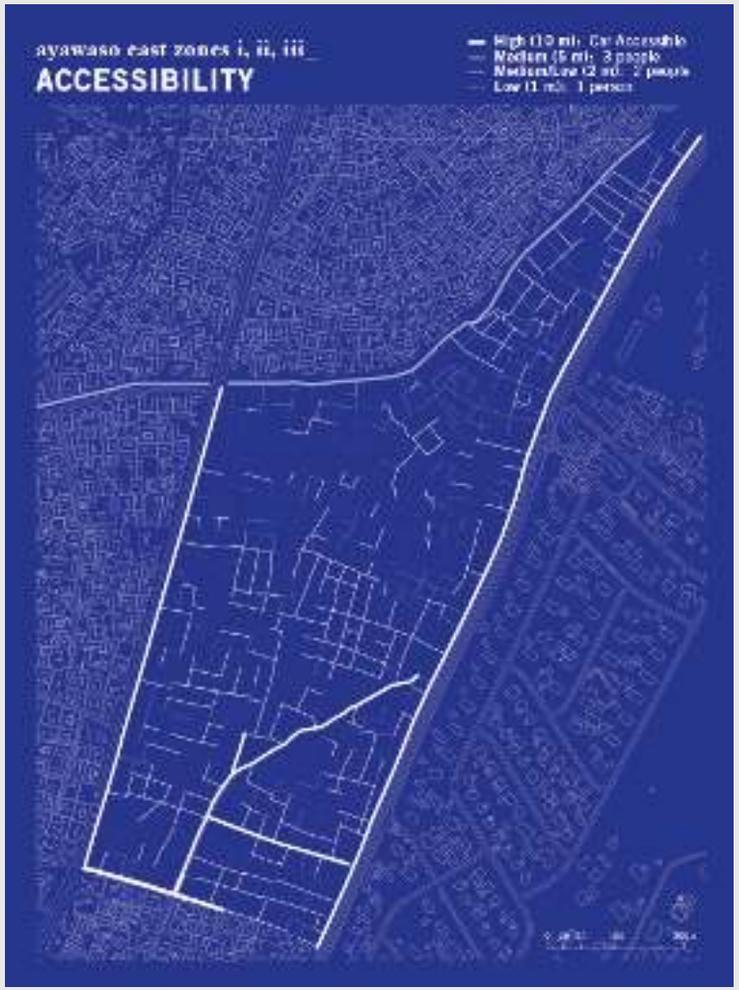

Figure 4.
Accessibility
Map

neighborhood and access essential services, such as emergency medical response and waste pick-up (Figure 4).

Although Alliance Waste is the official provider of waste services in Ayawaso East, the community's narrow streets make it impossible for Alliance Waste's expansive fleet to pick up waste (Mingle 2018). Since Alliance Waste's existing waste fleet cannot access Ayawaso East's residential interior, Alliance Waste only services several communal waste bins located on the peripheral neighborhood roads (Figure 5). These communal waste bins are leased to bin operators who charge residents to throw away their waste.

Figure 5.
Waste
Infrastructure
Map

Sometimes, residents walk more than ten minutes throw away their waste in informal communal receptacles and pay more than GH¢10-15 (USD $2-3) to throw away a week's worth of domestic waste (approximately 120 liters). Residents who are unable to afford the Pay-As-You-Go (PAYG) waste fee or walk to a communal waste bin resort to paying a disproportionately higher fee to throw away less waste; burn waste; or litter. Since many of residents are unable to afford the PAYG waste fee, littering, especially in public spaces, has caused extreme a public health and environmental hazard.

As a way to reduce litter and overcome Ayawaso East's infrastructural constraints, there have been controversial top-down interventions, which have sparked grassroots counteraction. Due to an active local economy,

urban centrality, proximity to the home of Ghana's President and Vice President, and relatively low land values, Ayawaso East has become an attractive site for luxury real estate development. Prospective real estate development is perceived as a catalytic opportunity to upgrade the challenging infrastructure conditions of Ayawaso East. Although attracting upper-class development would encourage developers to build new roads, sturdy housing developments, and adequate waste management, such top-down development would apply immense pressure of displacement and gentrification on Ayawaso East's existing population.

There have been several non-commercial interventions to directly improve Ayawaso East's infrastructure conditions; however, previous attempts have not been successful. The most significant top-down public-sector intervention is the incompletion of the 2016 Nima Drain project. After years of public planning and limited community engagement, National and City agencies declared a plan convert the local stream into a road and covered sewage system in effort to improve vehicular access and reduce litter from contaminating the local water source. Although part of the road infrastructure has been built, a pending political dispute has resulted in halting the project indefinitely. Consequently, it is uncertain when critical waste management and sewage infrastructure will be implemented.

Although the government and private organizations have a formal and top-down approach to waste management in Accra, their interventions and politics have failed the essential needs of Ayawaso East's residents. Frustrated by how the politics and controversy amongst privileged stakeholders have resulted in depriving the residents of Ayawaso East of adequate infrastructure, residents have informally organized as an alternative way to improve their environment and protect themselves from displacement.

Founded in 2010 by local resident, Ahmed Yaajalaal, VOiCE CIC is a center for local governance, leadership, and research dedicated to promoting youth participation in decision making and facilitating the implementation of socio-economic development projects in Ayawaso East (VOiCE 2018). In addition to engaging the community from within, VOiCE CIC works closely with a diverse set of stakeholders to promote transparency, accountability, equality, and self-reliance in Accra, Ghana. Since VOiCE CIC serves as a central local community resource, they are well-connected and support other grassroots initiatives in the Ayawaso East. The most robust VOiCE CIC-affiliated initiatives addressing local waste management issues is "Process Sanitation Team" (Figure 6).

Established in 2017, Abubakari "Abu" Issaka, a popular local activist, leads a volunteer-based waste pickup service. Every three-five days, Abu and his team identify and clean several blocks of their neighborhood, especially around the Nima Drain. Within a 1-hour clean-up session,

Figure 6. Process Sanitation Team

Process Sanitation Team collects upwards of 2,250 liters of litter, which equates to about nine 250-liter household waste bins.

Through the support of VOiCE CIC, Pride of the East school, and numerous local residents, Process Sanitation Team has gained great momentum. Such prolific and bootstrapped community support reflects how the residents of Ayawaso East are eager to support initiatives that help improve the health of their community and promote their autonomy.

Being a low-income and a majority Muslim community, residents, like Abu and Process Sanitation Team, do not have a lot of money and are unable to receive loans with interest, which limits the Team from accessing money to purchase materials needed to implement and scale their waste management initiative. Due to the constraints that systemic marginalization and extractive top-down interventions have created, Process Sanitation Team must find resilient ways to scale their crucial services. By relying on the trust and strength of their neighbors, the

creation of Ayawaso East's alternative and grassroots waste system is the ultimate act of resilience.

Design Approach

The story of Ayawaso East is a universal narrative of how a lack of access and misguided design interventions can perpetuate the marginalization of vulnerable communities. It is also a story of how community networks and grassroots initiatives are essential in filling the gaps of institutional voids. Community mobilization, as a form of social resilience, is a critical tool that is most common in marginalized communities. According to Gregory Fairchild, segregation has led to opportunities for marginalized peoples with limited resources because those who are marginalized have more tactic knowledge of the community's needs rather than outsiders. Ultimately, marginalized communities are able to reinforce trust and bounded solidarity within their communities, rather than an outsider externally imposing these bonds. Therefore, as a socially-conscious designer who wants to help, it is crucial to erase the "I" and "them" dichotomy and engage in a process that is collectively defined by "us".

Motivated by utilizing design as a catalyst for social impact, especially to help vulnerable communities like Ayawaso East, it is essential to redesign the role and approach of a designer and their intervention. Anyone who intervenes inherently possesses a position of power. As a person who has the resources and expertise to use design as an intervention, anyone who has the power to intervene should translate their privilege into the power of enabling equity in an unjust system. Traditionally, design has invoked leader-centered assumptions and a deficit-based approach to problem-solving. Instead of positioning the designer as the center of change, the anti-exploitative role of a designer is to become an ally and have a support-oriented process enabled by deep dialogue. As Paulo Freire warns, "leaders who do not act dialogically, but insist on imposing their decisions, do not organize the people–they manipulate them. They do not liberate, nor are they liberated: they oppress".

Hybridizing processes from user experience research, participatory action research, and appreciative inquiry, I have developed a comprehensive anti-exploitative design research methodology that promotes equity, self-determination, context-sensitivity, and design resilience. Although design research processes may change depending on the discipline and project parameters, my proposed design research method applies to all user-centered design.

As illustrated in Figure 7, the anti-exploitative approach to design combines exploratory, generative, and evaluative research methods that foster trust, value, build on local-knowledge and problem-solving, and enable authentic choice-based and dialogic engagement. Facilitating mutual engagement that emphasizes "what is working",

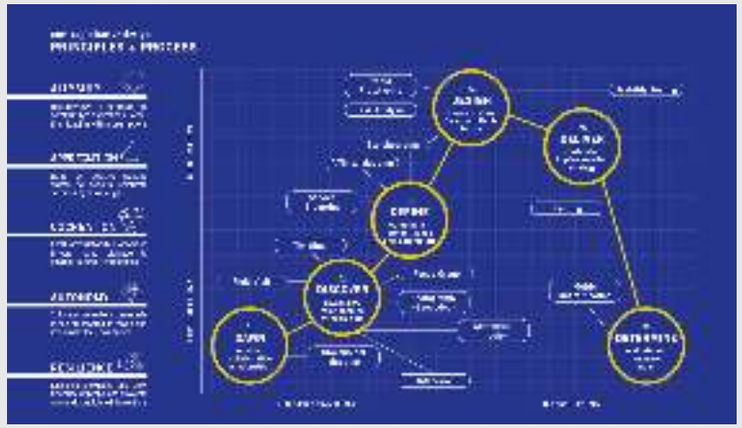

Figure 7 Anti-Exploitative Design Methodology

a positivist approach, rather than "what needs to be fixed", a deficit-based approach, shifts the role of the design interventionist from being a design savior to supporting the community to make self-determined change. "It reframes the project to one that is mutual- "acknowledge[ing] users as active participants and partners rather than as passive repositories of "lore" to be [mined]" (Abdullah 2014).

In this section, I will introduce the anti-exploitative design research methodology and explain how I integrated it into my work with the Ayawaso East community.

Stage 1- Dawn

In contrast to the traditional design process of initiating research by defining the problem, I initiated my research by researching and cultivating relationships needed to lay the foundation for change. By embedding oneself in the community they are designing with, one can build trust and co-establish an approach that embraces local knowledge, perspectives, and priorities.

Although some aspects of the "Dawn" stage can be completed remotely, the "Dawn" stage is most effective when conducted in person. Therefore, fieldwork is essential for understanding a first-hand account of the community's context. Before my initial field visit to Ayawaso East, I researched the history of Accra and community organizations in Ayawaso East, which serves as introductory knowledge to identify who would be ideal stakeholders to engage. Through my stakeholder mapping exercise, I discovered the work that MCI created during their Nima Drain project. Although MCI is a non-local stakeholder and a more neutral party in the Nima Drain project, they provided me with specific contact information on local partners and spatial data, which was critical information that was not readily available online. Not wanting to be limited by MCI's existing network, contacts provided by MCI provided an initial foray into building my unique network of connections in Ayawaso East.

Upon arriving in Ayawaso East for fieldwork, I visited all potential local partners in-person, which is how I become acquainted with Ahmed Yaajalaal, Founder of VOiCE CIC. By being transparent about my research intentions, asking for permission to work with and engage local residents, and building trust within VOiCE CIC, Mr. Yaajalall then connected me with more community partners, which compounded into developing numerous deep relationships with local organizers and residents, including Abu of Process Sanitation Team.

Stage 2- Discover

In order to capture a story as complex as Ayawaso East, design research must capture the community's context by gathering and synthesizing qualitative and quantitative data. During the "Discover" stage, the overlay of data will begin to reveal trends, systems relationships, motivations, priorities, and initiatives which can be interconnected and augmented through the design process. By collecting many stories from local and diverse stakeholders, these positive stories reveal which existing community assets to expand on in order to overcome contextual challenges.

When establishing my quantitative analysis, Ayawaso East's existing spatial data was limited to hand-collected GIS data gathered through MCI's Nima Drain project. Due to the common constraint of informal communities lacking robust data and VOiCE CIC's mission of collecting more data on Ayawaso East, it was essential to utilize democratic data collecting tools to help the community update and improve their data collection. "For citizens to be able to influence decision-making in government or the private sector, they need to be able to access, use and control data relevant to them. In other words, they must be empowered by data" (Pawelke 2018).

New tools that I introduced to VOiCE CIC and other residents who were interested in collecting data included free crowdsourcing tools such as Mapillary (platform for crowdsourcing geotagged photos) and QGIS (open-sourced geospatial tool).

When gathering qualitative data on Ayawaso East, my primary methods included contextual inquiry, interviews, focus groups, stakeholder mapping, and geolocated photography. By having permission from community members established in the Dawn stage, I arranged to follow 50 diverse residents around for 1-8 hours of their day. By observing consenting residents, I learned more about mundane aspects of their everyday lives, the experience of living in Ayawaso East, and the issues they care about most. Through contextual inquiry's semi-structured format, I structured my inquiry by reintroducing myself, describing the intentions of my work and collaboration, asking about pressing local matters that residents care about, and ideas they had about overcoming such matters.

While my contextual inquiry was designed to sample a diverse cross-section of local residents, my interviews targeted specific community stakeholders. From interviewing local activists to business owners and government officials, my purpose was to identify the capacity, perspective, and goals of each key stakeholder, which served as the foundation of my stakeholder mapping exercise (Figure 8).

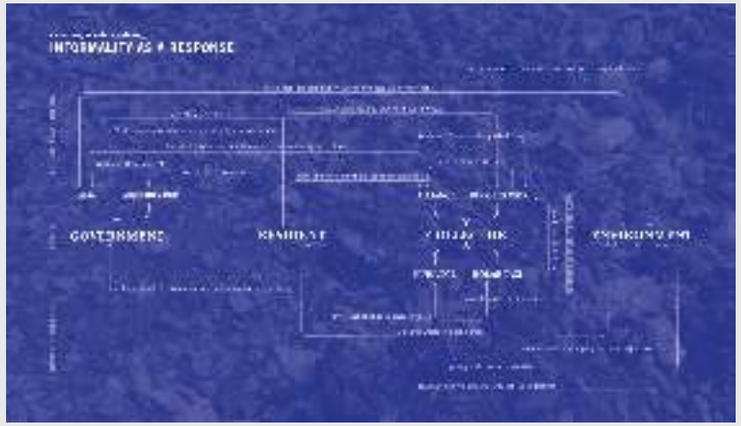

Figure 8: Waste Service Blueprint

In addition to interviewing 35 select stakeholders, I facilitated 5 focus groups, which ranged from 8-20 diverse residents per session. Appreciative of the time residents volunteered to help me, I hosted the focus groups during manageable hours in easily accessible spaces and provided snacks. The focus group activities included storytelling and documenting what inspires the participants to take action, how participants get their neighbors to contribute to their cause, and challenges they may experience when organizing.

Stage 3- Define

By eliminating any presumptions about the community's context, the designer can equitably co-define what problem should be addressed. Co-definition is key in eliminating the power imbalance been a designer and the community they are helping. By providing space for the community to share their concerns, priorities, and ideas, the purpose of the designer becomes more about what capacities, expertise, and tools the designer may have to support the community's aspirations for the future.

By analyzing the data from qualitative research utilized in the Discover stage, I organized my discoveries using affinity mapping and service blueprinting. The affinity mapping exercise unveiled that residents were most passionate about projects relating to improving their local infrastructure, particularly waste management. The service blueprint identified the actors, behaviors, and connectivity and gaps in the existing local waste management service. Through a quantitative assessment, spatial patterns revealed that Ayawaso East's informal settlement

pattern has made it difficult for resource vehicles, like waste trucks, to serve the community. Due to the alarming amounts of waste in Ayawaso East and unsuccessful municipal action, residents were inspired to take local action by picking up litter.

Through volunteer assistance and donations, residents encourage and recognize that the work of Process Sanitation Team is an essential service needed to overcome the precarious state of waste in Ayawaso East. Since Process Sanitation Team is a volunteer-based initiative; the viability of the organization is dependent on people donating their time and resources. Abu expresses his desire to make the organization more reliable and robust. "Although my community and I are passionate about the work of [Process Sanitation Team], it is sometimes hard because we do not have enough [donated] money to throw away our trash after the clean-up. Or sometimes people cannot afford to volunteer because they need money for their time. I wish there was a more reliable way to pay volunteers with water or other [resources] instead of money", Abu stated.

By uncovering and linking community needs (ie. waste management), existing positive assets (ie. Process Sanitation Team), and my design capacity (ie. time, skills, and budget), active community stakeholders and I co-defined the project scope as developing a way to extend Process Sanitation Team to a sustainable community-run waste management system. Developing a problem statement and project objectives foster transparency between the designer and the community while holding the project to a set of standards that can be measured during the "Determine" phase of this process.

Stage 4- Design

Now that the intervention scope and context parameters have been established through the Discover and Define stages, the Design stage translates community aspirations and project scope into targeted actions. The Design stage is an iterative and collaborative process that consists of projective and constructive approaches that balance collective visioning and project feasibility.

Projective methods emphasize product ideation, which includes a diverse range of ethnographic tools like additional contextual inquiry, interviews, and task analysis. Since Constructive methods are centered around concept development, tools utilized in this approach include charrettes, rapid prototyping, and usability testing.

When utilizing projective Design methods, I assisted Abu and other members of Process Sanitation Team during routine waste pick-ups. This first-hand experience of waste pick-up gave me invaluable insight into the logistics needed to clean Ayawaso East, new relationships with key partners and resources needed to upcycle and safely dispose of waste, and tools that would help Process Sanitation Team overcome labor and financial inconsistencies.

Inspired by Process Sanitation Team's unique approach to filling in waste service gaps through volunteer litter clean up and upcycling plastic waste into public trash cans, animal feeders, and other community-specific tools, I developed an urban design logistics guide and barter-enabled community organizing app that would help coordinate existing waste management initiatives and scale them to sustainably and efficiently remove more waste in Ayawaso East, all while maintaining community ownership and autonomy of their grassroots-managed infrastructure system.

The first tool designed to address Ayawaso East's waste management context included a logistics guide to manage and uniquely utilize locally-generated waste, "A Cleaner Nima" guide (Figure 9). Based on urban design principles, the guide identifies priority sites of waste cleanup, integrates local waste removal practices into a regional waste stream, develops strategies for waste upcycling, and establishes the foundation for a circular waste-based economy.

Figure 9. Urban Design Waste Manual (A Cleaner Nima)

Expanding on existing community behaviors, such as grassroots organizing enabled by social media broadcasting and informal bartering to overcome monetary constraints, I developed the "Nima X Change" app, which is a personalized project management tool that helps community organizers formalize and aid in community initiatives through barter-based exchange (Figure 10). By using the app, Abu and other residents could facilitate waste clean-up sessions, collect donated resources, manage and compensate Process Sanitation team

Figure 10. Nima X Change app process

volunteers.
Both the urban design guide and app tool respond to specific findings addressed in the Dawn, Discover, and Define stages of the anti-exploitative design methodology. The tools designed can be used complementary of each other to enable Ayawaso East's first holistic and grassroots-operated infrastructure system.

Stage 5- Deliver

Since all the designs were developed through extensive collaboration between the designer and the community, establishing sustainable ways to implement the interventions is inherent to the anti-exploitative design approach. By identifying and integrating the capacities of key stakeholders during the Dawn, Discover, and Design stages, the Deliver stage communicates specific tasks and strategies with community members who have committed to upholding the intervention. This stage is crucial in transferring power from the designer so that the community self-governs and evolve their initiatives without further external intervention.

In order to devolve my participation, I organized group meetings with all self-identified community project implementers, particularly Process Sanitation Team and VOiCE CIC. During the meetings, I served as a facilitator while Process Sanitation Team and VOiCE CIC's team discussed a collaborative strategy on how they would like to carry out Ayawaso East's community waste infrastructure plan. In addition to facilitating implementation discussions and transferring my design materials to key stakeholders, I also suggested future resources that community organizers could utilize to evolve their project. An example includes integrating Code Academy training, a free online coding education platform, into VOiCE CIC's existing youth education and capacity-building initiative. By training residents how to code, VOiCE CIC will be able to continue its successful work on helping Ayawaso East learn valuable skills that may help reduce existing high unemployment skills, and allowing residents to modify the app as it continues to change post-implementation.

Stage 6- Determine

Even after the designer's active participation has ceased, evaluating the impact of the project helps the designer understand the usefulness, usability, quality, and impact of their intervention. In the Determine stage, the designer will evaluate the project's progress after 6 months – 1 year after implementation.

Trust from the community does not stop after a project is designed. By continuing dialogue to understand the community's experience during and after the intervention process allows the designer to reflect on and grow from their anti-exploitative practices. An impact measurement plan is best when based on a theory of change. Breaking down the anti-exploitative design research principles and project objectives

into quantifiable metrics serve as key performance indicators (KPIs) to objectively assess the impact of the intervention (Figure 11). In order to ground impact measurements in evidence-based claims, establishing

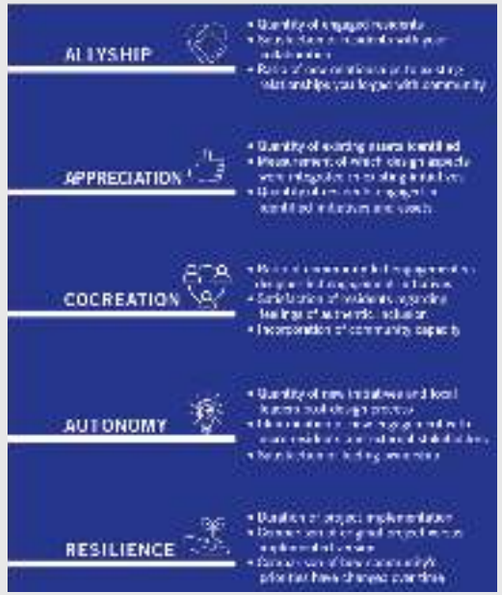

Figure 11: Establishing KPI metrics

KPIs is paramount in claiming impact with confidence (Reynolds 2018). As I closed the Design stage of my research in January 2019, I am continuing aspects of the Deliver stage. I plan on conducting the Determine stage 1-year after the Deliver stage has been completed.

When measuring the impact of Ayawaso East project, there are several dimensions to assess: the anti-exploitative relationship between the designer and the community; and the catalytic nature of the process and product of the intervention.

The role between the designer and the community must be reflected on from two perspectives. As a designer, I actively fostered an anti-exploitative relationship by consistently positioning myself as a support resource rather than a project leader. Also, all the tools that I co-developed were an extension of existing community knowledge and initiatives. From the community's perspective, I helped expand their network of resources. By connecting them to relevant stakeholders and tools to help them implement and evolve their waste management project, enables the community to continue to be self-sufficient without my direct assistance or any future help.

Although the development of "A Cleaner Nima" guide and the "Nima X Change" app were pivotal technical resources to further the community's endeavors, the most transformative aspect of the Ayawaso

East waste management collaboration was the design process. Since the community has the autonomy to implement and evolve their waste management system, the method and tools that the community uses today may not be the ones that they choose tomorrow. Regardless of what tools they may choose to utilize, the experience of co-developing a waste management strategy and connecting the community with resources/training to implement their project is fundamental in transferring knowledge, capacity, power to ensure resilience and self-mobilization of the community, rather than perpetuating dependence on the designer.

Conclusions

In a world abundant with resources, a person may be compelled to help combat adversity and injustice. Problematic models of helping those who are marginalized centers the interventionist as "the voice for the voiceless".

Design as an intervention has the power to shape systems and the lives of people who engage within it. Therefore, the design process must be refined in a way that increases accountability and context-sensitivity of the impact of design interventions. Developing an anti-exploitative design research methodology is key in enabling empathetic practices and practitioners.

The story of Ayawaso East is a ubiquitous reality of systemic marginalization, extractive interventions, and the power of grassroots organizing for community resilience. By developing a hybridized anti-exploitative design research model, I navigated the role of the designer in facilitating a process and designing an intervention that authentically disrupts power hierarchies. My design research experience in Ayawaso East reveals the essentiality and interconnectedness of collaboration, transparency, support, social capital, and local knowledge and imagination as the means for promoting equity and autonomy in marginalized communities.

Being inspired and directed by the community is a humbling and transformative experience for both the designer and the community. By building on local knowledge and positive existing assets in Ayawaso East, the anti-exploitative paradigm of design research resulted in the co-creation of the two distinct tools, as well as augmenting local residents as the interventionists of their existence and the self-liberation from the power imbalance of the designer and greater network of oppression. However, reducing the designer's power does not mean giving up the fight against injustice. In fact, "when [a designer has] the privilege of power and influence and can see that others are being denied their rights, [designers] can continue to speak out against injustice. But even in those circumstances, … [the] end goal should be to work and change the environment that has imposed the silence" (Registre, 2017).

As scholar Ananya Roy states, "there is no such thing as 'the voiceless'. There are only the deliberately silenced, or the preferably unheard". Ultimately, anti-exploitative design research has the power to dismantle unjust power systems by celebrating the voices of marginalized communities, rather than speaking for them.

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Material reality to materiality: Ocean plastic and design research

Katherina Vones and Ian Lambert

Abstract

With approximately 5 to 13 million tonnes of plastic waste being deposited into the marine environment every year (Jambeck et al., 2015), oceanic plastic pollution is approaching catastrophic levels. This figure is widely used across the news media, although Jambeck et al. also state that, "[…] no rigorous estimates exist of the total amount and origin of plastic debris in the marine environment" (2015, p.768). As large islands of plastic waste such as the Pacific Gyre (more commonly known as the Pacific Garbage Patch) amass through the forces of intercontinental currents (Law et al., 2010) and microscopic plastic particles enter the food chain, serious consequences on the delicate ecosystems of marine life, and ultimately human health are becoming more apparent (Wright et al., 2013). Remote beaches in the pathway of oceanic currents, such as those on the West Coast of Scotland, become repositories for discarded ocean plastic (Barnes and Milner, 2005), with only a small percentage of the total amount being usefully repurposed by locals. The rest is left to photodegenerate, breaking into ever smaller parts and being washed back into the sea or ingested by local wildlife (Seltenrich, 2015). Ocean plastic therefore represents a serious environmental threat as well as an underused material resource freely available to local populations.

Introduction

In recent years, the problem of ocean plastic has received increasing attention from the media and as a consequence has gained wider public recognition. In the UK, this increasingly applied after the broadcasting of the episode "Our Blue Planet" in 2017, which forms the final part of the BBC's popular Blue Planet II series (Honeyborne, 2017). Presenter Sir David Attenborough examined the effects of anthropogenic activity on the world's oceans, and reported that plastics, along with rising temperatures, were the biggest concerns currently facing the marine environment. An article featured in The Guardian newspaper previously reported estimates of up to 12m tons per year (Gould, 2015). As far back as 2010, an episode of BBC Radio 4's Costing the Earth (Roberts, 2010) provided a detailed report on the above mentioned Pacific Gyre. This is a mass of plastics floating on or just below the surface that has collected in the north Pacific Ocean, approximately twice the size of France (Callan, 2014), although estimates of its size vary. It is in fact one of five gyres (Cózar et al., 2014). Costing the Earth (Roberts, 2010) reported that plastic litter on beaches has doubled since 1994. Today, there are many groups around the world trying to address the problem, with numerous attempts to retrieve plastic from the sea and coastlines, to others at reducing single use plastics and the amount of plastic entering the oceans in the first place. Environmental organisations such as Parley for the Oceans aim to foster public awareness and encourage a more meaningful engagement with the ecological implications of ocean plastic on a commercial level by engaging business partners such as G-Star RAW, Adidas and Stella McCartney in collaborative projects (Parley for the Oceans, 2019). While the resulting "special edition" products successfully utilise remanufactured ocean plastic as a composite material, these initiatives are often short-lived and economically unsustainable in the longer term. Individual designers such as Studio Swine, through their projects Sea Chair (Swine, 2012) and Gyrecraft (Swine, 2015) have taken a more experimental approach, by focusing on the process of directly harvesting the raw material from the sea and then devising original in-situ manufacturing approaches to create thought-provoking objects that draw attention to the underlying ecological issues.

There are multiple challenges. Retrieving marine plastic is immensely difficult: much of the plastic (up to 60%) in the ocean consists of particles less than 1mm in size (Roberts, 2010). The National Geographic (Evers, 2014) estimates that up to 70% of the plastic forming the large gyres sinks to the ocean floor: "[…] The seafloor beneath the Great Pacific Garbage Patch may also be an underwater trash heap." Once retrieved, the plastic needs to be cleaned of salt and micro-organisms that might contaminate recycling, but even then, ocean plastic can be exposed to ultra violet light for many years and photo-degenerates. This, along with continuous contact with salt makes the ocean plastic extraordinarily plastic brittle. To enter it back into the recycling stream it requires to be mixed with other plastics retrieved through waste disposal on land and a certain percentage of virgin plastics. In 2014, trade publication Packaging News announced that environmentally conscious detergent brand Ecover had launched bottles made from ocean waste plastic but then states that it "…is made entirely from recycled plastic, with 10% collected from the sea." (Corbin, 2014). This low percentage of ocean plastics is further elaborated upon by Ecover's Philip Malmberg in an earlier article published by newspaper The Guardian: "It will always depend on the amount and quality of the plastic they [the fishermen] have managed to fish." (Smithers, 2013). Online technology magazine Wired reported that soap manufactuer Method had also used bottles made from a blend of 10% ocean plastic and 90% other recycled plastic for their packaging in 2012 (Hurst, 2012), although an earlier report claimed this would be 25% (Guevarra, 2011). Method (Method, 2015) advised that firstly this was due to the short supply of ocean plastic – it is difficult and costly to collect in the reliable quantities needed at this scale of manufacture – and also confirmed that ocean plastic was of a lesser quality due to a combination of the photo-degeneration and salt (Method, 2015).

Given the enormity of the problem, individual attempts may seem futile, but as part of a combined global effort of activism stimulated by design research in conjunction with targeted public engagement can make an impact. We make no claim for this project to as a solution to the problem – indeed, experiencing the extent of the ocean plastic problem in remote places such as the Outer Hebrides first hand has emphasised to this team of researchers that individuals can only have a relatively limited impact on the conversations that need to be had in

order to generate a meaningful solution. It is a small gesture intended to bring further understanding to the wider public.

Objectives of the research

So far, the difficulties inherent in obtaining and working with ocean plastic have prevented a comprehensive engagement with this material in a larger context. The concept of ocean plastic as a viable material for design, manufacturing, remanufacturing and recycling has not been explored to its fullest degree. Conventional methods of recycling, such as industrial remanufacturing or depolymerisation, are currently unviable both economically and from an environmental point of view, mostly due to the cost of collecting and transporting ocean plastic to centralised industrial facilities and quality issues connected to foreign particle contaminants having entered the plastic during its lifecycle. Ocean plastic therefore represents a serious environmental threat as well as an underused material resource freely available to local populations. Applying a systemic approach to this circular process allows locals to experiment with materials and processes and discover novel ways to repair, repurpose and remake objects from ocean plastic, encouraging skill sharing and community education. As 3D printing is gaining ground both in popularity as well as general availability, exploring strategies for remanufacturing ocean plastic into 3D printing filament suitable for FDM printers was specified as an intended outcome of the project.
At the core of this research was fieldwork involving site visits to locations on the Isle of Harris, where nautical currents have turned local beaches and secluded bays into large ocean plastic 'repositories', spread over a period of six months. More specifically, the coastal areas on the West of the Isle of Harris were targeted for their potential to attract large amounts of ocean plastic predicted by marine surface modelling (Sherman and van Sebille, 2016). The site visits were conducted in August and March, enabling the observation of the effects harsh winter weather has on plastic distribution and accumulation in the chosen locations. The weather during our second trip in March was too inclement to consider a repeat visit to the Islet of Scarp, but data from a previous site visit in 2015 nevertheless provided a basis for comparison.

Each site visit involved scoping and documenting what ocean plastics are available by collecting a range of samples from different locations, including those that are only accessible by boat. Small samples of those plastics identified as viable for remanufacturing were brought back to the Edinburgh Napier University Polymer lab to be analysed and evaluated for quality. This involved exploring how they could be cleaned, pelletised, desiccated and subsequently remanufactured into 3D-printing filament for use in FDM 3D-printers.

At the end of the project, educational workshops held at two local high schools and at the bi-annual Research Through Design Conference served to share the material knowledge developed during this project,

providing pathways to feed research findings directly into secondary education and to specialist, informed, audiences.

Location of the research

Following an initial visit to the Isle of Harris in the outer Hebrides on the West Coast of Scotland by one of the researchers in 2015, the Islet of Scarp was identified by the research team as a location of interest to the project with a very high concentration of plastic waste being washed up on the South-West facing beaches of the Islet, particularly the Mol Mor inlet (Figures 1 and 2). By consulting the oceanic current models developed by (Maximenko et al., 2012), (Lebreton et al., 2012) and (Sherman and van Sebille, 2016), the team extrapolated that the likelihood of beaches with a West or South-Westerly orientation on the West Side of the island to contain significant accumulations of Ocean Plastic was greater than of those with a Northern orientation, or those on the East side that face the Scottish mainland. In this respect, the research undertaken by (Neumann et al., 2014), while not directly focusing on the beaches of Scotland, offers an excellent visualisation of the types of oceanic currents that may affect exposed areas situated in the Northern hemisphere. The multitude of small inlets situated along the coastal landscape of the Isle of Harris, some of which culminate in substantial sea lochs, provide a comb-like structure that traps marine debris amongst the rocks of Harris' dramatic coastline. Anecdotal evidence gathered during the two field trips from local populations suggests that many of these marine debris deposits exist in remote and practically inaccessible locations of outstanding natural beauty. It is the peculiar irony of the Anthropocene that geographical areas mostly untouched by human presence are amongst the worst affected by marine debris.

Figure 1. The Mol Mor on the Islet of Scarp in August 2018. Note that from afar the beach looks prisitne.

Figure 2. The Mol Mor covered in ocean plastic as seen in 2015.

Fieldwork and initial findings

After receiving funding from the Carnegie Trust for the Scottish Universities in 2018, a team of researchers travelled to the Isle of Harris in the last week of August 2018 for a seven day field trip (Figure 3). Documentary filmmaker Dr Diane MacLean accompanied the team on this field trip in order to facilitate interactions with local populations known to her from previous visits to the area that formed part of her extensive doctoral research on the oral histories of the Islet of Scarp (MacLean, 2014). The following objectives were identified by the team prior to commencing the fieldwork:

- Revisiting the Mol Mor on the Islet of Scarp to investigate whether there had been significant change in the accumulation of Ocean Plastic debris since the first visit in 2015.
- Surveying the area around Scarp for further significant accumulations of Ocean Plastic debris. This included gaining access to more remote locations, particularly the sea lochs north of Scarp, by liaising with local farmers and fishermen.
- Surveying several beaches along the South West coast of the Isle of Harris to assess whether Ocean Plastic Debris is present. Beaches that were targeted included those located around Hushinish, Gobhaig, Borve and Rodel.
- Visiting the two secondary schools (Sir E. Scott School in Tarbert on the Isle of Harris, and Mallaig High school on the West Coast) that were previously identified as locations for conducting public engagement workshops.

On visiting the targeted locations, the team decided to collect a representative selection of Ocean Plastic samples to analyse and experiment with in the Polymer Laboratory located at Edinburgh Napier University. The samples collected ranged in size between 2 and 40cm, and included broken parts as well as whole objects. The team aimed to gather as wide a variety of plastics as possible. Despite the existence of the polymer recycling code system, most plastics that have been through the rugged environment of stormy seas and rock-strewn coast lines, were found not to contain such hints to their material origins, so the team used their own judgement in selecting the samples. Another criterion in selecting the samples was to pick those with an attractive array of colours, as the intention to eventually turn them into 3D-printing filament added the consideration of an aesthetic element. The use of photography as a research method was employed extensively, both in recording the location of Ocean Plastic samples, the environmental issues that were witnessed and later as a tool for in depth analysis in the laboratory.

Figure 3. Katharina Vones & Ian Lambert on a remote beach at Loch Tamnabhaigh.

The Islet of Scarp is only accessible by boat, and the team's first attempt to cross the short distance between the pier at Hushinish and the landing on Scarp was foiled by an increasing swell of the sea. Scarp has not been permanently inhabited since the 1970s (MacLean, 2014), and the only human presence on the Islet is contained within a few cottages on the site of the old village during the summer months. There are no footpaths on Scarp, and the Mol Mor beach is only accessible by scaling a steep hill and subsequently descending through marshland towards the rugged coastline. Even as high as halfway up this hill, evidence of marine debris could be detected, possibly deposited there during the stormy winter months. If this debris is left undisturbed, it gradually degenerates, slowly sinking into the fabric of the boggy landscape. This is a phenomenon we witnessed at multiple locations (Figures 4&5) and is one of the most insidious environmental issues to be tackled. Once the plastic debris is thus embedded in the landscape, it becomes incredibly difficult to remove and needs to be extracted manually, piece by piece. Furthermore, as harsh environmental conditions deposit soil, stones or sand on top of the embedded debris, strata of plastic waste are formed

and become a fossilised element in the landscape. We witnessed such stratification on the cove-like beach at the small hamlet of Gobhaig (Figure 6), where locals had reportedly been observing this process since the 1980s. These direct observations confirm the model of marine plastic pathways proposed by (Critchell and Lambrechts, 2016), and worryingly point to the eventual degradation of these stratified layers into microplastics that finally enter the water table and food chain.

Figure 4. A crate that has sunk into a boggy marsh and been overgrown by mossy algae. This was seen on a beach only accessible by boat near Loch Tamnabhaigh in August 2018.

Figure 5. A thick plastic rope that has been swallowed into the fabric of the soil on the Mol Mor, as seen in August 2018.

Reaching the Mol Mor beach itself was an eye-opening experience for the team. The beach is completely covered in large quantities of marine plastic debris as far as the eye can see. A recent drive by the local community to gather the ocean plastic was still evidenced by large white bags, filled to the brim with plastic objects and awaiting collection (Figures 7 and 8). However, it is currently unclear when such a collection

might take place, as the beach is not easily accessible even from the water and needs to be landed on with a dinghy. Despite a tentative agreement having been formed between local pressure groups and the fishing industry to undertake this arduous task, it depends entirely on the goodwill of individual companies. We saw similar large bags of collected ocean plastics in several other beach locations on the Isle of Harris, but as of our last visit in March 2019 they had been untouched. Images of the beaches strewn with larger objects may elicit a more sensational response from viewers, but these are in fact easier to collect. The bigger problem by far are the smaller fragments embedded in the rotting seaweed, sand, earth and under rocks and stones (Figure 9). These are more difficult to collect and are the types of items inadvertently eaten by sea creatures, through which they enter the human food chain and also kill birds and mammals (Furness, 1985, Moore, 2008). Collecting plastic washed up on beaches is one place to start; however, plastic debris that comes ashore can easily be taken back by the sea during the stormy winter season.

Figure 6. Plastic stratification on the beach at Gobhaigh, as seen in March 2019.

Figure 7. The Mol Mor in August 2018, facing South. Note the large bags of gathered plastic waiting to be collected.

Figure 9. Plastic fragments entangled in seaweed and driftwood on a beach near Rodel, as seen in August 2018.

Visiting a location like the Mol Mor really emphasises the scale and materiality of the global ocean plastic problem. The objects we saw included those from a domestic environment (bathroom fixtures, shoes, brushes, broomheads, plastic bottles and bags), as well as those clearly related to the maritime industries (including fish farms) and nautical activities (crates, wellingtons, buoys, packaging materials, parts of fishing implements, different kinds of rope) (Figure10). The latter category forms the majority of the waste we discovered on the beaches of the Isle of Harris, and suggests that a more holistic approach including close involvement of global maritime and nautical industries and central government is required to even begin addressing the problem of ocean plastic. Some of the plastic objects found intact on these beaches, such as PVC pipes, undamaged fishing nets, tubs, crates, buckets and lengths of rope may be reclaimed by local populations to reuse, but the majority of the plastics we saw was in fragments. One local resident explained that the variety of objects coming ashore on one beach had in fact declined since the mid-1990s. This coincided, she believed, with the time that New York had stopped dumping its rubbish in the sea (MacLean and Lambert, 2015). Nevertheless, there was still a vast array of objects and many different types of plastic were initially identified: PVC, PP, HDPE, LDPE, PET, PS, nylon, rubber, acrylic. Subsequent, more detailed, analysis in the laboratory confirmed these findings, but suggested that the plastics most plentiful in the visited locations were in fact HDPE, PP, Nylon and PS.

Material reality to materiality

Following our initial site visits, the plastic samples the team had gathered were taken to the Edinburgh Napier Polymer Laboratory and analysed in detail by a research assistant with a materials science background, using an infrared spectrometer and differential scanning calorimeter to measure melt flow index and thermal behaviours. Utilising the expertise of someone with a scientific background in the context of collaborative design research is a cornerstone of the methodology proposed by (Miodownik, 2003), and later expanded upon in the context of contemporary craft (Vones, 2013, Vones, 2017), as it emphasises the interplay and amalgamation of fundamentally different perspectives on the nature of materiality. In this case, the technical data gathered during the initial analysis provided a basis for comparing variations in the remanufactured filament in terms of strength, printability and melt-flow. After initial discussions, it was also decided that following scientific protocol in recording the samples before remanufacturing them into 3D printing filament would be beneficial for later-stage analysis. Thus, each sample was photographed in a studio environment from above, using a ruler (cm) as an indicator of scale. A full frame 35mm DSLR (Canon 5D MkII) was used in conjunction with two lenses: the Canon EF 50mm F2.5 Macro for small to medium sized samples, and the Canon EF 24-70mm F4 L IS for larger samples. Additionally, some samples were selected to be photographed using a high-magnification macro lens (Canon MP-E Macro 65mm F2.8), which enabled images of the surface textures of the plastic to be taken at a magnification factor of between x3-x5. Each sample examined in this way was photographed using the focus stacking method, to produce an image that provides maximum magnification and depth of field. The resulting close visual examination of the surface qualities of ocean plastic gives a fascinating insight into the material and biological realities encountered in the field. In addition to the expected discolouration and scratch marks left by environmental conditions, the surface of some of the PP samples examined appears to disintegrate into small scales, that trap dirt beneath them and in time crumble away from the surface to become insidious microplastic particles (Biber, 2016) (Figures 10 and11). The HDPE samples on the other hand seemed to attract increasing colonisation with marine organisms, which could point to consequences for the wider ecology in terms of species migration (Barnes and Milner, 2005) (Figures 12 and 13). This is an area of great interest and warrants further investigation.

In terms of processing the ocean plastic samples for remanufacturing, the observed surface qualities had a similar impact, namely that of making the cleaning process and removal of foreign matter increasingly difficult. Despite concerted efforts by the research assistant to remove as many contaminants as possible, some remained and were inadvertently included as small particles within the finished Ocean Plastic Filament. It is important to note that the finished filament also retained a strong aroma of the sea, despite having been through a high-temperature extrusion process. This points to the inclusion of contaminants at a molecular level, which would be impossible to remove without further elaborate processing. However, during the public engagement activities that were conducted by the team, this smell was generally received positively and served as a reminder of the historical origins of the material. After vigorous cleaning, the samples were granulated and mixed by weight with virgin PLA to different ratios between 50-60% of ocean plastic (HDPE and PP). PLA was chosen as a carrier material as it

Figure 10. A brush-like object made from PP. The dirt accumulating between the bristles is particularly hard to remove, and some marine colonisation can also be observed.

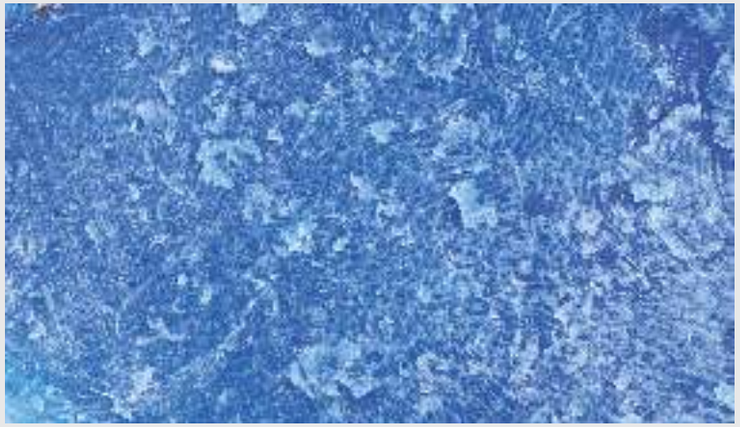

Figure 11. The same object as Figure 10 photographed under a magnification of x3. Note the scaly surface disinte grating over time, shedding mircoplastic particles.

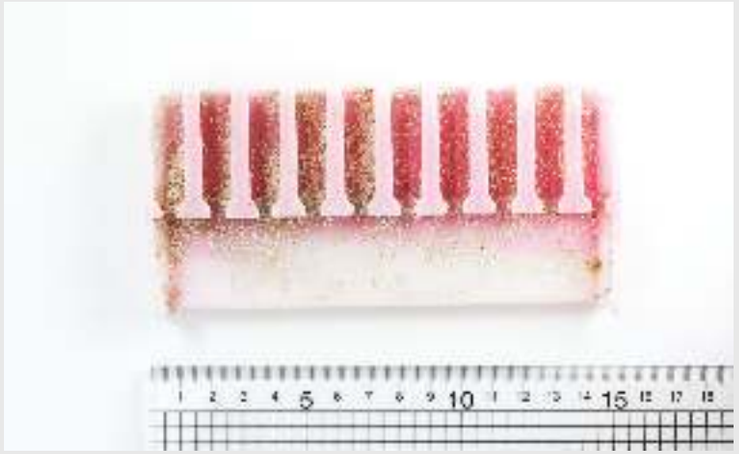

Figure 12. An HDPE sample, displaying severe photo-degeneration and heavily contaminated with sand.

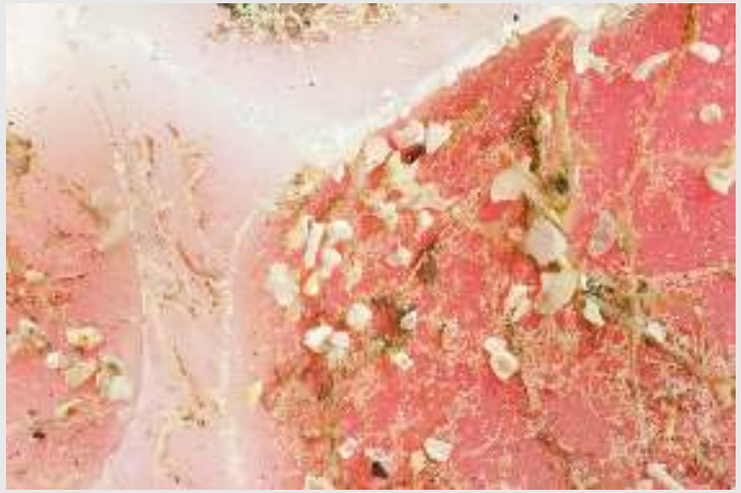

Figure 13. The same object as Figure 12 photographed under a magnification of x3. Note the visible colonisation with algae, that serve to adhere sand particles to the object and have completely enveloped the sur face.

is a bioplastic and can be composted in industrial facilities (Ebnesajjad, 2013), thus increasing the end-of-life options of the new material. The extrusion process was undertaken with an industrial single-screw extruder, culminating in a water band cooling track and filament winder. The process was subsequently also trialled with a small 'enthusiast'-level single-screw extruder (Noztek) and filament winder (V1.0), with promising results. This type of equipment might be reasonably found in a well-equipped local maker space, and open-source initiatives such as Precious Plastic even supply plans to build shredders and extruders to adventurous makers (Precious Plastic, 2019). The diameter chosen for the filament was 1.75mm, as it is easier to extrude within tight tolerance than the other commonly used type at 2.85mm. Over the course of four sessions, seven rolls of filament were produced from approximately ten of the samples.

Workshops

Three short workshops were undertaken, two with year 9 and year 10 schoolchildren in group-sizes of around 8 to 10 participants (Sir E. Scott School in Tarbert on the Isle of Harris, and Mallaig High school on the West Coast), and one as part of a research workshop at an academic conference. The two workshops with schools, both in remote locations situated on an affected coastline, served to introduce the children to the idea that the ocean plastic coming ashore locally had potential value as a material that can be reprocessed for making new things. Using an enthusiast-level single screw extruder, they were shown how granulated ocean plastic (PP), when mixed 50:50 with PLA, can be extruded into 3D printing filament, and then used to print a small scale 3D map of the area where they lived (Figure 14). The children also had the opportunity to play with 3D printing pens to help understand the principles of the process. Each workshop was followed by a public lecture in the evening, attracting surprisingly healthy numbers of local residents despite

inclement weather. The Q&A at the end on both evenings gave rise to lively discussions that revealed useful local knowledge and insight into the problem, with many using personal evidence to point the finger at marine industries and particularly fish farms.

The third workshop took place at the 2019 Research Through Design conference at the Delft University of Technology (TU Delft), having been accepted in a competitive peer-reviewed call for pre-conference research workshop proposals. With six participants, including research students and experienced academics, we were able to make use of TU Delft's Makerspace to granulate polypropylene rope, and form

Figure 14. Pupils at Mallaig High School experiment with filament extrusion and 3D printing technologies.

Figures 15 and 16. Workshop participants at RTD 2019 granulate ocean plastic and extrude filament. Note the inconsistent quality of the filament due to elevated moisture levels within the ocean plastic.

extrusions using granulated blue polypropylene and white PLA. The filament emerged with variations in the weighting of colour (Figures 15&16), probably because of the larger diameter (2.85mm) that was

Figure 17. Workshop outcomes as they were displayed at the RTD 2019 showcase.

required for the University's 3D printers.

As a group, it was decided to design and print simple rings. The reason for this was, firstly, that these were small and easy objects to design and print, and second, as jewellery they symbolised the value of returning a difficult to retrieve material into the commodity chain. The resulting rings emerged in a semi-translucent colour that had an uncanny resemblance to aquamarine blue, and these were gifted to any delegates throughout the conference. Some of the designs the participants created had symbols of the sea on them (waves, swirls) while other, such as the "26.8kg ring", embedded a more conceptual narrative based on the amount of plastic each person in the world (7.6bn at the time of the workshop) would have to collect in order to retrieve all of the plastic estimated to have entered the ocean in the last 25 years (Figure17). The key learning outcomes of the workshops came from the physical demonstration of the transformation of materials, the tactility of the resultant objects, as well as the discussion and creative enquiry throughout. For example, to know that approximately half of the material in the rings, printed there and then, had just a few days before been plastic debris on a beach added a new dimension of appreciation, which resonated strongly with sustainable design narratives.

Conclusions

The problem of ocean plastic is enormous. It has to be addressed through combined activism and the passing of strict international laws. Plastic is a very useful material, but the approaching Anthropocene Epoch needs to see a dramatic reduction in its feckless use and reserve it for essential applications. The project has given rise to new insights into the potential and challenges of working with ocean plastic as a material for practice-led design. We have shifted from a position of optimism

following early encounters with large amounts of seemingly useable material, to a degree of pessimism as the growing impossibility for humankind and nature to address this challenge unfolds. Furthermore, the process we are exploring is currently limited by the need to mix different plastic types (i.e. PP and PLA). Mixing of materials is taking one step backwards to take two steps forward.

We also acknowledge that 3D printing does not currently afford opportunities to utilise large amounts of the material. When considering economies of scale in terms of the amounts of plastics used by a single process, our efforts could be more effectively deployed in exploring other manufacturing technologies such as DIY off-grid injection moulding (Lambert, 2017).

However, while our contribution as design researchers and makers is a miniscule dent in the problem, but nevertheless allowed us to engage with local communities and fellow researchers to discuss the problem, share knowledge and demonstrate the potential of ocean plastic as a viable material for remanufacturing. This contribution should not be underestimated in terms of reframing the narratives surrounding waste materials and developing novel strategies for stimulating wider, more meaningful, public debate. As a growing number of design researchers focus their efforts in this area, the diversity of public engagement approaches multiplies accordingly. Speaking about her own research of tasking care home residents with remaking plastic and textiles waste into objects of personal significance, Julie Behseta rightly concludes that:

> *"...the ethics and aesthetics of sustainability must include recycling as a symbolic and poetic statement about the re-evaluation of the role of empathy and relationality. […] The aesthetics of the process of use and reuse are celebrated here as a means to enable us to reconsider the meaning of 'care'. This is no longer a matter of sentimentality […] but is now an essential and integral element of a global and industrial agenda for sustainable manufacture." (Behseta, 2013) p.144*

Our changing relationship with the natural environment, in light of current material realities, necessitates assuming increasing ethical and personal responsibilities as both design researchers and human beings who care for this planet in crisis. To promote an ethos of custodianship within affected communities through exploring how the altered materiality of remanufactured ocean plastic can be used to communicate wider environmental issues has been the focal point of this research project.

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Professor Paul A. Rodgers
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The twenty-one papers in this Design Research for Change (DR4C) book examine and explore how contemporary forms of design research are increasingly involved in a range of major social, cultural, economic, and environmental challenges. The research included in this book highlights a variety of significant roles that design researchers play in some of the most complex and demanding issues we face, such as energy and the environment, education, public services, health and social care both in the UK and globally.

This rich set of papers are the end result of a lengthy process that began with an amazing response to the call-for-papers for the Design Research for Change (DR4C) symposium. We received 62 papers from researchers based in countries all over the world including Australia, USA, India, China, Sweden, Germany, Italy, Norway, Denmark, Israel, Greece, Turkey and the UK. After a thorough review process, twenty-one papers were accepted for this book and presentation in a single-track session over the course of two days at the Design Museum, London on Wednesday 11 and Thursday 12 December 2019.

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