Imagining Otherwise.

A Speculative Feminist Design Approach to Interspecies Kinship - a reflective account of other ways of *knowing*, *thinking* and *being* with and in the world.

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Acknowledgements

Throughout the reflective accounts in this thesis I have situated the practice in the everyday, and attempted to integrate a subjective and positioned account of making. Many of the people who influenced the thinking in this project are named throughout the thesis in the reflective interludes, the design diary, or the written exegeses.

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Introduction

All Research projects come from a tension and a curiosity to explore and understand the world. For me, this tension occurred in a seminar room with my students when I asked them what they thought of C*at Fishing* 2, a game which claims to be Designed 'for cats'. The students were bemused, affronted and presented as generally quite angry. It opened a discussion about how – but more importantly why – we might Design for other species; why play is important; if indeed whether cats *were* 'playing'. This led outwards to look at other media forms produced 'for animals'. The students, and many others in the institution, found the idea frivolous, trivial, laughable and unimportant; but for me, thinking about meditated experience and what it might mean for other animals – how they understand it, how they process it, how they enjoy it – it opens spaces to think about why we might find humour in their lived experience. Within this cultural tension (and I get a wry smile when I see an animal playing with a digital device), there is something interesting happening. In the diminution of the importance of other species there are complex cultural biases at play. So I started a journey to find out how you might Design playful mediated experiences for other species, how you might know how effective they were, and how you might gain access to how the animals experienced them. The study started by exploring how existing Researchers work in this space, and the different ways that these practices have been disciplined by institutional knowledges. This investigation highlighted more tensions; tensions between the politics of making and the methods employed to build new understanding(s) and knowledge(s), tensions in method, tensions in discipline, tensions in species, tensions that play out in the world around us.

My Research 'home' is within Media and Cultural Studies, but through the study for this thesis I have attempted to build a trans-disciplinary practice to explore how we might build experiences that nudge our understanding of other species. I have engaged with a large body of work from Human Computer Interaction (HCI), and Animal Computer Interaction (ACI) to make Feminist Design interventions within the discipline, using RtD as a method. The thesis is very much situated in 'Design' as a field, in learning how to work within the constraints and cultures of a discipline, and for my own practice to be disciplined by this culture. I have worked

to reposition my writing and my methods to draw important tactics from Design, but also from adjacent or connected Research areas, to create a body of work that honours and celebrates reflexivity, process and situated knowledge(s). The thesis is grounded in my practice, and lived experience as a Feminist, and adopts and adapts tactics to foreground the importance of Feminist methods to the practice of Interspecies Design.

Through the development of this thesis, it has been important to foster approaches to writing and to making that honour positionality and understanding(s), that link the methods and processes of Design back to the individual Designer. Throughout this writing, reflective tactics have been employed to situate the process of thinking and making, and to celebrate the importance of positioned practice. As the thesis unfolds, it encourages or propels particular ways of reading and engaging with the text that are 'resistable' by the reader but are Designed to offer a poetics of drillability, plurality and subjectivity to the Academic writing, locating it temporally, spatially and subjectively. The structure and format of the thesis is Designed to promote distinct politics and understandings about, and for, Design. The personal and professional journey through the cycles of thinking, making, reflecting, writing and rethinking have been rendered down through the formal writing-up process to try to capture and present modes of inquiry that embrace and foreground Feminist approaches to Designing and writing (Clare & Hamilton 2003:77). As the thesis unfolds it is underpinned by ideas of positionality and subjectivity in Research: understanding the Researcher as a locus to generate, mediate, validate and present new knowledge is important to the outcomes generated; Design, and Research more broadly, is a subjective and situated practice (Haraway 1988). Throughout the iterative processes of scholarship – both writing and making – reflective models have been employed to structure the process and render out important findings. This reflective process has been structured using digital and physical notebooks, Design journals, presentation and discussion of ideas for feedback from Academic and public audiences at a wide range of conferences, symposia and events – and time, lots of time; time spent thinking about what shapes the Designs we make; about what consciously, but more importantly unconsciously, shapes the direction and form of the 'work'.[1] A wide range of resistances to traditional Academic scholarship is threaded and woven through the body of work

[1] In many ways the reflective process was shaped by the time that the thesis stretched over, not just in terms of days, months and years, but also over global events like the COVID-19 pandemic, the continued global climate crisis, the rise of movements like right-wing populism, national conservatism and neo-nationalism, our changing relationship with the planet and global anxieties like the Anthropocene. The thesis has also spanned personal events that prompt reflection and these may include turning 40, raising two children, buying my first house, losing my dad to dementia, and taking on professional 'leadership roles' in Higher Education.

Feminist Approaches

This thesis tries to resist the urge for authority and mastery over an area of study, but instead employs Feminist tactics, charting a reflective journey. Adopting and adapting processes from Feminist scholarship and Feminist Design, the thesis celebrates plurality, positionality, provisionality, complexity, resistance, liberation, social justice, wellbeing, equality, entanglement and inclusion. These approaches are important sites to critique hegemony and power, not as a novel approach, but as one core to my personal and professional methods in learning and teaching, scholarship, civic engagement, pastoral care and Research.[2]

I understand Feminist Design as a multidimensional approach to thinking, making and authorship that integrates principles from the Feminist movement. It aims to address and dismantle not just systemic inequalities, biases and structures of power embedded within the Design process, but also ways we work with and understand knowledge. Situated within broader Feminist movements, it challenges traditional Design paradigms that often prioritise patriarchal framings, perspectives and experiences, advocating instead for inclusivity, diversity, and social justice. Due to the movement's approach to intersectionality, and the impacts of class, sexuality, race and dis/ability, it is a site of considered and intentional practice which addresses the effects of power. Feminist Design has created space for the rise of movements such as Design Justice, and intersects with work in post-colonial Design, pluriversal Design and more-than-human Design.

Feminist Design asks us to fundamentally rethink how Design can serve to empower marginalised groups and promote equity, from method to outcome. It favours plurality, lived experience, story, complexity and embodiment; it acknowledges the systems of power that shape knowledge production, and identifies important sites to examine, critique and change (Lupton et al. 2021). Within the movement there is also an acceptance of the limits of knowing, which can leave Feminist scholarship, and Feminist Design, as potentially delicate or exposed. The provisionality, and the resistance to over-reaching and over-extending claims and findings, is a counter-move to traditional Academic publishing and knowledge production that looks to extrude out of the particular to generalise the findings. This shift in the magnitude assigned to claims can create new methods and new approaches to knowing and not-knowing, which can be fragile and vulnerable – but also powerful – sites on which to ask new questions about the world (Page 2017:14). Feminist approaches to scholarship have troubled many disciplines, but most pertinent

[2] In 2024 I received the first Ulster University Academic Excellence Award for EDI after being nominated by a colleague. This nomination described me as a 'trailblazer in EDI at Ulster University' and was awarded in recognition of the commitment to inclusion over the last 15 years and for championing EDI at what I consider to be quite a conservative institution.

to this study is the work in Human Computer Interaction (HCI) which informs the project's Design Context, and Design as a field of Research. Feminist scholarship offers new critical lenses to established disciplines, re-examining established power structures, biases and methods. It is these new "critical perspectives that could help reveal unspoken values within HCI's dominant research and Design paradigms and underpin the development of new approaches, methods and Design variations" (Bardzell 2010). These new approaches and methods could be used as sites for new ontological (re)configurings, or spaces for new understandings, positionalities and subjectivities to grow in both HCI and broader areas of thinking, making and Research.

Feminist Design understands all Design to be political, and shaped by hegemonic vectors and cultural power. Feminist scholarship more broadly understands that knowledge is not produced in a vacuum and that the individual that produces the Research effects the knowledge produced; it understands that the 'personal is political' (Hanisch 1970/2000). At its core, Feminist Design emphasises the importance of context and lived experience as important qualifiers for Research and the work we, as Designers and Academics, create. It recognises that traditional Design methodologies within capitalism often overlook the nuanced needs of different genders, races, classes, and abilities, and have contributed to the marginalisation of communities and identities by reinforcing structural, systemic and cultural power imbalances. Feminist Design attempts to be actively conscious of these differences, and seeks to create more equitable, inclusive and accessible solutions.

One key method employed by Feminist Designers is participatory Design (*inter alia*, Friis, Duran Sánchez & Marttila 2024; Bardzell 2018; Sciannamblo, Lyle & Teli 2018), which involves users and other key stakeholders in the Design process. This approach ensures that the perspectives of those who will be affected by the outcomes are included in decision-making. It is important to Design *with*, and not *for*. Feminist Designers often apply intersectional analysis to identify and address the overlapping and interdependent systems of power that shape the decisions that can be made. This method ensures that the Design process does not reinforce existing power dynamics, but resists and then works towards dismantling them. Feminist Design is critical of the Eurocentric mono-narratives in Design history and explores ways to decentre traditional sites of power (Sales 2023:9). Its practices are attentive to the power dynamics within the Design process itself, and how these shape the outcomes. This includes examining who holds decision-making power, who is represented in Design narratives, how Design impacts different groups, and how this power shapes knowledge (Place 2023:47). It promotes collaborative and non-hierarchical approaches, where power is shared and diverse voices are valued equally. Place advocates for Designing for the margins and edges first, valuing qualitative over quantitative methods, not speaking on behalf of groups but platforming their voice, Designing *with* communities but also 'for the long haul', and resisting Design approaches that prescribe solutions for groups, instead raising

awareness and empowerment (2023:49).

Throughout this thesis I have explored ways to weave a Feminist approach and tactics through undertaking Research, not just in the core ideas, methodologies and practice, but also in the way that the knowledge is framed and presented. The thesis uses 'reflective interludes' to surface some of the personal and positioned narratives. The aim is to help to situate some of the subjective and systemic forces and personal histories that have informed the decision-making processes. These notes work as annotations to the more formal, traditional Academic scholarship and writing, and present some of the background. These reflective interludes are an attempt to bring Feminist approaches to the more traditional thesis, to frame some of the potential conscious and unconscious biases and ideological positioning(s) that shape the work. Clare and Hamilton (2003:65) state the importance of embracing the personal in Feminist approaches to Research and Scholarship:

> Feminist approaches to scholarship bring personal perspectives to the surface, making explicit the ideological lens that is brought to bear upon the work. The perspectives of the researcher fundamentally influence the choice of research purpose, questions, methods, procedures and the selection of relations with participants.

Within the positioning statement that follows this section, and the reflective interludes threaded through the work, these Feminist approaches have been employed to demonstrate reflectivity, evidence some of the forces that may have shaped the creative decision-making, and to provide extratextual elements to frame the reading of the work. These link the written thesis to the reflective journals and smooth the styles, connecting to form a network of textual reading(s) of the '*work*'.

Throughout the Academic writing, I have adopted a recursive approach to the scholarship that is Designed to reaffirm and build consensus. This involves reaffirming key points, reiterating phrases, and reasserting the journey before nudging forward with new insights. This can sometimes present or be interpreted as 'writing in circles' because the same points are reiterated and reworked before stepping forward, but this softer, repeating form of writing is a method for untangling the complexity of the knots, easing in through them in concentric spirals. This is a deliberate attempt to work through and with the issues at the core of the thesis. This tactic has been employed to make considered, intentional, thoughtful and purposeful steps in how the work is framed and how the argument is presented. Drawing on DeVault (1999), Ehrlich (1995) and Young (1997), Clare and Hamilton (2003:68) emphasise the importance of considering how Research is presented and how knowledge is communicated to audiences:

> The active process of putting the work into descriptive and interpretive language shapes the work and gives it substance. The written account of research is more

> than a simple report. It is an active process that shapes social and political relations, and shapes the relationship of the research to the culture, the people and the society.

By considering the argumentation and how it is mounted for the audience, how the written rhetoric is formed, and how the reader is led through it, I have attempted to foreground Feminist approaches to scholarship not just in the making, but throughout the project. It is important to Design broadly, but more specifically to Feminist Design, that the work is 'positioned', and that there is an introductory reflective account by the Designer that locates them socially, culturally, politically and ideologically as a maker, thinker and cultural agent. We understand Design as a subjective authorial process, and it is important that we spend time positioning the author of the work, that we start to untangle the meaning imbued into the work, through the iterative cycles of thinking, making, reflecting, writing and rethinking – but, most succinctly, as we will explore later in the study "it matters what *Designers Design Designs*" (Westerlaken 2020:85, emphasis in original).

Positionality

In a shift in tone, I will attempt to position myself as a thinker, maker and Academic, understanding that I have worked in Higher Education for 20 years, and as an Academic for 15, which may be important to the reading and interpretation of the work. I will attempt to be transparent, honest and unguarded, to locate the work and approach. This positioning is not an attempt to justify the work, or to position myself with authority, but, I hope, the opposite: to help tether the work, and to proceed with vulnerability. This section will be written in first person as a small indulgence, but, as the thesis proceeds, will shift back to a more traditional Academic tone. The story will focus on tracking stories that *I think* have led me to a thesis, and indeed *this* thesis in Design.

When I was little, I really used to struggle with my dyslexia, but I was interested in the world, so spent a lot of my childhood watching VHS recordings of David Attenborough programmes instead of reading. I struggled Academically through primary and secondary school but left with a good set of results; favouring practical and applied subjects like Resistant Materials, Electronics, and Art. This helped me progress to Further Education where I studied for one of the Labour Government's new General, National, Vocational Qualifications (GNVQ), which allowed me to explore Art and Design in depth, across eight subjects (1999-2001). The course was heavily focused on individual creativity rather than method, but allowed me to apply to study towards a BA in Fine Art Sculpture at Bretton Hall Art College at Leeds University (2001-2004). Again, this course adopted a creative practitioner approach which encouraged students to engage in reading art

history, but also cultural studies, which is where I developed an interest in work that engages with the body, and in Feminist scholarship. The pedagogy was largely crit-based, and I would create odd machines for casting and reproducing the body, wrapped in ideas of objectification, sexuality and the body. These peculiar prototypes of machines that never worked were presented as 'sculptures', and always suggested a proposal that the public could use them to create odd assemblages and reconfigurations of the human. Again, the education did not focus on formalised method but allowed students to develop their own approaches, under mentorship, in a highly traditional Art School setting.

In the second year of my degree, I started to work for Leeds University at a digital spin-out company. I graduated with a strong portfolio of odd practice, and an HE employer on my CV, which helped me secure a job at Manchester Met University. I worked at the Institute of Education as a Design and Technology and ICT technician running workshops, supporting teaching, helping students make work, demonstrating how to use fabrication equipment, and trying to find ways to continue making without a community or other artists and markers around me.

What was interesting to me, every day, was watching lessons, as the Academic staff like Melanie Fasciato and Sue Sayers worked through the underpinning theory, discussing the 'Design loop', and experimental Design.

While working at MMU I undertook a part-time Masters in Creative Technology at Salford University, working with Media Artists like Paul Sermon and Mathias Fuchs. I created more odd machines and participatory works, and read a lot more media and cultural theory. Academics like Theresa Wilkie introduced me to scholars like Haraway, Plant and Butler, and artists like the VNS Matrix, ORLAN and Lynn Hershman Leeson, who thought about the intersection of the digital and identity politics. In the second year of my MA I progressed to teach on the BA in Computer Video Games and the MA in Creative Games as a precarious Academic, supported by my full-time role as a technician. My MA works were not as concerned with Feminist thought, but I created more odd machines like sound art sculptures with robotic tape measures, experiments in online virtual embodiment, odd audio tape looping devices, and a theremin suit to experiment with proprioception. The work was all based in media arts, and usually did not employ formal Academic methodologies in the practice.

While at Manchester Met, I had the opportunity to work alongside scholars like Nichola Whitton and Kerri Facer, who pushed me to think about method, pedagogy, participation and play. They helped me draw threads out of my work with games, and my interest in pedagogy, to consider new works using pervasive games, play and cultural theory. Alongside these career developments I also helped establish the Deleuze studies journal *A/V*, with Anna Powell

and David Deamer. The journal explored alternative ways to present Academic knowledge and scholarship about Deleuze that did not privilege writing over other modes of knowledge creation.

I took on my first full-time Academic role in 2004 at Ulster University, where I still teach and Research as a Lecturer in Interactive Media, but I was confronted with my lack of knowledge around Research Methods, and how I should constitute and frame as Research the things that I *make*. The institution has a strong Research culture but is a widening access institution with one of the highest populations of first-generation students. The department has a long history of Media and Cultural Studies and was among the first Academic institutions to teach Media Studies as a discipline. When I joined the department several staff had been appointed from non-Academic, industry backgrounds alongside more traditional, well-established media and film Academics to address governmental agendas such as Creative Skillset. This bred an institutional scepticism in making as a form of inquiry and/or Practice in Research more generally, magnified by numerous instances of 'unclassified' Research in the REF2014 return; more seasoned scholars attributed these to any Research that utilised methods other than writing.

I produced many Outputs that used participation and play as an approach, but I felt that I did not have a formal language to discuss and frame method, and at the time there was (and I would argue still is) a large scepticism around 'making' as a mode of authorship. I have published work about Alternate Reality Games (ARG), Transmedia, Convergence Culture, Play and Media over the past 14 years in leading Academic journals alongside making games and playful experiences.[3] Before this PhD I was best known Academically for creating the ARG *[in]visible belfast* with Dr Danielle Barrios-O'Neill, writing the first Academic article on the TV show *Making a Murderer*, which emphasised its ability to use play and participation, and for my work dealing with play as a mode of engagement for complex issues, tactile media, and world-building. All of this work responds to what Jenkins calls 'participatory culture', what we might have once referred to as the 'experience economy', and what will be referred to in this thesis as the 'experiential turn', drawing on Candy's work on Foresight. The work before this thesis, as a body of Research, links together

3 I do not do a lot of this blended reality fiction any more; these transmedial, networked and dispersed narratives that promote working with complexity have changed over the last 30 years and feel more conspiratorial. The world-building tactics that I employed in this work are really useful to Speculative Design and Design Fiction, which is a possible future trajectory for the Research after this thesis.

media's capacity for world-building with the importance of participation and play.[4]

These have all been aimed towards particular ways of structuring and disciplining knowledge for the UK Research Excellence Framework, framed as Media and Cultural Studies. In this thesis I have explored other methods, and other discipline framings, outside of my normal 'unit of assessment'. In the PhD I have tried to link the threads of my practice to my personal and professional journey, drawing out underpinning concerns from my practice that I think have shaped the direction the thesis has taken. Maybe some of this contextual information will help to illuminate creative decisions.

In many ways, I think I undertook a PhD to find a language to discuss method.

I have a strong professional persona as an educator and teacher, and teach modules in Information Design using Feminist Methods (D'Ignazio & Klein 2020; Feigenbaum & Alamalhodaei 2020), Web Design, EDI in the Workplace (Lupton et al. 2021), and Immersive Media, which applies a practice-based approach to Media. I have taught lots of different modules and the origin story for this project started in my classroom while teaching a seminar on 'meaning' in video games. The session was part of a module that took a proceduralist approach to game Design. Students were asked to make a serious or persuasive 2D game that encouraged the players to think through a social or cultural issue, using game mechanics to apply Bogost's ideas of Procedural Rhetoric (Bogost 2006, 2007, 2008) to the making process. After formal lectures on media theory, I would bring in games for students to play and discuss – small art games, which pushed students to think differently about the medium. In one session I brought a series of games Designed for cats and lizards. The seminar did not go 'well' as a piece of teaching, and most of the students were confused, angry, and very vocal about what they saw as frivolous, 'stupid', and 'pointless'. The visceral reaction that the students had to this session triggered questions around media, experience, play, audience and meaning.

The project started with a set of questions about Designing for other species, how other species play, and how we might play together using media and technology. I spent a long time trying to unpick different media texts, using approaches from Media and Cultural Studies, that claimed to be 'Designed for animals' such as music and TV for dogs, iPad games for cats and lizards, and

4 I have traced these threads in my Research to the many times during lockdown that I considered walking away from the thesis to spend more time with my family. If the goal was to achieve a PhD then there are clear threads I could trace through my work thus far for a PhD by publication from my institution. I think though that working reflectively across discipline knowledge and methodological schisms has helped strengthen my practice. I have tried to leave a lot of this work from media studies 'at the door' and focus on the work. It has been a real pleasure to work outside my formal discipline boundaries and map knowledge back and forth.

interactive smart-home interventions for companion species, to try to find analytical frames from my discipline to understand these as media.[5] Through discussion with my now Supervisor, Prof Paul Coulton, I started to situate the practice work in Design, and feel the benefits of a reframing of the ideas using different approaches and language. I was familiar with Paul's work with games, and his work with Nokia, but he introduced me to the fields of Speculative and Critical Design and helped me dig back into some of the discipline-specific approaches to producing and framing knowledge. As I had no formal grounding in Design and no deep relationship with the methodologies, he signposted foundational texts and helped me to orientate myself in the field as an interloper.

The starting point for the project, however, was a set of game Design interventions to encourage interspecies play. This led me to explore more formal methods from Animal Computer Interaction, and dig into cultural studies and philosophy that examined our relationship with other species, such as Agamben's *The Open* (2004), work that I had overlooked in play scholarship on play in animals. I also re-examined Deleuze's work on Becoming Animal in *A Thousand Plateaux* (2004), novels like *Metamorphosis* (2020) and *Investigations of a Dog* (2017) by Kafka, and expanded my understanding of scholars important to cultural studies like Berger with his *Why Look At Animals* (2009). Most importantly, it made me return to Feminist scholars like Donna Haraway, who were formative for my earlier practice, to find that they had expanded their work to post-humanist discourse. Some of this work comes through in this written portion of the thesis, surfacing in the narratives, and some has closer relationships with smaller projects I have undertaken alongside *Equine Eyes*, such as the *Interspecies Design Toolkit*, which mixes some of the analogies from interspecies philosophy with approaches to inclusive Design in HCI, and is linked to the Reflective Journals that form part of the presented body of work.

Lastly, I would like to pause to acknowledge my privilege as a cis, straight, white, middle-aged man with a stable income, formal links to an Academic institution, and a long publication history in other disciplines. This personal and professional context has undoubtedly opened many opportunities not afforded to most PhD Researchers facing a more traditional entry point or trajectory, although it has also made progress slow and complex in other ways. The professional networks have leveraged support and skills to make this project possible despite many other personal and professional constraints. My privilege and positional power have allowed me to travel, gather feedback, and access a wide cross-section of knowledge which is often siloed by discipline. Sharing the caring responsibilities with my wife has afforded me the support that is often needed, and not available to lots of scholars, to follow the lines of inquiry that come from the

5 This original, very naive, proposal is still live on the Design Journal that was used alongside the making process to track the thinking and evolution of ideas. https://www.cryptoludology.com/?page_id=2

drifting nature of Research. Some of the everyday stories of this surface in the Reflective Journals as they inform the work, shape the practice and create the milieu that influences the practice. I am thankful for, but always remain conscious of, my privilege...privilege that is inaccessible to many PhD Researchers and even many Academics because of our uneven distribution of power.

Understanding Animals

Throughout the study it has been important to pay attention to (non-human) animals and explore a wide range of practices. I have selected a variety of approaches, tactics and methods across the arts and humanities, and computer, natural and social sciences that have laid various claims to being able to bridge the interspecies divide. This underpinning work employs a wide range of methodologies and imaginings that aims to help humans and animals coexist in more productive and sympathetic ways. Several meanderings through the formation of the thesis have been rendered out in the write-up, but have contributed to building understanding(s) of non-human animal subjectivity, drawing on Animal Behavioural Psychology, Play Studies, Media Theory, Biological Sciences, Game Studies, Literature, Design, Philosophy, and Cultural Studies. Some of this work surfaces in the Reflective Journals, some informs the positioning, and some will have impacted on my biases – both conscious and unconscious – but may not form the central rhetorical arguments distilled into the formal written thesis. A broad net was cast to start to map out the methods, approaches and limitations, and to survey the types of knowledge they privilege, and it is important to acknowledge this foundational work which extends some of the Feminist methods, and examines the complex, culturally constructed exceptionalism in humans.

As this developed as foundational knowledge for the study, more attention was paid to Researchers who work at the interface of non-human animals and the current cultural condition, addressing ways to smooth the tensions between animals and technological and social progress in the West. This study does not look to address the core underpinning issues and anxieties caused by living beside and with a wide range of non-humans, but explores approaches to imagine more inclusive futures, ways to be more attentive to them, ways to imagine them otherwise, and ways to reposition our understanding of them. A lot of this work has informed some of the smaller projects – featured in the Reflective Journals – that are not part of the core thesis, but are documented in the submission as a body of work, and are also presented as part of the portfolio.

This broad body of reading drew on work from post-humanist discourse such as Despret (2016), Haraway (2016) and Parikka (2010), as well as philosophers like Deleuze and Guattari (2004) and Agamben (2003). A lot of this research fed into projects like the *Interspecies Design Toolkit* which spoofs the Microsoft Inclusive Design Toolkit, or the *Animal Persona Cards*

delivered in workshop. These have all been part of the journey of the thesis and have been largely refined out in order to sharpen the portfolio's focus, but are gestured towards in areas like the reflective interludes and diaries, and become paratextual documents to the main submission.

Through this meandering journey through interspecies philosophy, post-humanist thought and cultural studies, the thesis focuses down on Animal Computer Interaction as a Design Context for the study as a site of huge significance for animal welfare, the politics of inclusion, and a space where Academics and Designers address issues of social justice, animal rights, and contemporary culture. The study explores in depth the discourse around this discipline, studies it as a disciplinary interloper, and looks to make some disciplinary interventions to 'trouble the discipline' as a contribution to other ways of understanding our relationship with (non-human) animals.

The work of scholars in this area is important, if not critical, to the progress on animal kinship, living better together, and animal welfare, but this thesis looks to apply alternative methods as a reflective approach to open debate, understanding(s) and new framings of knowledge production and consultation. I have been inspired and deeply moved by Researchers like Clara Mancini, Anne Galloway, Ilyena Hirskyj-Douglas, Fiona French, Michelle Westerlaken, Hana Wirman, Patricia Pons and Steve North, who all work within the discipline. The work in this thesis is not a critique of the importance, rigour or significance of their Research and the important work that they do, but a way to frame and reflect on the value of alternative methods to help us open up spaces of imagination, re-consideration and reflection, making us more attentive to other species, and fostering new forms of kinship by applying Feminist tactics, new methodological understanding(s) across disciplines and launching productive new dialogues.

Throughout the thesis I have explored how other Researchers, Academics, Artists, Philosophers, and makers have explored our relationship with other species, and I focus this down in two main areas. The first stakes out ground for the Design Context, which explores the methods employed by ACI, as a discipline linked to the Computer Sciences, and I return to explore alternative methods in Design Research to map out how Designers have framed animals, and ways to propagate new considerations of the animal through critical making. In this way I outline a core body of work that explores embodiment, sensory understanding, and the somaesthetics of non-human animals.

Structure of thesis

This study explores approaches to fostering interspecies empathy and understanding, to build towards new forms of kinship with non-human animals. The study employs Feminist approaches to scholarship, and applies Research through Design (RtD) as a

methodology, to develop counter-tactics to more positivist stances in Animal Computer Interaction (ACI). The outcomes, however, offer wider concentric cultural interventions which help audiences rethink their understanding of non-human animals. The project explores ways to 'think otherwise' about our framing of non-human animals, using play, embodiment and other forms of 'knowing' to create productive sites on which to build new understanding(s).

The thesis consists of:

- *A written Academic piece of scholarship which explores the conceptual and theoretical framework(s) that underpin the work.*
- *A linked written reflective account of the prototyping, refining, and development process of a Design artefact which forms the application of the thesis in the second half of the written submission.*
- *A Design diary which reflects on the personal and theoretical development of the work over the duration of the study.*
- *A video which helps to frame the artefact and guide its interpretation.*
- *A set of pictorials to position, showcase and assist in the reading of the artefact.*
- *A final piece of Design work, embodying the thesis in a crafted artefact*

Chapter one of the thesis, entitled 'Mapping Animal Computer Interaction', surveys ACI as a Design Context, and an important site for contributions to animal welfare, interspecies connection, and ways to live with non-human animals. The project frames this discipline as an important space for rethinking the politics of inclusion, and a site of challenging hegemonic positioning of non-human animals, but identifies possible productive spaces to explore ways to 'trouble the discipline'. The study explores tensions in the politics of ACI and some of the positivist methodologies it employs, to build better understanding of non-human subjectivities. The study understands Research not as a discovery or uncovering of objective truths through observation, with repetitive abstraction and correlation of data; it employs instead a Feminist approach which frames knowledge production as a subjective, positioned, and situated space for the exploration, experimentation and consolidation of new knowledge(s), celebrating vulnerability, provisionality, positionality and nuance. These new approaches and methods are used as sites for new ontological (re) configurings, or spaces for new understanding(s), to grow in both ACI and broader sites of thinking, making and Research. The chapter identifies 'limitations' in the approach and offers some productive ways to add to the discipline to help re-emphasise the radical politics that underpin the discourse. The study explores approaches to 'trouble the discipline' to challenge some of the methodological assemblages that have crystallised in the methods, and probes ways to re-emphasise the radical politics of the discipline through alternative, speculative, Feminist

methods or writing, thinking and making.

The chapter 'Multiplying through Method' identifies Research through Design (RtD) and, more granularly, Speculative Design as making an important contribution to interspecies entanglement which could be used as a productive approach to work with and through the limitations highlighted in the previous chapter. It explores how Design Rhetoric can be used to frame the wicked problem of interspecies kinship, and draws on Object Orientated Ontology (OoO) and Academic Carpentry to inform new approaches to construct arguments about the importance of new interspecies understanding(s). The study explores a range of approaches to examine, frame and question hegemonic politics, and identifies Speculative Design as the most appropriate method to frame the complex power dynamics between human and non-human animals, anthropocentricism, and human exceptionalism. It looks not to render out mess and complexity, but crafts nuanced rhetorical framing and opens productive spaces of reflection, reconsideration and reconfiguration of hegemonic vectors. The study platforms important contributions made to this approach from artists, Designers and Academics, but highlights some of the limits in existing seminal works. The thesis also identifies limitations in the prevalent methodologies to mounting arguments through Speculative Design. It offers *play* as an important contribution to extend the practices in Design, in order to strengthen the audience's entanglement, create embodied arguments, and reveal tacit new knowledges of other species through playful, immersive artefacts. The thesis proposes this as an important site for (re)thinking, reconfiguring and reimagining our relationship with other species.

The chapter 'Mediating with Method' outlines the methods that will be put to work through the thesis charting the development of RtD as a discipline, and gauging how it will be employed to create productive spaces in which to reconsider, reflect on and reconstitute our relationship with non-human animals. The chapter explores why making, crafting arguments in Academia, and embracing more speculative methods, are important approaches to building new framings, bonds and kinships with non-humans. The chapter maps some of the productive contributions that play can make to enhancing Speculative Design, new imaginings and new cultural configurations.

The final chapter in the body of the written thesis is 'Mounting with Making'. It operationalises this approach to craft to 'mount' a personal, positioned and situated argument celebrating interspecies entanglement by prototyping and honing the Design Rhetoric into the project *Equine Eyes*, an immersive experience which claims to help audiences 'see like a horse'. The chapter applies Speculative Design as a method, and play as a means, to foster a more attentive relationship with non-human animals. Within the written submission there is a reflective account of the making process. This documents core project development milestones in prototyping, crafting and refining as productive tactics to present the forming of Design Rhetoric and

to chart Designerly intent. This prototyping process is broken into sections which outline the aims at each stage, and the records of where the project was disseminated for feedback, followed by a reflective account of progress. The project links to a development journal which was kept through the prototyping process before the final artefact was outlined and crafted. The process is documented directly in the more traditional scholastic written component, but also links out to a Research Reflective Diary, and through the linked Research notebook *Cryptoludology*. These help to reflect on process, craftpersonship, and the honing of Design Rhetoric.

The project offers many framings of the 'work' to create productive sites of interpretation in and in between the work, and should be read as a multi-component portfolio which platforms Feminist approaches to Design, questions hegemonic vectors, explores how to trouble discipline and method, and uses Designing, making, playing and reflecting as important sites for (re)configuration and resistance.

Mapping Animal Computer Interaction

Animal Computer Interaction

ACI in relation to HCI

This study uses practice-based approaches and tactics to explore anthropocentricism and how this is challenged or resisted in the process and methodologies employed in interspecies Design. Although anthropocentrism proliferates within hegemonic Western culture it creates interesting knots and mess within the field of interspecies Design – which is aimed at addressing cultural power imbalances between human and non-human animals – to create more inclusive and respectful connections between humans and the animals they live with and beside. The study explores interspecies Design, and more specifically Animal Computer Interaction, as a situated site of knowledge production, where complex communication and subjectivity thresholds problematise process, but where often imagining and building more inclusive futures are at the heart of the practice; this resonates with Feminist approaches to Design and scholarship. The study explores the wider implications for our relationship with non-human animals, and alternative, speculative methods for framing core cultural issues. The overarching study began as an exploration of the research methods in Animal Computer Interaction (ACI), and the approaches from

ACI, as a discipline, to understanding non-human subjects as a particular and increasingly more established instance of interspecies Design – albeit one that might in some ways be problematic, as I argue in this chapter.

Several debates frame the relationship between Human Computer Interaction (HCI) and ACI (Mancini 2011; Mancini et al. 2014; Resner 2001; Westerlaken & Gualeni 2014, for example). Some of these debates chart the similarities and differences in methodology as a pragmatic mapping of methods to help practitioners transition from one field to the other, to build informal learning communities, or to construct a set of approaches informed by the distinctions. There is also a body of work emerging that takes more of a political stance, using the framing to discuss the social, cultural and institutional biases that make distinctions between human-animals and non-human animals. This political move could be framed as having synergies with More-Than-Human Design which considers the Design processes outside of the functional usable solution and considers the method, material and socio-political entanglements of the Design process. This more overtly politicised work often plays on the sub-setting of Humans as one form of Animal; situating HCI as a subset of the broader, later established, field of ACI. For scholars such as Mancini (2013), ACI is not a niche form of Research, but is a larger umbrella under which exists the more prominently practised HCI. The politics behind this approach depends on a semantic (but important) argument, linked to a larger cultural framing, that distances and elevates human-animals from all other species. This work argues against the cultural biases of human exceptionalism, and positions humans as one category of animal which we may understand deeper than other forms of life because of our situated and embodied positioning, but this is solely one way of *knowing, thinking* and *doing* (Escobar 2018).

This positioning is important as it informs and disciplines the process, but also frames the reading of the outcomes by an audience; by positioning HCI as part of ACI, we are positioning humans as only one form of animal that can interact meaningfully with technology. Within the Computer Human Interaction (CHI) research community there has been a tendency to see HCI as the umbrella under which other practices organise (as implied by the name). So, Child Computer Interaction (CCI) or Human Robot Interaction (HRI) are seen as subsets of HCI which should adopt its overarching methodologies, mythologies, values (or what types of knowledge it values), and its methodological approaches to produce, frame, test and validate new knowledge. This sites HCI as a mono-narrative that shapes subsequent disciplines. Mancini states: "Above all, ACI can keep CHI healthy by reminding it of what Haraway calls the 'foolishness of human exceptionalism'. ACI belongs at CHI because HCI is ACI" (2013).

Mancini outlines three core areas where HCI could benefit from a better understanding of ACI: strengthening HCI, broadening participation in Interaction Design, and supporting

CHI's commitment to sustainability (2013). In this work, Mancini *troubles the discipline* by challenging some of the core assumptions. Other scholars also highlight the practical advantages in exploring Interchangeable Methods, Transferable Learning and Usefulness to one another as two distinct practices (Hirskyj-Douglas et al. 2016). This presents the practice in two contrasting ways, either as the application of Computer Science to Non-Human Animals, or as a meta-field that encompasses all forms of technology, and all forms of animality (including human). "The tension between the two positions challenges ACI to consider methodologically the position that animals hold within the research space" (Hirskyj-Douglas et al. 2018:3).

This (re)positioning, and (re)consideration of other forms of life and knowing, are important counter-hegemonic moves which widen the scope of the Research. They allow spaces for alternative methodological thinking and the juxtaposition of other types of knowledge production to open fruitful and important dialogues between disciplinary and disciplined ways of thinking about our relationship with non-human animals, technology and culture. This could be a productive space in which to reflect on and challenge some of the hegemonic cultural biases, and to consider alternative, more inclusive futures.

ACI is situated within User-Centred Design, which encourages study of – and often collaboration *with* – the end user during the Design process. It centres the user as one of, if not *the*, most important element of the Design process, which often requires iterative Design methods of testing with users, feedback, and refinement. This will be unpacked in more depth later in the study, but it is important to situate the practices and methods within wider concentric circles of Research to establish its stance towards *making*. In other areas of User-Centred Design the Designers have a wide range of methods that can be deployed during the testing and iterating process. These can be drawn on to measure the potential success of the process and to validate the knowledge produced by the Research. Methods from both qualitative and quantitative feedback can be employed to evaluate user outcomes, but scholars have warned of issues around interspecies communication in the Research process. Within ACI, methods lean towards the quantitative and positivist: to observe, measure, test and validate. This has been argued as an important strategy in overcoming the species divide to work with users where direct communication of intent, emotion and experience can be distorted across the species communication barriers, and be prone to anthropomorphic bias (Hirskyj-Douglas & Webber 2022). ACI could then sit within a discourse of User Centred Design or Participatory Design process, where the users of the service, technology or product are predefined and included in Design and development. However, less considered and nuanced applications of ACI also can suffer from the approach's shortcomings in the definition of 'ideal users', normative statements, and the potential to reduce a user to a point of abstraction (Bardzell & Bardzell 2011).

These issues in User Centred Design can become magnified in ACI, as they rely on the Designer's understanding of the non-human animal, and this understanding is often generated through observation and interspecies ethnography, rather than there existing an embodied understanding of the subject and extrapolation from the Designer's own positioning. To attempt to counter these biases, Researchers often gravitate towards positivist forms of abstracting the subject into data for interpretation by human animal Design agents. This positivism is often employed within Academic inquiry as an approach to building objective readings of the world that can be rendered into 'findings'. Some, like Escobar (2017:223), have argued that this detachment is problematic, potentially undermining and stifling Academic Research's ability to make important contributions, while separating scholars from the world:

> Founded on the principles of separation and disconnection from the natural world, Academic knowledge in general seems unprepared to provide us with the earth-wise knowledge needed for integral functioning of humans and the Earth.

For Researchers like Law and Escobar, there are core issues in how Academia operates, the methods it employs, its claims of objectivity, and the methods it uses to form new knowledge. We need to be critical of the way that knowledge is constructed, what is cleaned out in the process, and the way that methods, disciplines, and institutions as situated sites of power frame and reframe the world. We must examine how, in Research, humans are a site of knowledge production and mediation, how that knowledge is situated and shaped by power, and how we decide to prioritise particular narratives, methods, subjects, ideologies, outcomes and 'solutions'.

In ACI the Design outcomes, from prototypes to later-stage Designs, are tested with non-human animals. The data that can be gathered and measured often employs methods such as biometric measurement, close behavioural observation, tracking, and non-invasive monitoring to measure and evaluate the success of the Design outcome. Extracting and abstracting the experience of the non-human animal into a more disciplined form can help build findings and datasets, help refine the outcomes and hone the effectiveness of the Design solutions. This increases the opportunity for repeatability, replicability and reproducibility of evidence and outcomes; all core underpinning anchors of knowledge production in the Sciences – including Computer Science.

ACI, as a growing discipline, has produced three main interconnected bodies of work outlined by Mancini (2013):

- *Designing of systems and technologies created as a place for interspecies communication, where the technology forms a place for humans and animals to interact;*
- *improving animal wellbeing in a landscape shaped around human needs;*

- *integrating animals into the technological ecology of modern life, allowing for increased productivity, tracking, monitoring and utilisation as a resource (Mancini 2013). Examples include tracking and monitoring species migration with GPS, or automatic milking machines for cows.*

To narrow the scope of this study, this Research project is most concerned with exploring the first body of work from ACI, interspecies communication and connection. The exploration of this form of practice is aimed at helping to address how we, as humans, might start to address the second core issue – wellbeing in an anthropocentric landscape – challenging and resisting cultural biases, and aiming to build more inclusive futures through deeper understanding of other species. The study focuses on the first two elements of ACI because they link most closely with building our understanding of other species, and the limitations of knowing (Hook, 2019).

ACI situates the non-human animal as an important cultural and Design stakeholder. It is most connected with positivist, qualitative methods to understand non-human animals as subjects, audiences and participants. This is an important political component of ACI: to consider the non-human animal as an important social and cultural agent that can be Designed for but more importantly *with*. Elevating the non-human animal to a cultural agent is often a counter-hegemonic move which, as a practice, is more open to other understandings – ways of *knowing*, *being* and *doing* in the world – than are more established aspects of HCI. This frames non-human animals as individual users or audiences rather than as cultural resources to be used by humans for comfort, entertainment, food, or labour; what Heidegger refers to as the standing reserve (2013:17). Mancini understands ACI as an attempt "to understand the interaction between animals and computing technology within the contexts in which animals habitually live, are active, and socialize with members of the same or other species, including humans" (2011:70).

The approach looks to find ways to communicate and understand other, non-human, ways of *being* in the world and how we can use technology to connect and communicate across species divides. This interspecies communication first needs to explore how the non-human animal experiences and understands the world before we can Design with and for them. For instance, if we are Designing a video game for a cat and a human to play together (such as Westerlaken's work *Felino* (2014) or Noz and An's *Cat Cat Revolution* (2011)), we must first understand how the cat sees and experiences the world, how it understands the technology, how it plays, how it sees and understands the human player in the situation, how it understands structured play and appropriate feedback loops, its understanding of virtual space, its relationship to the human player and how this might alter play, and the environment that the cat plays in.

Although this list of Design considerations is not exhaustive, it is indicative of some of

the additional deeper, and possibly more complex, Design considerations that need to be part of the methodologies. The Designer needs to understand the non-human animal as a Design subject in order to understand how to create outputs for and *with* it. ACI adopts a number of co-Design methods to help establish the non-human animal as an important social and cultural agent who participates in the co-creation of the object, system or artefact, and helps in the meaning-making with the human-animal Designers. These processes will be unpacked later in this chapter to help illustrate process and the politics of placing a non-human animal at the centre of the practice. For much of the ACI community the driving force is towards better animal welfare, and a rebalancing of human exceptionalism.

Animal Welfare in HCI

ACI focuses on animal welfare, improving the living and working conditions of non-human animals, and on working in ways to integrate non-human animals into the 'technological ecology' of everyday life. The discipline draws on animal welfare science which explores approaches to improving animal living conditions and mental and physical robustness, and to reducing animal exploitation, rather than on areas of animal rights that would engage with deeper cultural debates on animal ethics and ideas such as a right to life (March 1984; Silberman 1988; Morrison 2009; Bekoff 2010). ACI aims to engage with the ethics of suffering and how to best care for non-human animals while we hold a culturally dominant position, rather than with wider debates on animal rights. This focus on care and inclusion underpins the discipline's approaches and ethos to present technologically focused alternative ways of living with other species. These are often presented as 'solutions' to cultural issues that have marginalised or misinterpreted non-human animals. Under the practice, when applied to Design Contexts where the non-human animal is considered a cultural resource (food, entertainment, etc), there are core underpinning considerations that frame what we mean by 'animal welfare'. The Brambell Committee in 1965 set out five freedoms for intensively farmed animals which still form the basis for wider animal welfare debates today:

1. *freedom from hunger and thirst;*
2. *freedom from discomfort;*
3. *freedom from pain, injury, or disease;*
4. *freedom to express normal behaviour;*
5. *freedom from fear and distress.*

ACI focuses down on the tensions caused at the interfaces of human culture and non-human animal everyday life, and applies technology to address issues of animal welfare

in a broad range of Design Contexts. This can be by implementing technologically mediated solutions to issues such as farming, for example with robotic milking machines (Rodenburg 2017), or by finding new ways for companion species such as cats to connect with their human co-habitants (Trindade et al. 2015). The welfare of the non-human animal is paramount in all projects in ACI, and can be broken down into a number of core areas:

- *performing work* (Robinson et al. 2014; Mancini et al. 2015)*;*
- *interspecies play, often between human animals and non-human animal participants* (inter alia, Noz & An 2011; Westerlaken 2014; Pons & Jaen, 2016)*;*
- *physical wellbeing (Haladjian et al. 2017; Jukan et al. 2017);*
- *habitat and environmental enrichment* (French et al. 2015, 2016; Scheel, 2018)*; and*
- *interspecies communication and connection* (Resner 2001; Lee et al, 2006; Neustaedter & Golbeck 2013; Rossi et al. 2016).

Many of these outcomes are focused on solving for non-human animals human-made problems such as captivity, boredom, and cohabitation. Projects often tend to engage animals of particular types and scales who already inhabit urban landscapes, or habitats Designed for human animals to be primary users. Only a small number of projects involve non-human animals of a larger scale, such as charismatic mega-fauna, but a notable example is French, Mancini and Sharp's interactive toys for elephants (2015) or the tracking of giraffes with thermal cameras by Dong et al. (2017).

Manifestos and the politics of ACI

An important document in the shaping of ACI as a field has been Clara Mancini's 'Animal-Computer Interaction (ACI): a manifesto' (2011) published in *Interactions*. The article outlines the history of the field, and the importance of a shift in the scientific understanding of non-human animal cognition which gives weight to the growing practice. It outlines some of the core changes in thinking that have helped to highlight the similarities between human-animals and non-human-animals. These include Design considerations such as species sensory faculties that are far superior to ours, or the discovery that they can possess sophisticated cognitive abilities, that many species have been seen to exhibit high-level problem-solving, use purpose-built tools, communicate effectively through language, experience a diverse range of emotions, form complex social relationships with members of their own species and other species, make moral judgements, and pass on cultural practices between generations (Mancini 2011:70). The manifesto is an important founding and positioning document for ACI from one of the discipline's seminal scholars, and starts to outline the boundaries of the proposed field of study. The article, and indeed

its title, establish this work as a keystone in a field that has developed in the subsequent years.

Manifestoes have a long history within art and Design practice of establishing sets of operational parameters for groups to work under, but also of outlining sets of guiding principles that have larger social, cultural or political aspirations. The writing of a manifesto is a political act, which envisions a different type of cultural practice, moving towards a more desirable future for the artist or Designer. The manifesto imagines a different kind of praxis, establishes a set of ways to produce new systems, objects or artefacts for this new future (which is usually politically charged). The politics of the manifesto are explicit and driven by cultural change. For Latour (2010:473) the manifesto makes

> explicit (that is, manifest) a subtle but radical transformation in the definition of what it means to progress, that is to process forward and meet new prospects. Not as a war cry for an avant-garde to move even further and faster ahead, but rather as a warning, a call to attention, so as to stop going further in the same way as before towards the future.

This positioning of the manifesto as a future-focused document which proposes a reconsideration of the present is an important anchor for this study, and links the practices of making in ACI to wider areas of Design Research (covered in later chapters). For Mancini and others within the ACI movement, this is not the avant-garde, but as the practice sits outside of orthodox Design positionings to other species, it creates a type of speculative, politically charged, praxis that could be seen as a type of inclusive Future Making (Montfort 2018). The manifesto operates as a cultural punctation mark and then proposes a mode of production which is 'other' or counter-hegemonic as a practice. ACI is not the "outrageous HCI expertise" (Thomas 1995:222) predicted in the 1990s, but has often been framed as fringe or extraordinary because of its inclusion of non-human animals as cultural agents. ACI is not a novelty, a thought experiment, or an avant-garde practice, but one aimed towards solving the problems we cause by not taking the lives and lived experiences of animals seriously enough –building more inclusive, shared, smoother futures for human and non-human animals to coexist. The discipline is always moving forward, and during the early 2000s ACI was seen by some researchers as a place to foster interspecies communication and interspecies play (Resner 2001; Mankoff et al. 2005; Lee et al. 2006; Tan et al. 2006). Many early pieces of research from the community, before it established its own annual conference, were published in the proceedings of the alt.chi conference, which is established as a platform for "controversial, risk-taking, and boundary pushing research at CHI. [A] forum for innovative and insightful work that can go unrecognized through the standard review process" (2021). The founding manifesto frames the political nature of the work in a discipline which, through solving problems, makes counter-hegemonic moves on the world. ACI values the non-

human user or subject as a cultural agent and promotes more inclusive Design practices so as to develop more inclusive futures. ACI practice, in its third body of work outlined earlier in this chapter, aims to integrate animals into the technological ecology of modern life. It is driven by a political desire for a more inclusive future where non-human animals can participate in and through technology, on their own terms. ACI is radical. It pushes against the hegemonic framing of animals, and finds productive ways to include them as important cultural agents and decision-makers who could help us shape the world through making, nudging it to be more inclusive, and forces us to take the welfare of animals seriously.

ACI, from its manifesto to its evolving and maturing methods, positions itself as a politically charged, more-than-human, less hierarchical Design practice that aims to establish the non-human animal as a key Design stakeholder, to Design for and *with*, aiming to create more inclusive futures that value the non-human as a subject on its own terms. Through its manifesto as a pivotal positioning document, it recognises itself as a politically positioned, counter-hegemonic practice which *imagines otherwise* about how the world could or should operate, and tries to shape (parts of) the world in its political vision. It is often not looking to replace existing practices, but to include more forms of *knowing*, *thinking* and *being* into the Design decisions we take to shape the future and our relationship with non-human animals, mediated and augmented by technology. This more-than-human approach to Design will be returned to later in this chapter after a deeper understanding of ACI as a Design Context or frame is established through a series of key examples. These will help ground the arguments and better shape the positions within the Design methods.

Disciplining ACI

To give the practices and outputs of ACI some substance, and to illustrate the processes and politics at play, this section of the study will outline a series of short illustrative examples across a range of Design Contexts; this will ground some of the disciplinary practices in real-world cases, and give examples of method and shape within the discipline. The framework of technology applications outlined by Hirskyj-Douglas et al. (2018) will be used to segment the small case studies and will look to give examples of:

- *tangible and physical objects;*
- *haptic and wearable technologies;*
- *olfactory interfaces;*
- *screen interfaces; and*
- *tracking mechanisms.*

This work has expanded earlier frameworks by Jukan et al. (2017) to applications outside of animal welfare in its formal industrial sense, into a wider set of implementations including leisure and play, which have direct impacts on animal wellbeing. Examples will be given to help illustrate a range of applications and Design Contexts in companion species, livestock, charismatic megafauna, and parasitic species, applied to domestic settings, natural habitats, captive habitats, and industrial farming. By drawing on a wide range of Design Contexts (welfare, communications, productivity), a range of user types (livestock, companion, working), and a range of implementations of technology (wearables, screens, haptics) this section will exemplify the wide range of ACI practices, but will try to trace commonalities in the ways of disciplining and validating the knowledge produced.

The applications of technology will also draw on an expanded idea of the 'user' applied by Lawson et al. (2016) that applied the term 'usees' to connote that not all non-human animal entanglements with technology are consenting, deliberate, or active. Some applications are more passive, such as wearables; sometimes animals inform the system but sometimes they directly input data or information; sometimes they deliberately and actively control the system; and sometimes they are unknowing (or unwilling) participants. Examples will also draw from early work in the field, from later, more nuanced, applications, from commercially available sources, and from more experimental applications.

An early example of ACI that addresses interspecies communication, in a domestic setting with a companion species, is the often-cited Master's thesis by Resner, *Rover@Home* (2001). This project implements a clicker training system, through a domestic digital network, so that humans can communicate with their canine companions synchronously but remotely. The thesis explores a range of communication modes including audio, vision/video, olfaction and touch as feedback options for interaction. The project is tested with a range of end uses, across breeds and ages, to produce a set of repeatable, replicable and reproducible results and outcomes. The Design links two contexts: for the human the project is accessed in a work context, and for the dog a home or domestic context. The human can see the dog through a simple web camera interface, speak directly to them, give them simple commands, and then reward them with a click sound and a treat remotely. There are also a number of bespoke interaction points such as fluffy animals and balance toys that the human and dog can use to interact. This type of project has now been explored commercially through companies such as Tomofun, who released the Furbo dog camera in 2016 as an Indiegogo Campaign (Indiegogo 2016); it is now the best-selling animal camera on the market. The application of technology allows the human to be remotely *with* their dogs while they are outside of the home, and at work; the system is Designed to reduce loneliness in the dog usee and presumably among their companions, so they can still interact together even though they are physically separate. This project focuses on animal (both human and non-

human) wellbeing and the cultural tensions produced by balancing traditional notions of work and the social and familial obligations of having a companion species at home.

Another early example of ACI is a project by Lee et al. (2006) which, like *Rover@Home*, addresses loneliness, interspecies connection and communication. It adopts (then) leading-edge technology to allow remote users to have caring, remote relationships with poultry. The project presents the dichotomy and tension between urban living and rural wellbeing as a Design Context, and allows, through a series of escalating prototypes, human users to stroke chickens remotely. The human can first stroke a small toy chicken which collects feedback from the device, broadcasts it across the network to a haptic wearable vest on a real chicken, which can 'feel' the touch of the human. This develops further into a marker-based augmented reality experience where the image of the chicken is captured and reproduced in 3D for the human user, replacing the toy chicken. This affords two-way communication and agency in the feedback loop so that the human animal can gauge the response and fold this back into the interactions. This intimate, caring interaction is Designed so they can have a shared, simulated, mediated telematic experience across the network. The chicken is seen as a companion species in this context (like a pet) rather than as livestock, so has a series of similarities to the first example in the application of technology, networking, wellbeing, and sharing.

Tactile response through a wearable haptic vest gives an extended form of feedback which is also applied in dog-training work by Britt et al. (2011). Their project allows the trainer to give vocal and touch feedback to dogs in training situations. The vest has a GPS receiver and antenna for position tracking, with accelerometers, gyroscopes, and magnetometers to help track and monitor the canine. The position, motion behaviour, and orientation of the dog is transmitted in real time to the trainer, which allows for 'objective analysis' (2011:1) of the dog's performance in trials in a working context. This approach has also been applied to other working contexts in dogs, such as in an application by Mealin et al. (2015) for seeing-eye dogs and their visually impaired companions. This type of wearable is seen as non-intrusive and a more objective form of analysis of non-human animals. Researchers such as Majikes et al. (2016) and Westerlaken and Gualeni (2013, 2014) emphasise the importance of mixed methods of analysis through human observation to supplement data extracted from the animal usees. Supplementing the data extraction and monitoring with observation were human user interviews and wider methodologies – more traditionally seen as less objective – associated with Research in the Arts, Humanities and Social Sciences.

The types of wearable technologies employed in these projects Designed for non-human uses allow for easy, close tracking, data collection and tactile feedback. The data is produced by the wearable technologies and transmitted for cleaning, storage and interpretation by

human Designers. Réhman and Li stress the importance of tactile feedback across species divides as a form of multimodal communication or language that can communicate more directly to the dog (2014) and, by extension, other types of animal (both human and non-human). The data feedback from non-human participants can be used in a large range of ways. Byrne et al. (2018) in a project involving digitally enabled toys, applied approaches from ubiquitous computing employed in a ball and tug rope to measure dogs' temperaments and predict their suitability for becoming service animals. This broader range of measuring methods than we may see in more traditional HCI establishes new ways of monitoring, quantifying and *knowing* usees.

Outside of the domestic, companion and working animal entanglements with technology, researchers such as Kobayashi et al. (2015) have worked on meaningful interactions with and through technology with wild species such as deer. The *Playful Rocksalt System* creates a space to experience 'unexpected encounters with wildlife' (2015:1). The system is similar to projects such as *Rover@Home* in that it has a live, networked, remote and virtual experience for the human that can interact with live camera feeds of deer. The Design Context is different, however, as the relationship between human and non-human animal shifts the Design process. This is partly to do with the species (dog/deer) but also the connectedness (domestic/wild).

In wild contexts, where the non-human animal has limited or no human contact in its day-to-day life, GPS tracking is a commonly employed data extraction technology in ACI, where the animal is fitted with a series of trackers to record and relay its location-based information. The tracking can be through collars, vests, tags or implanted invasive chips that ping the location at intervals. This has also been implemented in more domestic and mundane setting in a variety of projects such as the Yonezawa et al. Cat@Log (2009), more commercial applications like *Pawtrack*, a GPS tracking collar for cats, or *Whistle*, a tracking device for dogs. Tracking can be implemented in less invasive or intrusive ways, with minimal contact and disruption to the animals, such as the Dong et al. (2017) tracking of giraffes in captivity using infrared cameras. Tracking at a distance, with image capture technology, can be framed as more objective data because it does not interfere with, or require direct contact with, the animal. This drive towards producing more objective data sets can be seen as a thread that runs through ACI as a discipline, employing increasingly advanced, bespoke applications of technology to produce more distanced, cleaner data extraction to consolidate and validate findings.

An often-referenced application of ACI for animal welfare is the robotic, automatic milking machine which looks to subvert more traditional hegemonic farming practices of mass milking. There is a wide range of commercial examples, but all build on the same premise or Design problem; a farmer will have a large number of cattle with individual milking needs. The farmer usually herds all cows from the fields to the milking parlour together, meaning that

some cows are past their optimum point for milking, and some are under. This has large health, wellbeing (and productivity) implications for the cows. The automatic milking machine allows cows to be milked individually and at a time of the cows' choosing, affording them some limited agency and autonomy in their care. Cows can enter and exit the stations individually or in groups and additional layers of surveillance, tracking and data collection can be added to optimise milk yield, track infections and regularity. Literature around these machines has focused on the wellbeing implications, and the increased "efficiency of automated agricultural processes" (Mancini 2011). Outside of the field of ACI the systems have been explored as a process of shifting the power dynamics between non-human animal, human and technology which "has effects of discipline and subjectification on cows, inserting them into a regime of biopower which re-captures, re-encloses or re-determines what it is to be bovine" (Holloway et al. 2014). These types of cultural critiques of ACI, from outside of the field, can help in understanding the cultural and socio-political entanglements in ACI and deepen the political critiques of the implications for non-human animals, humans and technology – looking past positivist approaches to understanding the applications and discourses of productivism, dominance, and anthropocentricism. These approaches are important sites on which to 'trouble the discipline' by applying analytical framings from other fields to explore productive tensions.

Several projects explore interspecies play, often employing screen-based technologies, such as Wirman's (2014) work with captive orangutans, Westerlaken's prototypes with penguins (2016) and cats in *Felino* (2014) or *Pig Chase* (Driessen et al. 2014), which will be addressed in more depth later in the thesis. Screen technologies can offer visual, auditory and tactile feedback through touch interfaces and haptic vibration to non-human animals. There are also commercial applications such as *Cat Fishing 2* (2012).[6] Developed by cat food company Friskies, and grounded in behavioural research conducted among a group of cats to determine the preferred colours and types of movement (Nestle 2011), this game is marketed as "Designed especially for cats" (Purina 2011). The game is played by a cat who tries to catch virtual, brightly coloured fish that come to the surface of the screen. To explore some of the complex power dynamics in interspecies and multi-species play, this commercial and popular example will be explored to explicate some of the themes and Design considerations at work. This piece is used because it is openly and publicly available, with minimal specialist technology. It will be explored as a text to illuminate and examine some core textual qualities in the game and some of the ways

6 This game was the genesis of the project, from the first seminar. The example has been picked here because of its approaches, how it frames the animal, its often-naïve stance on Designing with other species, but also its importance to the start of the project. It was this game which I showed, alongside videos of a game Designed for lizards, to my students, and it also became a favourite game for my son when he was a toddler, which is featured in the Reflective Diaries.

of reading the Design and its implied interactions, affordances and constraints. Many of the existing examples listed earlier in the chapter are Research-led and can be accessed only through Academic literature, Design documents and summary videos. The direct access to this text allows for a deeper first-hand analysis of the Design and what it may imply. The commercial example has some evident tensions compared to more Academic, Research or scholastic-informed approaches, but affords the opportunity for first-hand analysis of a popular and recognised textual example of interspecies play. The example is also used as an example of less nuanced or thoughtful Design, which may reinforce hierarchical structures and human dominance through its Design decisions. I will focus on the visual, auditory and haptic feedback to the user, and the game's core mechanics as outcomes of the Design process where meaning is constructed and a site of multi-species technologically mediated commination in ACI.

As the game launches, the user is presented with the words 'Level 1', which bubble to the surface of the screen, alluding to depth and simulating a pool of water. The game is played in portrait orientation, and presents the user with a top-down, bird's-eye view of a carp pond with the sound of fast-flowing water. In the top left is a 'Current Score' which increases in units of 10 for every fish caught. The top right displays a 'Your High Score' and the bottom right a countdown timer with the word 'Time' displayed. All the feedback that structures play is semi-transparent to help players focus on the interaction.

A fish fades in and its size increases to give the impression that it is swimming to the surface of the virtual pool. If the player taps the screen, ripples expand from the point of interaction and a small shallow splashing sound effect plays from the iPad's speakers. These visual and audio feedback cues help to orientate the player and inform the interactions with the game mechanics (Sicart 2008).

If the player taps a fish, 10 points is added to the score and the fish swims deeper into the simulated pool, however if the player retains contact with the screen once they have tapped the touch screen, the fish squirms and wriggles. The cat must tap as many fish as possible within the limited time. The cat must clear all fish from the pond to progress to the next level (of which there are three) and each level has an increasing number of fish to collect or scare. The fish shrink between Level 1 and 2 by 10% and remain at 90% size for Level 3, denoting a slight progression and difficulty curve between delineated game levels.

The game plays a 'meow' sound effect if the player does not interact with the touch screen for 30 seconds to encourage a sustained interaction with the game. The Design of the player feedback system suggests that the game is not Designed "especially for cats" (as the promotional material suggests) but is Designed for cat and human to experience together; the cat interacts

with the touch screen interface, receiving visual and audio feedback, and the formal alpha-numeric feedback communicates progress to the human player in the form of timers and scores. This type of commercial Design works through the processes of ACI, understanding the cat's vision and developing core game mechanics that appeal to the feline. The game was tested with focus groups of different cats as part of the development process, but the project lacks some of the more political, inclusive politics around interspecies play and communication that are incorporated into the development process of more Research-based ACI work like *Felino* and *Cat Cat Revolution*. We could see this power dynamic as the human *playing through* or *with* the cat: technologically mediated multispecies play.

The outputs from ACI are varied in their application of technology, the user groups, and the desired outcomes. They are underpinned by a core manifesto and a tight community of practice which help to reinforce the politics of the practice and apply methodologies from HCI to a wider set of species. The politics of ACI often sit under the surface of the methods and scholarly work in the field. They are built on shared, more inclusive, spaces, that understand non-human animals as subjects with specific needs and desires that can be Designed for and more importantly *with*. The non-human animals are reframed as meaningful cultural agents. The discipline's links to positivist forms of research – from its foundations in HCI and its gestures of objectivity through data extraction, capture, cleaning and disciplining – are aimed at crossing multi-species communication barriers, but also propose a particular way of *knowing* other species and Designing for and with them. The counter-hegemonic politics of ACI and its exploration of the complex entanglements between human animals, non-human animals and technology are important sites of resistance, spaces for exploring animal wellbeing, interspecies communication and the integration of non-human animals into the technological ecology of modern life.

Politics of Interspeciesism

ACI as a political move

ACI helps to establish the non-human animal as an important subject and user of technology. This section of the chapter will aim to situate the practice as a political act which recognises the interconnectedness of humans and non-human animals, and the privilege that human animals bestow upon themselves. It is a counter to the hegemonic exceptionalism that humans inscribe on to and into the world, and a counter-narrative thread that connects humans and non-humans with and through technology. It is important that ACI Designs for and *with* the non-

human animal, and shapes the interface, system and technology around the physiological and psychological needs of the subject. McGrath terms this sort of Design a species-appropriate computer interface (2009:2530), where the interface is Designed to cater for the subjects' specificities and allows them to interact in a 'meaningful way' with the system. This draws on the practices in Inclusive Design that Design for different types of user bodies. The movement looks to counter the ablest biases encoded into the Designing process that exclude other types of bodies. Favouring a majority of users, over-catering and Designing for all users. The Inclusive Design movement aims at Designing more inclusive technology and systems that can be engaged with by users with a disability and able-bodied, normative bodies alike. There are similar threads in the rhetoric and process between ACI and Inclusive Design in HCI in that they look to Design for a singular user and then abstract this outwards in concentric bands across a taxonomy of users. This is often referred to as 'solve for one, extend to many' from the Microsoft Inclusive Design Toolkit (2016).[7] There are similar patterns in Design methods in ACI and interspecies Design which start from the premise that one cat, dog, cow, pig or ant is an individual and needs to be studied in a single-user scenario, and then this can be extrapolated out to more users from this study. This approach is unpacked in more detail later but, in summary, the complexity of unknowns that Designing across species divides presents, means that often Designers focus on a particular cat/dog/hamster/jellyfish as a singular user, and then extrapolate from their findings elements that can be employed in Designing for wider audiences. This creates systems, technology and interfaces which are Designed around a particular single user. This is mirrored in Inclusive Design as a practice and is written through a number of industry guides and Academic surveys of the field, such as Microsoft's Inclusive Design Principles, Toolkit, and Activity Cards (2016). This creates 'user-appropriate Designs', and is employed as a method in ACI species-appropriate Design. This species-appropriate Design in ACI puts an increased importance on understanding the way a non-human animal experiences and views the world so that we do not anthropomorphise them as Design subjects and mis-frame the problem.

ACI politics understands and situates the non-human animal as an important subject capable of its own unique and species-specific understanding of the world around it. This approach forms an important method for ACI as it refocuses Design away from an adaptive process, which Mancini terms "Animal Technology", into one which inscribes the animal *into* the technology as it creates objects, interfaces and systems that are species-specific. The technology, interface or system

7 This is an important document to me personally and professionally as I use this in my teaching about inclusive Design. It has particular – sometimes problematic – rhetoric around disability, inclusion and technology. It focuses on system or service Design but has logics of inclusion which are widely adopted Design in commercial, orthodox Design for users with diverse bodies. This work inspired some of the approaches but also some of the outcomes for the thesis.

becomes an extension of the animal as a subject rather than adapting human-centred technology for an animal user.

Animal Technology or ACI

Mancini differentiates between 'animal technology', where existing technologies are used and adapted for the use of animals, and ACI as a discipline which "place[s] the animal at the center of an iterative development process as a legitimate user and Design contributor" (2013:2228). This approach to 'Designing with' links to the increased focus in the wider Design community on User-Centred Design and Participatory Design practice (covered in more depth in later chapters). This approach in ACI is at its heart imbued with a politics that fosters interspecies connections and questions the anthropocentric cultural bias, decentring humans as the only or most important Design stakeholder. It explores new types of relations or entanglements between the human, non-human and technology. These have been described by Eben Kirksey and Stefan Helmreich as "new kinds of relations emerging from nonhierarchical alliances, symbiotic attachments, and the mingling of creative agents" (2010:546). These could be considered as counter-hegemonic narratives to the ideologies of Western culture and its positioning of the non-human animal. It is not that these politics are counterfactual or speculative, but that they drive against the grain of Western culture and, for most, present themselves as slightly alien to the human animals' lived experience of what they could term 'everyday life'. The rhetoric is clear through the process, and through the Design objects, which are Designed with non-human animals as a Design contributors and cultural agents. The Design methods for ACI displace the human at the centre of the process and problematise more prevalent anthropocentric Design principles by opening a counter-narrative of inclusion.

Within ACI the process of adapting existing technologies to incorporate non-human animal subjects is seen negatively as a reductive approach, which does not honour the specificity of the lived experience of the non-human animal. If technology, which has been Designed and developed *by* human animals, *for* human animals, is imbued with the Design outcomes best suited to the human motor schema, cognitive ability, cultural expectations and social practices, then its usefulness to non-human animals can be limited. The human animal user is ingrained in the Design outcomes, be they objects, systems or artefacts. To trace an earlier example, we could consider the *Cat Fishing* game. In the Design process, cats' physiological characteristics, such as their ability to see different colours, were taken into account in the Design process, and the Design was user-tested with cats; but there are strange logics in the Design which mean that parts of the feedback system are Designed around human animal play, some are Designed around

our projection of what we think of as cat play, and some seem to gesture directly towards the cat. However, there are particular logics ingrained into the technology which underlie the software, and in the iPad itself, which are harder to address, and which could impact the effectiveness of the Design outcomes, such as the screen refresh rate, the surface, the audio pitch range. These are underlying issues as the technology has been adapted from human-centred Design. Some of these issues could link to the shared interface, which gives feedback to both users simultaneously.

Resner highlights the importance of considering "asymmetric interfaces" (2001:31) to enable the development of systems and technologies that can connect humans and animals on their own terms, helping to focus the Design on all animal-users as equal participants. This allows for two discrete interfaces, which speak to distinct species, affording a space for interspecies communication through a shared system. This can also create issues in shared understandings of cause and effect, sign systems and the shared construction of meaning. It has the potential to reinforce power divides, dominance and control between humans and non-humans through play. Resner's approach highlights the importance of understanding how a non-human animal experiences and understands the world, while connecting to a more traditional interface for the human animal user. There is an imperative for the Designer to understand the animal as a subject rather than anthropomorphise them and project the attributes, behaviours and needs of the human Designers onto the animal users (*inter alia*, Mancini 2013; Noz & An 2011; Westerlaken & Gualeni 2013, 2014). To Design *with* and *for* non-human animals we need to start to understand the way they experience the world around them. The interactive system, user interface and technology should be Designed around the animal subject to cater for their specific bodies, behaviours and motor schemas. In this approach, the animal becomes inscribed into the Design and the interactive system becomes species-specific.

Solution-focused Design

The methods in ACI are collaborative and co-authored with the non-human animal – participatory, iterative and negotiated – but are also usually focused on resolving problems or issues in shared habitats or spaces of co-habitation. Within the Design community the types of conceptual frameworks, where Design is used as a process to move from problem to solution, arise in the early 1970s with the work of scholars such as Simon who propose approaches to tackle well- and ill-structured problems with Design (1973) but are repeated throughout a particular type of Research in HCI and referred to as a type of rational, problem-solving paradigm. The work within this track of Design has developed, and the original approaches have been qualified and refined, but the approach is still well seated within the Sciences and especially the

Computational Sciences which encompass HCI and ACI (or ACI and HCI).

In ACI the outcomes are often tilted towards 'better' animal welfare, but also result in solutions that are always beneficial to the human co-habitants. They shave the rough edges off deeper social and cultural hierarchies and make the power dynamics more palatable for the human stakeholders. The solutions are often mitigations or adjustments which help to smooth tensions caused by issues of cohabitation. Often the solutions are not to remove the 'problems', but to find ways to smooth them, increase animal wellbeing and promote more positive interspecies coexistence.

There have been critiques of solution-focused Design practices, as they rely on well-defined problems, which can have well-delineated solutions. In thinking through these issues, we should always question the Design intent, and the power dynamics within the Design Context. Solutions are often presented as singular and final, but as Buchanan states, "solutions are only probable and can always be changed or set in opposition to others" (1985:7). Solution-focused Design can often render out issues that are seen as "too wicked" or do not favour the human stakeholders. Solution-focused Design methodologies in ACI can be counter to the shift towards post-humanist thinking which understands the importance of plurality, connectedness and interdependencies (*inter alia*, Ferrando 2019; Escobar 2018; Morton 2019; Haraway 2016).

Design outcomes, as *possible* 'solutions' to Design 'problems' are important, but we should be mindful of approaches that try to solve issues; we should keep a critical eye on where the problem comes from, who sees the problem as a problem, who the solution solves the issues for, and the power dynamics and potential biases at play in the solution. A deep, reflective understanding of process is important in understanding how the solution arose and what factors played into the decision-making processes by the Designer to address these 'problems'. This reflective approach will be addressed in more detail in later chapters, and will inform the studies methodologies in order to develop working examples of practice that attempt to work *through*, and *with* these issues. This is especially important in ACI, as the core non-human animal stakeholder cannot communicate the evaluation as the key user, cannot express whether the solution solves the problem, or creates new problems that are hard (if not impossible) for human animals to understand and articulate.

Designing for/with

How to collaborate with non-human animals

ACI at its heart is a collaborative practice which explores ways to 'Design with' other species so that the non-human animals as users, usees, participants and collaborators help to Design with the human Designers. The focus and power shift, and the non-human animal becomes a central part of the process. The ACI Lab at the Open University, a leading disciplinary institution for ACI, emphasises the importance of firstly understanding the non-human animal through consultation and observation to "understand as much as possible about an animal's physiology, psychology and sociality" (Mancini 2015:3). It consults with those who work with the non-human animal closely, such as their trainers, caretakers, companions and cohabitants. This is supplemented by closely observing the animals during structured and unstructured activities. This information-gathering is a core part of any Design process that Designs for end-users or audiences, but can cause issues because of the barriers to communicating intent, and our limited understanding of animal emotion. Research into the cognitive processing undertaken by the non-human animal is very important as they cannot vocalise their opinions and choices in a way that is easy for the human Designer to understand (Mancini 2011). Members of the lab then use a series of low-fidelity prototypes which are used to gather feedback from the animals at the early stages of development. The prototypes are judged through qualitative methods such as observation, and quantitative measurement and data extraction such as biometrics, technological tracking and monitoring. This tight, fast prototyping process helps to ideate and iterate the ideas quickly with direct feedback from the usees as the project develops. Play is often used to facilitate a particular type of interaction with animals through technology "as a different form of communication, via a technology bridge" (French et al. 2021:2). Play is important to engage the non-human animals through iterative, progressive cycles of interaction where the feedback can be used to adapt the interaction quickly.

The ethics, and often the ethics of consent, play a large role in the Design process for Researchers who collaborate across species boundaries, especially when the focus of the project is animal welfare in non-industrial contexts. In some Design Contexts, such as industrial farming of livestock, these issues are not often tackled head-on, and this is seen as a limitation of the context, but in other areas, like Designing with working animals, domesticated animals, companion species, and creatures in captivity, it is a core concern of the Design process. The animal-centredness of the process means that Researchers often adopt methods such as allowing "consent through walking away behaviour (innate behaviour), research into how to make systems more suitable for animals (comfortable), and often seeking ways to monitor health (healthy and

nourished)". (Hirskyj-Douglas et al. 2018:2). The Design Contexts allow for interesting research that has wider implications, such as the non-human animals' entanglement with technology outside of the specificity of the Design. An example would be a dog's understanding of the heavily media-saturated landscape that it inhabits day-to-day, full of radio signals, disjointed audio and visual communication from speakers and screens, the IoT-enabled landscapes that it interacts with, and the understanding of the interactions its human cohabitors have with smartphones, televisions, laptops, tablets, heating systems, and ovens. This, however, is seen as outside the scope of ACI, which targets a specific issue, often extracted and clean from the rough and tumble of 'everyday life' in labs, university buildings, and specific and controlled Design Contexts.

Methods for Designing with

The species divide creates a set of difficulties in the methodology of Designing with other species and exacerbates underlying issues in User-Centred Design practices that we see in other areas. More traditional methods of testing Designs in HCI have been softened to work with other species, and Researchers have adopted approaches such as developing the Design prototypes for the animal user, and then deploying them in contexts where the non-human animal is allowed to "become with" the technology (Wirman, Ida & Jørgensen 2015), where there are no set 'right' or 'wrong' interactions with the system, and the system and outcomes are iteratively re-Design, based on observations that employ approaches from Design (French et al. 2016). This approach puts the everyday for the animal back into the Design process and allows space for the interspecies communication issues to be iteratively teased out by all of the stakeholders (both human and non-human). In Wirman, Ida and Jørgensen's work with orangutans and screen-based technologies, the Researchers listed how the users interacted with tablet screens in their enclosures, and how they chose to interact with the devices without human intervention. These interactions included not just the interactions that could be deemed 'right' and 'proper' based on the values imbued and inscribed into the technology through human-to-human Design, but also using sticks, licking, and pouring liquids over. These types of interaction can then be folded into the Design process to nudge the Design towards a more orangutan-centred understanding of technological interaction, on their terms.

Designers such as Westerlaken and Gualeni have written about the importance of Designing for a singular animal, one that the Designer has access to, and knows (2016). This helps in the Design process as the Designer is familiar with the non-human animal's behaviour, personality, eccentricities and needs. Designing for the specific use – one cat, one dog, one orangutan, cow, whale, donkey, chicken, amoeba, horse or lizard – means that the Designer can focus on

the very specific iterations needed, but at the possible expense of marginalising other members of the same species when the user pool is expanded and the Design replicated. The Design process can be expanded outwards, and abstracted from the original user, in concentric circles of user types, as in Inclusive Design, but this risks losing the benefits of the method. It may produce the best outcomes for the specific user, but works to counter other tendencies in orthodox Design and HCI in creating easily replicable and reproducible outcomes with commercial and capital value.

The subjective evaluation of the outcomes and process by the human Designer often causes issues within interspecies Design and ACI, where the values of the Designer are projected onto the non-human animal, creating an interspecies bias in the process. For many ACI Researchers the promise of objectivity that comes from monitoring, tracking, computational observation and data collection can be employed to help to tackle or balance that bias; the objectivity of the data in ACI, much like HCI, therefore has the promise of piercing subjective value and offering an objective 'truth' about the outcomes. There is a process of interpretation from the Designer here, both in how to extract the data and what it communicates. We can interpret the data within which "elements include 'looking at behaviours' and 'attending to behaviours', but not the reasoning behind animals' actions (intentions). Within this space, all we can do as researchers is interpret these behaviours" (Hirskyj-Douglas et al. 2016:4). We must imply emotional and animal intent through observations but our access to and knowledge of these areas, even in dedicated scientific disciplines, have limitations. This study tries to reject anthropomorphic bias which "may prevent [us] from understanding the lives of other organisms on their own terms" (Sheldrake 2021:39). If we can understand non-human animals on their own terms, then we can explore new ways of coexisting, cohabiting and collaborating with them.

Through an exploration of ACI several tensions and concerns emerged in the quantitative, positivist approaches employed to understand other species and the processes embroiled with scientism. These approaches raise concerns about the mono-narratives in regard to *knowing* that they propagate. It also highlights some of the positioned and disciplined ways of *knowing* other species through scientific measurement, quantitative analysis, data extraction and abstraction of the animal into data to be parsed, interpreted and evaluated. These investigations formed the starting point for considering different Design methods and approaches to propagating interspecies understanding, and exploring how we can use more speculative methods as an alternative approach such as RtD to explore and develop understanding(s) of how non-human animals experience the world. These alternative and speculative approaches could be used as productive spaces to 'trouble the discipline' of ACI and open new imaginings, new positionings, and new configurations as new sites of *knowing*, *being* and *doing* in the world.

Limitations

Positivist approaches

ACI relies heavily on positivist approaches to Research to produce Design objects and systems that cater for the specificity of animal physiology. The discipline has a tendency to clean the messiness from interspeciesism. Through adopting a methodological stance underpinned by HCI and Animal Behavioural Psychology, user observation, ethnography, data-gathering and analysis ACI works to inform the Design process and help the Designer make educated Design decisions. These approaches to Research are applied in a positivist manner, as they are intended to answer Design problems with fixed outcomes, which cleans rather than considering and exploring the multiplicity of Design solutions (Coulton and Hook 2017). The animal's behaviours and biometric data is often tracked, logged and processed to help understand its relationship with the computer-mediated experience that abstracts and codes the animal into data sets. ACI also relies heavily on quantitative analysis of the Design, as Mancini highlights, but qualitative analysis entails the problem of inter-subjectivity in the Design and evaluative process. Westerlaken and Gualeni advise that biometric and tracking data should be used to offer data for quantifiable analysis of the interaction (2013:5), and this could help to remove the human interpretation of the animal signals to offer clearer and more useful results – the promise of objectivity. This approach can offer insights to help shape the iterative Design outcomes, but could also disrupt the natural interactions of the animal with the technology as it is observed, measured and tracked. Through human interference with the 'natural habitat' we affect and shape the interactions within it; put simply, a dog with a set of data capture devices attached to it may move or behave differently than a dog left to its own devices. Biometric monitoring also relies on the human animal's ability to understand an interspecies subjectivity and interpret and analyse the abstracted information as species-specific data. In this process the animal becomes abstract from the lived experiences and becomes *known* through data (Hook 2019). When we monitor data sets, especially abstract data sets that we may find hard to pattern because of the interspecies divides, how do we know that, in Despret's framing, 'we are asking the right questions' (Despret 2016)?

Gathering data sets, and relying on such grounded approaches to Design research, offers useful insight into non-anthropocentric Design principles, but prioritises particular ways of thinking, making and doing that marginalise the possibility of other Design practices, or Design as a place for critique, reflection, introspection or speculation. This form of Design, drawing from its origins in HCI, has a focus on creating 'useful products' which function to serve predefined needs and are solutions to perceived problems, judged by their ability to work in certain

ways and fulfil certain logics. We need to understand this scientific approach as a particular type of situated knowledge (Harrway 1988) which can come with particular types of bias in the interpretation of data.

Mess and Scientism

ACI respects the species-specific nature of the subject and Designs concerning the non-human animal, understanding all animals as subjects capable of meaningful contributions. Lawson, Kirman and Linehan suggest we must avoid "project[ing] human characteristics, such as complex cognition and emotionality, onto animals" (2016:39). To Design *with* non-human animals, we need to foster interspecies empathy and understanding so that we can start to understand the non-human animal's position in the world. We need to frame the problem and develop new approaches to understanding the non-human. We need to develop ways of understanding the non-human animals' subjectivity and foster ways of exploring other forms of being that we could think of as an inter-subjectivity. This inter-subjectivity could be considered a kind of tacit knowledge which is hard to communicate through language.

There is a danger in ACI that the Researchers focus only on the specifics of the Design process and outcomes, and not on the larger and wider entanglement between non-human animals and technology, especially in domestic contexts that are media- and technology-rich. The interactions are studies in isolation from the wider connections between non-human animals, human animals and technology. Law refers to this as cleaning the mess in science (2004).

Other forms of Design practice and Design methods from outside HCI and the sciences, drawn from Research through Design, could help to reframe ACI, open up new possibilities to reflect on the animal subject, and challenge anthropocentric Design principles. Methods from the Arts and Humanities could help to address closed, solution-focused approaches, open spaces for plurality, and help to develop new mixed methods for interspecies understanding. In an attempt to negotiate what I have called elsewhere the interspecies 'inter-subjective subjectivity' (Hook 2019) required to understand how a non-human animal experiences the world and to Design for these animals, there lies the possibility of investigating a range of interconnected Design practices such as Critical Design, Speculative Design, Design Fictions, and Design Probes. These alternative methods could be used to rethink the Design process and focus on the Design Rhetoric in ACI. Through these methods, Design can be used as a process of "engendering debates and changing perspectives about important social issues" (Bardzell Bardzell & Stolterman 2014:1952). For example, we could use a Design Probe as a discursive method to explore the possibility (or impossibility) of an interspecies embodied understanding of the world.

The outcomes of any ACI Design process all say something about how the Designers view the status of animals and the world we inhabit with them, but employing other methods could help to honour a commitment to plurality, connectedness and interdependencies which are at the political heart of the discipline. ACI could create interesting spaces for Critical and Speculative Design to investigate animality and the animal subject through Design objects. However, these objects should not necessarily be dismissed for not producing the desired usability data, as they open spaces for reflection and consideration and could be equally used to challenge anthropocentrism, but through a different lens. To return to McGrath's thoughts on such speculation, this type of Design can "excite the imagination and challenge our understanding the basic nature of computer mediated interaction" (2009:2529). If these Design outputs were more experiential and could be used by human and non-human animals, we could move to frame (rather than solve) problems in interesting ways, to open spaces for contemplation, reflection and shared futures with our non-human companions.

There are other forms of making, such as Speculative Design, that could help re-emphasise the original political nature of ACI, offering alternative ways of understanding the animal subject and helping to challenge important social and cultural issues around anthropocentrism and our relationship to non-human animals. Designers such as Anne Galloway and Catherine Caudwell (2018), Ilyena Hirskyj-Douglas and Lucero (2019), Fiona French et al. (2021) and Steve North (2019) call for a deeper exploration of Speculative Design, and more speculative methods within ACI – a wider inter-disciplinary mixed methodology, highlighting the anthropocentric biases that could be called into question through these practices.

There is a space to re-emphasise the radically political nature of ACI by focusing on what we may want to say about the world through *thinking*, *making* and *doing*. There are productive spaces within ACI as a Design Context to foreground its inclusivity, highlight the new futures it tries to propel, and explore ways to 'trouble the discipline' with other methods and approaches to Design which create new imaginings. We could use these new approaches to challenge ACI's reliance on particular methods by proposing counter-tactics that celebrate plurality, positionality, provisionality, complexity, resistance, liberation, social justice, wellbeing, equality, entanglement and inclusion. These new imaginings – rather than solutions – could open critical debates about anthropocentricism and human exceptionalism, examining our relationships to other species in the hope of fostering new forms of kinship across the species divide.

Multiplying with Research through Design

To make interventions within the current discourses in ACI I will review Research through Design (RtD) as a site for productive 'critical making' which can be used to re-emphasise or elevate the radical political nature of ACI as it offers productive spaces for new imaginings. I will assess a wide range of connected making practices in RtD through a series of Design lenses, exploring how they might offer some interesting responses to the tensions – and what I consider to be limitations – in the discipline because of its prioritisation of particular ways of *knowing* other species.

There are productive tensions between ACI and RtD that could help to 'trouble the discipline' and offer new insights. I hope to multiply the important spaces of interspecies connection, the elevation of non-human animals as an important cultural agent and Design collaborator.

Critical Making

To explore and model approaches to address some of the limitations outlined in the Design Context chapter, wider concentric circles of 'making' will be explored as approaches to model alternative, more speculative, approaches to Designing for and with other species. In this study we are experimenting with alternative Academic methods – more closely aligned with the work of Law and Escobar, who are deeply critical of the way knowledge is formed and operates – to help build understanding of, and ideally new expanded ways of *knowing*, non-

human animals. The project will investigate ways to foreground the ideologies in order to counter hegemonic political movements like ACI, and to employ the wider practices of Interspecies Design to reprioritise the importance of their underlying arguments about the way the world could be.

When Designers author new systems, processes, artefacts, experiences and outcomes, they are constructing arguments about the world, and proposing alternatives. In ACI many of the core arguments propose a new framing of the non-human as a cultural and social agent that we need to consider as a core collaborator in the Design of the work and the world at lots of different scales and using lots of different rhythms. Designers say things about the world through making, inscribing and imbuing the outcomes of their process with values and things that they think are important – proposing new ways of *knowing*, *being* and *doing* in the world: new aesthetic pleasures, new ways of framing the day-to-day, new futures, and new ways of engaging with the present. All of these are value-laden and work on audiences in different ways. They make arguments about the way the world could, might or should be. These arguments are a particular type of rhetorical form and are employed most consciously in the Research though Design movement, forms of Critical Making (Rato 2011; DiSalvo 2014), and strands that have emerged in Radical, Critical, and Speculative Design.

This chapter will explore how Designers can pose alternative, counter-hegemonic positions on the world through making, and how these approaches could broaden the methods employed in ACI to explore new ways of Designing *for* and *with* non-human animals. A broadening of the processes, and a focus beyond utility, solutions, scientism, and positivist approaches, could offer new outcomes that could address anthropocentric biases.

The chapter will first outline what we mean by a 'Design Rhetoric', and then will track a historical vein through Research through Design methods that takes a critical approach. This vein will be largely chronological, starting with Radical Design as a site for critical practice to address and challenge hegemony, through to Discursive Design to open debate and reflection. The study will then focus on Critical and Speculative Design as methods used for social, political and cultural critique. To narrow the scope and outline the approaches, the chapter will use illustrative instances of Interspecies Design from Speculative Design to deepen our understanding of the approach, and where it has been used to challenge, problematise, elevate or illuminate our relationships across species divides. Several core examples will be used, and through the exploration I will attempt to highlight where there may be some limitations in method and approach, as I did with ACI, to maximise the impact of the arguments authored into the Designs – where there are fruitful spaces within the methods to inform the approaches adopted in this study, extend those approaches, and use them as an alternative speculative strategy to the central methods in the Design Contexts.

Design Rhetoric

Overview of Rhetoric

Before examining rhetoric within Design it is worthwhile considering how the term rhetoric is being applied. Historically the term rhetoric is used to describe the art of persuasive speaking (Rapp, 2010) and how an argument is constructed to persuade an audience of a particular point of view or to convince an audience of the evidence presented. In terms of applying rhetoric within a specific context, it can be considered in relation to the three modes of persuasion: logos (argument), pathos (emotion) and ethos (character) identified by Aristotle (cited in Rapp, 2010). Within these three levels or modes of discourse, various devices can be used to appeal to the audience; for example:

- *logos underpins the argument with data, facts and logical reasoning;*
- *pathos aims to appeal to our emotions and draw upon an audience's feelings; and*
- *ethos draws upon credibility, reliability, trustworthiness, and fairness.*

Although for Aristotle, and early scholars of rhetoric, the concept was associated only with speech and later the written word, it has developed beyond this in many fields; some of them core to the consideration of this study are Visual Rhetoric, Design Rhetoric and Procedural Rhetoric.[8] These approaches expand the terms of reference and processes that can be employed to persuade an audience of the authors:

- *to the Visual Rhetoric associated with image (Kim & DiSalvo 2010), which is prevalent within marketing;*
- *to all artefacts of Design through Richard Buchanan's (1985) argument that all Design can be considered "as rhetoric"; and*
- *to Procedural Rhetoric where arguments are authored in system (Bogost 2007).*

These three core forms are employed in different ways in RtD where Visual Rhetoric is employed

8 In the refined narrative thread that I have drawn out of the study, Procedural Rhetoric wasn't applied because the responses were more playful and resisted some of the proceduralist views. It is an important component of contemporary rhetoric, and could be applied to other outcomes. The outcome of this thesis is not structured play because it makes the experience greedier – in line with Haraway's thinking on new approaches to kinships.

largely in areas such as Graphic Design, Information Design, Data Visualisation, Product Design, Industrial Design, Marketing and Communication Design. Design Rhetoric was developed within Product Design but later adopted by other forms of making to explore how an object or artefact can communicate meaning and persuade an audience. Procedural Rhetoric explores how interactive systems such as video games can construct and communicate arguments to persuade audiences of the author's or Designer's position. This study will focus on Design Rhetoric – as outlined by Buchanan – and Procedural Rhetoric for interactive systems outcomes as most appropriate and applicable to the development of Speculative Design.

Design Rhetoric, or Design as a communicative discipline, is a method of proposing arguments about the world, through authored objects, products or artefacts. It recognises that the Design process is shaped and moulded by the Design brief and the scoping exercises, but that the process is not an objective one. The Designer, as an author, plays a role in interpreting the brief, shaping the direction, interpreting the data, and shaping the outcomes. These objects, as outcomes of a subjective process, are influenced by the Designer's ideologies and politics, suggesting possible future scenarios or needs. There are many systems of power that shape the direction and decisions of the process. Some of these forces come from the commercial constraints of the discipline, where we could use the Design brief as a set of formal constraints which contribute to conscious bias, and we could use the Designer's world view as an example of unconscious bias in the process. The iterative cycles of *thinking*, *making* and *doing* are never this structured and clean, but it is important to state that there are many productive and opposing forces, some conscious and some unconscious, that shape the direction of a Design process.

The Designer works under a series of formal and informal constraints which influence the decision-making processes – these could be financial, commercial, functional, audience-led, contextual, etc – but the way that a Designer manages and prioritises these conflicting pressures and forces on the process is important. The process of creating a Design outcome is shaped by the Designer through a series of decisions (some made consciously, and some unconsciously). Within more orthodox Design outcomes, Designs are targeted to help persuade an audience or market of a particular need, or desire, either aesthetic or functional. These products form encoded statements which, as Buchanan suggests, are infused with the "influence of a Designer's personal attitudes, values, or Design philosophy; or the way the social world of Design organization, management, and corporate policy shapes a Design" (1985:4). Buchanan's work interprets Design as an ideological or subjective process of authoring objects that are imbued with, and shaped by, the Designer's social, cultural, and political environments. Although this subjectivity in the authoring of artefacts is often targeted as a weakness or limitation in RtD as a method, it can also be used as a strength to explore and expound complex social, cultural and political issues. Through the lens of Design Rhetoric, the Design outcomes form encoded statements which, Buchanan

suggests, are infused with the "influence of a Designer's personal attitudes, values, or Design philosophy; or the way the social world of Design organization, management, and corporate policy shapes a Design" (1985:4). It is important, though, to understand that the authorship of these objects can also be skewed by the Designer's unconscious or implicit biases which are also instilled into the object's rhetoric. Many tactics can be used in the iterative cycles of *thinking*, *making* and *doing* – and then in the mounting of the outcomes – in order to try to render these transparent to the audience (such as reflective work, Design diaries, annotations, process logs, statements of intent and positioning statements, some of which are employed through this thesis).

For Buchanan, Design is a future-focused, persuasive medium where the Designer (orthodox or not) is attempting to convince the audience of a particular need or a way of seeing the world, or to persuade them to choose their outcome over alternatives in a market. He embraces a move away from solutionism in Design and understands that possible Design solutions are only one particular focused and crafted outcome of an iterative process of *thinking*, *making*, and *doing*. He states (1985:7) that

> [a Design's] persuasion comes through arguments presented in things rather than words; they present ideas in a manipulation of the materials and processes of nature, not language. In addition, because there is seldom a single solution to a problem in human affairs dictated by the laws of nature, they do not provide necessary solutions. Solutions are only probable and can always be changed or set in opposition to others. In this sense, technology is part of the broader art of Design, an art of thought and communication that can induce in others a wide range of beliefs about practical life for the individual and for groups.

It is important to understand that it is not just the object or artefact that can be inscribed or encoded with meaning, values or the ability to act as a critical tool; the systems and processes underlying the technological or aesthetic structure of the Design also offer a space to foster critique or open discursive spaces. Bogost situates Digital Games as a medium that can render Design Rhetoric through the use of systems and procedures (2007, 2011). This Procedural Rhetoric uses the interconnectedness of game objects, player characters and game systems to propose arguments about the way the world could or should be. The game, as a system, can be used to author arguments about the world through processes (Bogost 2007). Procedural Rhetoric extends the work of scholars like Buchanan to help to understand how systems contain Design Rhetoric. Systems can be used as a persuasive medium, where users can explore relationships between signifiers within a system, using system affordances or mechanics. Although Bogost is essentially promoting only the conscious use of rhetoric, his definition would not necessarily preclude its unconscious use, and therefore, as Coulton (2015) argues, Procedural Rhetoric could

be applied to the Design of all computer-mediated interactive systems if we substitute system logic for rules.

We need to understand and position the varied ways that rhetoric is constructed through Design, and that Designing, as a process-driven activity, can be used to author a wide range of outcomes. The Design outcomes might be different in form, but rhetoric is produced through the authoring process; through the interconnected and intertwined Design qualities of the artefact's technological reasoning and its character, and through emotional engagement with the audience (Buchannan 1985). These three factors work to construct a Design Rhetoric for all Design practice. The outcome of the RtD process says things about the world, and the Designer (consciously and unconsciously) authors arguments through the iterative cycle of *thinking*, *making* and *reflecting*.

Design Rhetoric can be used as an investigative and iterative research methodology to explore a wide variety of complex issues through cyclical and iterative loops of *thinking*, *making*, *critiquing* and *reflecting*. This Rhetoric could be used to engage in social, cultural and political debate through Design which could be used as cultural commentary; the authoring of objects or systems could be applied to such critiques of our relationship to non-human animals, or a cultural anthropocentric bias. The approach is an important counterweight to the methods outlined in ACI (and HCI) in that it acknowledges the process as subjective, messy, and value-laden (both conscious and unconscious). Through embracing the approach and reflecting on what the outcomes communicate and how they attempt to persuade an audience, we can shape the politics at work in the Design. These tactics can encourage a more reflective approach to making which encourages thoughtful responses and which engenders more awareness of how the outcomes work on audiences to construct and communicate meaning through the work's technological reasoning, its character and emotional engagement. These approaches will be unpacked in more detail in the sections that underpin my own methodologies, to better situate the making process.

I will review a series of forms of critical making from the RtD discipline and explore ways that they could open productive spaces for questioning human exceptionalism, anthropocentricism and anthropomorphism to challenge audiences to imagine animals otherwise. These productive spaces could offer ACI new approaches to frame, reframe, and Design for and with other species, allowing us to imagine more inclusive futures that promote interspecies kinship. In the following sections I will discuss one trajectory through the 'critical turn' in Design that influences my practice and shapes the work that I make.

Radical, Discursive and Adversarial Design

Radical Design

The current critical turn in Design is by no means the first dalliance with the political, or the first response to commercial visions of the future. For example, the Radical Design movement of the late 1960s and early 1970s in Italy arose with an aim that Designers and architects should not only be seen as service providers for commercial interests, but that they could actively and critically engage in social and political matters through the authoring of politically motivated objects. It is important to trace back the practices and approaches from Critical and Speculative Design methods to understand their lineage and ground the work of this study within a wider frame of RtD.

In the paper 'Critical Design – Forgotten History or Paradigm Shift' (2005) Robach traces the linkages back from these emerging practices to the Radical and Anti-Design movements. There are many alternative histories to the practices, which can be traced back to the Droog exhibition in Milan (1993), as well as work that emerged – and continues its legacy – from Dunne and Raby in the RCA in London (Robach 2005:34). This heritage has also been tracked by Rossi (2013), Sparke (2014) and Malpass (2017) who have worked to unknot the forgotten histories of the movement. Sparke's work unfolds the 'critical' in Critical Design backwards through to the 1920 International Modern Movement. These commentators understand the movements of criticality within a broader landscape which uses industrial and product Design as critical tools to challenge hegemony, cultural norms and the role of the Designer in exploring how their practice is culturally and socially entangled.

Taking an archaeological approach and linking Critical Design to its foundations helps us explore and understand what is 'critical' or 'radical' about the practices. If we aim to produce work that challenges hegemonic norms such as human exceptionalism or anthropocentric bias, then understanding *how* Design as a practice and process does this (through Design Rhetoric) and *where* and *when* it does this, can create fruitful foundations for a more reflective and engaged practice. These movements see a shift in thinking and authorship by the Designer and a new ownership of the practice of making; this can tilt it towards a cultural and critical discourse rather than its servitude to capitalism, commercial gain and traditional industrial modes or models. The criticality across these practices, which will be explored in more depth later in the study, uses Design, and *making* as a mode of provocation to an audience, and asks it to (re)consider a range of hegemonic cultural, political and social norms. This approach can be found in

a range of countries and contexts during 1960 (and before) such as the work of The Construction School led by Potter, the Hornsey College of Art in London, and the Hochschule für Gestaltung in Ulm, Germany (Malpass 2017:20).

This (re)politicising of Design took the form of manifestoes, transdisciplinary working methods and utopian Design ideals. Radical Design protested against functionalism and the established practices of the more solutionist approaches; their gestures towards objectivity can be found in the commercial sphere – what I will categorise as a more Orthodox Design practice. One of the most influential groups in the Radical Design movement was Superstudio, cited as highly important by many architects, including Zaha Hadid (Stauffer 2002), whose work reflects this rejection of conformity. In the same time period, the UK-based group Archigram also promoted a more overtly political stance for Design, in particular a utopian, socially and politically engaged architecture (Sadler 2005). The practice harnessed playfulness, analogous to what is seen in some areas of Speculative and Critical Design in its more modern return to overtly political Design (Dunne 2008). These later moves in criticality, such as Critical and Speculative Design, outline very specific approaches and methods to explore how to engage with audiences. These will be unpacked later in the chapter, but historically become more formalised with Dunne and Raby's work. This formalisation is likely linked to their status in the Academy, as Researchers and Authors of more traditional textual research outputs.

Discursive Design

The use of rhetoric in this lineage positions Design as a mode of inquiry which can be used to raise debate and challenge audiences to consider not only a product's role in culture, but also underlying cultural conditions that lead to societal norms. This form of Design has been positioned as Discursive Design (Tharp & Tharp 2018); this overarching approach gathers together a range of named sub-categories and focuses on their commonalities and key identifiers to build a broader context for understanding Design practice situated outside of Orthodox Design. This grouping pulls together a range of conceptual Academic and industrial Design into an umbrella of methods including Critical Design, Speculative Design, Design Fictions and Adversarial Design.

Within this broad range of connected Design methods, Speculative Design, Critical Design and Design Fiction arguably share certain similarities in that they:

- *remove the commercial constraints that might normally limit the Design process, as they often do not need to be scaled or mass-produced in order to function;*
- *are often not employed day-to-day by audiences, uncoupling the methodologies*

from commercial discourses;

- *use prototypes as the main method of enquiry; and*
- *use fiction to present alternative realities outside of popular cultural attitudes and practices, often working through complex and messy social, cultural and political issues.*

As such they are indicative of a more general shift from Design no longer principally focusing on problem-solving, addressing instead the cultural and the construction of the communicative – a problem-*framing* (Arnall and Martinussen 2010; Balsamo 2011). This move to framing problems, rather than practices of solution-focused Design (prevalent in ACI) are important critical moves.

The focus of all these connected Design practices is to raise debate, and act as a catalyst for *thinking*. Where more commercial Design is often thought to decrease and smooth cultural friction, helping to reinforce cultural trends, Discursive Design challenges the audience to consider alternative presents and possible futures; it creates artefacts, proposals and context to help the audience imagine other possibilities, or critique current conventions. Orthodox Design is usually linked to ideas of utility, aesthetic pleasure, or commercial appeal; a cultural smoothing and seamless progression of technological and social change that builds ever forward along hegemonic cultural vectors that help to reinforce and bolster the social and political status quo, bias, inequality, and power dynamics constructed under capitalism. All forms of Discursive Design can be seen as possible approaches and methods of resistance. The term is contested as an umbrella categorisation because its framing foregrounds in the discussion the audience rather than the Design outcome. Such discussion is hard to capture, evidence or present; in institutional terms, the discussion is the impact of the Research rather than the Research itself.

This thesis will focus on two core trajectories in Discursive Design – Critical Design and Speculative Design – to help develop a working method of enquiry for the thesis. These approaches will be explored in more depth, as they offer approaches for more targeted critique and speculation on alternative futures by first critiquing anthropocentric bias, and then speculating on methods for progress. The study focuses on these two threads as they embrace the use of intentional and thoughtful Design authorship which can be used to examine social, cultural and political issues, author arguments about these issues and as a site of resistance to hegemony, to imagine otherwise about the world (Place 2023) and its cultural vectors.

Adversarial Design

Before focusing on Critical and Speculative Design, it is important because of the thesis' emphasis on political and cultural resistance to acknowledge Carl DiSalvo's concept of Adversarial Design (2012), a deliberately provocative approach within Design, focusing on the creation of objects, systems, artefacts and experiences that challenge hegemonic vectors and stimulate political and social discourse. Adversarial Design, like other forms of critical making (Hertz 2012), diverges from traditional Design methodologies by intentionally incorporating conflict and controversy as central components. This approach aims to provoke critical reflection and dialogue about the political implications of Design, encouraging Designers and users alike to confront and rethink their assumptions about the world. Much like Discursive Design, this is an umbrella collection of practitioners, Academics, Designers, works and strategies, but uses conformation as a rhetorical device to provoke audiences into reflective positions to prompt change. For DiSalvo it is an address to the question 'is Design political?' but, unlike with Discursive Design, it uses agonism as a rhetorical tool to elicit reflective responses from its audience (DiSalvo 2012).

Adversarial Design shares common ground with Critical and Speculative Design, both of which also seek to push the boundaries of Orthodox Design practices. Critical Design uses Design as a tool to question and critique the status quo, often by creating artefacts that prompt reflection on societal issues. Speculative Design extends this by imagining and prototyping futures that challenge present-day assumptions, encouraging audiences to contemplate alternative possibilities. Adversarial Design often antagonises the present through critical making, authoring tensions to call into question socio-political hegemonic norms and emergent cultural practices.

Despite these similarities, Adversarial Design distinguishes itself through its explicit focus on politics and conflict. While Critical and Speculative Design often engage with abstract and conceptual critiques, Adversarial Design directly engages with political and social controversies. Critical Design surfaces debate, but attempts to leave space for the audience to formulate a stance – although the space left to defend against the critical rhetoric may be small. A maker framing their practice as Critical gesture towards an intentionality to their practice which leaves a space for the audience to reflect on the benefits of the proposal. It is more divisive in this rhetorical approach because it asks questions, and leaves a space where there are appropriate-use cases. Adversarial Design takes a firm rhetorical position. For instance, whereas a Speculative Design project might envision a future society with radically different technologies or

social norms, an Adversarial Design project might create a device that directly critiques current surveillance practices or environmental policies. This makes Adversarial Design more immediate and confrontational in its approach, aiming to elicit strong reactions and foster active debate.

Critical Design

History

Critical Design uses Design methods and processes to create critical artefacts and objects, which are often outside of the traditional commercial practices of more Orthodox Design pursuits and serve an inquisitive, evocative or provocative role (Malpass 2010). The objects are usually counter to conventions or question usability, profit or taste (Mazé & Redstörm 2007) and are created as a process or product of critical reflection by the Designer. Dunne and Raby suggest that the practice "rejects how things are now as being the only possibility", and that "it provides a critique of the prevailing situation through Designs that embody alternative social, cultural, technical, or economic values" (2001:58). The Designs challenge, resist and trouble hegemonic cultural practices and vectors. This has been considered alongside Contemporary Art practices as a method that tries to open spaces for reflection, debate and critique. The outcomes of the Design process are often displayed in showrooms or galleries (Bardzell, Bardzell & Stolterman 2014) as objects of reflection.

Whilst Design Research can aid technological innovation it can also involve the creation of expressions of cultural understandings, including narratives, myths, values, and representations (Martinussen, Knutsen & Arnall 2014). These use Design Rhetoric to communicate to the audience a cultural understanding of the Designer as Author. Such approaches offer Designers a route to exploring and arguing a specific subjective political set of values to the audience through a process of making.

Critical Design as a movement is often attributed to the methods, practices and outputs of the Royal College of Art in London and, more specifically, the work of Dunne and Raby. It first appears, however, in the work of Gaver and Dunne (1997), which explores the relationship of artist and HCI Designers in the creation of artefacts and their associated methods, which explore ideas *through* Design. The work is angled towards provocation and debate, and engages audiences by employing its technological reasoning, character and emotional engagement to prompt the audience to consider what life might be like if the outcome were in common use. The 1997 paper by Gaver and Dunne focuses on the project *The Pillow* (1995),

part of Dunne's *Hertzian Tales* series (1994-1997), as a case example for how Critical Design can be used to focus debate and challenge audiences. The practice progresses and expands out from Dunne's original conception and develops into a working methodology explored in the text *Hertzian Tales* (2005). The Design artefacts, and the exegesis of the work in the published book, look to explore the politics of the unseen electromagnetic hertzian fields and how they intersect with Design objects. Dunne's approach to the body of work developed for his PhD thesis in the RCA Computer Related Design Department heavily tangles with and critiques HCI as a discipline.

For Dunne and Raby, Critical Design allows Designers to open a discursive space that accommodates the unavoidable plurality of the future: "the idea is not to show how things will be but to open up a space for discussion" (2013:51). Malpass notes (2017:42) that Critical Design, as mode of enquiry or form of authorship, favours plurality over simplicity, and how objects

> encourage us to think in tangible ways when we consider how they feature in everyday life. Applied in this way, the Design of objects – and the scenarios they exist in – can be employed to create a descriptive comprehension of complex issues.

Design as critique

Using as a starting point Buchanan (1985), who posits that all Design is rhetorical in that it constructs arguments about the future, the work of Critical Designers Dunne and Raby can be seen as ways to build cultural critique. This viewpoint extrudes intentionality, and the deliberate building of rhetorical devices within previous movements in this space. It further attempts to hone a set of approaches for using Design as a critical tool and a medium of inquiry to allow Critical Design to "embody alternative social, cultural, technical, or economic values" (Dunne & Raby 2001:58). The emphasis here is on what Malpass describes as the "epistemic qualities of a Design object" (2017:42), asking the audience to think through the use cases and everyday politics of objects presented. In this way, an object can encourage us to think through suggested scenarios and in what futures they may exist as a prompt for critical, counter-hegemonic discourse.

Within *Hertzian Tales* (2005), Dunne presents a series of objects and arguments that prompt the audience to consider a set of concerns around the unseen Hertzian fields and wavelengths. The project is "positioned as a form of social research that integrates aesthetic experience with everyday life through conceptual products" (Malpass 2017:46). These are described by Malpass as post-optimal and para-functional outcomes. These two approaches pose a certain type of argument and work as rhetorical devices to help position the objects in juxtaposition to more orthodox existing Designs or potentially more conventional 'solutions' to the

issues raised. In the schisms between the orthodox and the alternative vectors are the spaces for productive discourse on alternative ways of *knowing*, *thinking* and *being*.

Critical Design aims to resist and question the cultural smoothness towards which more commercially driven Design aspires. Where more Orthodox Design practices value ideas of 'user-friendliness' and 'optimality', Designers such as Dunne value provocation through creating 'user-unfriendliness' (Dunne 2005:32), producing post-optimal objects as forms of social, cultural or political critique. The resistance to seamless, user-friendly, functional, productive and useful experiences could be linked to the practice's *technological reasoning*. This post-optimality often relies on humour [9] and satire as rhetorical devices to engage the audience. The humour works as a form of distancing from the everyday, and also helps to frame the "units of analysis" (Bardzell, Bardzell & Stolterman 2014:1954). When engaging with a piece of Critical Design as a text, the audience must understand the units of analysis and then read the work in two steps; the "first is to classify it in relation to everyday Design languages, and second is attending specifically to the tropes that make it a critical Design" (ibid 1955). We could also consider the application of humour, satire and critique as part of the *character* of the rhetoric.

Interaction Designers Hällnas and Redström broaden Dunne's approaches to propose additional analytical frameworks and expanded methods to use Design as a critical tool. Hällnas and Redström use the terms 'aesthetics of use' and 'meaningful presence' to help expand the vocabulary and framework around Critical Design in a HCI context. The term 'meaningful presence' of an object recognises that the meaning(s) of an object does not rely just on the Designer's authorial intent; the user (or users), relates to the object and co-produces meaning through cultural entanglement. The meaning is not contained in the artefact – the Designer can lead an audience only so far – the audience creates the meaning by engaging with it. The meaning in an object does not necessarily come from its proposed use, but in our relationship. This marks a shift in Critical Design to a more constructivist approach to the creation and maintenance of meaning. Meaning is produced in the relationship between the subject and the object. Focusing on the 'aesthetics of use' for Redström shifts the analysis of technology under HCI from the functional properties and descriptors of a Design outcome to how it is used by end-users. There are issues in the application of 'aesthetics of use' and 'meaningful presence' in more traditional Critical Design because the outcomes are often objects in galleries; many do not function or work in the way they propose, and are signposts.

[9] The starting point for this thesis was the humour and seeming ridiculousness to my students of 'games for cats'. There have been many Critical Design projects that mimic these types of media artefacts, like the *Playing with Pigs* project. Humour is a really powerful tool, but maybe in the humour we can find important issues about why Designing video games for cats makes some audiences recoil or laugh. I once had to explain my project to a group of drunk golfers in a local pub while out on a 'work do', which taught me a lot about how to argue for different forms of practice, from lots of different angles, to lots of different audiences.

Critique of Critical Design

One of the key criticisms of Critical Design is Dunne and Raby's assertion of the promotion of the Designers' preferable future which, as Prado de O. Martins (2014) states, means "critical Design risks to incur the same mistakes as critical theory" by "promoting elitist views of a 'better world' that society should aspire towards" (Bowen 2010). It is important to consider who the authors of the work are and what point of power or privilege they hold. If all Design is rhetoric – to a greater or lesser degree, either intentionally or unintentionally – and argues something about the future, then it is important to consider who is making the arguments, why they are making them and the topology of conscious and unconscious biases that could be instilled into the artefact. Our world view as Designers matters, as it shapes the probable, possible, plausible, alternative and different futures that we articulate (Redström 2017:96-97). The positionality of the Designer, and their own reflective understanding of how their biases and personal histories have shaped their response, is important to the RtD process, especially in practice that aims to provoke audiences to think about alternative vectors.

Building on Haraway's statement that "it matters what knots knot knots, what thoughts think thoughts, what descriptions describe descriptions, what ties tie ties. It matters what stories make worlds, what worlds make stories" (2016:35), Interaction Designer Westerlaken suggests that it "*matters what Designers Design Designs*." (Westerlaken 2020:85, emphasis in original). The position of the Designer then shapes the Design outcomes, so we need to be conscious of the author's positioning and the ideologies that have shaped and informed the Design process. It requires personal reflection, critique, intentionality and openness. We need to be open about our intent, and the iterative loops of *thinking*, *making* and *doing* required to craft the work.

Critical Design as a discipline often elevates the voice of the author over the interpretation of the audience in the creation of meaning. This critique does not subscribe to a constructivist understanding of the creation of meaning (as Hällnas and Redström do), but instead sees the artefact as a puzzle for interpretation into which the Designer authors units of meaning; the artefact and an audience, well versed in the hermeneutics of the discourse, can work to unpack and explore the 'true' meaning of the object. The meaning is in the interpretation of the hermeneutic units of the Design by the audience. The decoding of the rhetoric and meaning is not instilled into the object by the Designer, but co-created between the Designer as author, the object and the subject. This approach is linked to Bogost's *Unit Operations* (2006), which laid the groundwork for his later texts on Procedural Rhetoric.

A further critique has been to consider Critical Design alongside Contemporary Art

practices in their attempt to open spaces for reflection, debate and critique about the world outside. They are too often displayed in showrooms or galleries (Bardzell, Bardzell & Stolterman 2014). Displaying Critical Design in a showroom or gallery separates and abstracts it from the mess of the world that it is critiquing, inviting the audience to imagine its use, or ponder how the object could affect their lives. In some cases, this is important, as it gives the method freedom to not have to consider safety, ethics, and risk in the same way as if the objects where 'useable' in the setting. The approach also has the benefit of affording the Designer more authorial control in the context that the Design is encountered. This separation from the mess also moots its potential, but has been critiqued as being elitist, sterile and disconnected.

Speculative Design

Past, (alt)present, future

In the book *Speculative Everything* (2013), Designers and authors Dunne and Raby reflect on their methods for Speculative Design, which accepts Design as a futures-focused practice, and adopt the Futures Cone to consider the categories of 'probable', 'plausible', 'possible' and 'preferable' futures. The cultural vectors under more Orthodox Design are seen as 'probable' futures that culture is building towards collectively, shaped by government's and industry's direction of travel. Orthodox Design is seen to generate more predictable outcomes and artefacts which can be mapped along the 'probable' and 'plausible' future cones depending on how smooth is their progression from the present (Dunne & Raby 2013:5). The authors adopt Voros' 'Futures Cone' as an approach to frame how we challenge and nudge audiences towards different futures. The practice, because of its future-focus approaches, speculates on how we may live in the future as a way to make us question the march of technological progress. It helps in questioning the neutrality of technology and its effects on social, cultural and political relations. It responds to some of the critiques of Critical Design's reliance on the gallery space by proposing more entangled imaginings. The Design is often accompanied by paratextual interpretive media, which helps the audience to frame and respond to the rhetoric. Speculative Design explores alternative vectors and new imaginings by examining the possibility spaces, to question what 'preferable' might look like, whose preference it is, and in the tensions between the now and the future that's proposed. Reflective spaces for imagination are created that question the prevailing hegemonic vectors. Speculative Design is developed from Dunne and Raby's work on Critical Design as well as a series of connected movements under the Discursive Design umbrella, mainly across America and Europe. Speculative Design focuses on Designed outputs intended

to facilitate discourse about the future, and focuses on technology's effects on the social, the cultural and the political, and their shaping of technological procession. Dunne and Raby propose Speculative Design as Designing for preferable futures, where more Orthodox Design is focused towards predicting probable futures and Designing products, services or systems that meet market need (Dunne & Raby 2013). This process takes the form of the extrapolation of the technologies and logics of existing systems, technologies or products to create meaningful reflections on the present and on possible futures that could extrude from our current social, political or cultural conditions. Auger also states that Speculative Design could present alternative presents as an exploration of ideologies as Design proposals (Auger 2013). Speculative Design can offer more solution-focused Design practices (such as ACI) a space for reflections, consideration and critique; to imagine other possibilities through the consideration of Design objects. It offers a space to focus on the rhetoric and politics distilled into artefacts through the process of Design. Along with the previously defined attributes of Speculative Design, it shares similar *character* with Critical Design in that the resulting artefacts can often appear subversive, irreverent, and frequently humorous in nature in order to break down the barriers to discussion and distance itself from the 'probable' outcomes of Orthodox Design.

It adopts the Futures Cone from practices in Foresight and Future Studies to assist in the Design process and frame the methods. The Futures Cone, a conceptual model used to illustrate different types of future, allows speculative Designers to experiment with and explore a wide range of future scenarios, encouraging creativity while grounding speculation in a structured framework.

The original Futures Cone, developed by Voros as a generic model for Foresight work, building on earlier Futures Studies work, creates a model comprising three main types of future: possible, plausible, and probable. The possible futures include any and all scenarios that can theoretically occur, constrained by physics and our understanding of the world, generally through scientific methods. Plausible futures are possibility spaces which could occur, based on our current knowledge, cultural vectors and hegemonic discourse. Probable futures are the most likely to occur, given existing vectors and data. Finally, the cone contains preferable futures, which represent the desired outcomes (Voros 2003).

In Speculative Design, the Futures Cone is employed to navigate and consider these different futures. By plotting scenarios within the Cone, Designers can explore a spectrum of potential outcomes, identifying not only what might happen but also what could or, based on the argument authored into the work, should happen. The could/should is often determined by whether the framing is a utopian or dystopian imagining by the Designer, led by reflections on our technological entanglement. The Cone frames complex societal issues by imagining a range of technologically mediated interventions and their possible impacts. Dunne and

Raby (2013) highlight how Speculative Design can challenge normative assumptions and stimulate critical reflection on current hegemonic vectors by creating tangible representations of alternative futures. There have, however, been important criticisms of the Cone and its application, such as those of Stead and Coulton (2022). This critique argues that the Cone propagates ideas critiqued by Law such as the 'one-world world view' which attempts to construct a unified mono-narrative of the world.

The use of the Futures Cone in Speculative Design facilitates a deeper understanding of the implications of emerging technologies and social trends. It enables Designers to create artefacts and narratives that bring future scenarios to life, making abstract ideas more concrete and accessible to audiences. For example, Speculative Design projects might include prototypes of future technologies, fictional user manuals, or immersive installations that depict everyday life in alternative future worlds. These tangible outputs serve as catalysts for discussion and debate, helping to democratise the process of future-making and involving a wider audience in the consideration of future possibilities (Auger 2013).

The Futures Cone can encourage a multidisciplinary approach, integrating insights from science, technology, sociology, humanities and the arts. This holistic interdisciplinary perspective, which draws on underpinning Research from a wide range of disciplinary knowledge, is a useful tool for addressing the complex, interconnected challenges of the future or proposing alternative presents. Its unification, though, can be problematic. Speculative Design, informed by the Futures Cone, can offer a useful tool for strategic foresight and policymaking, but also facilitates approaches to thinking otherwise about our present. By exploring a wide array of futures, Designers can identify emerging risks, opportunities, ethical debates, and examine complex social and political power dynamics. It can be deployed as an investigative framework into areas of intrigue or intervention by Designers to help to frame and discipline the iterative cycles of Research; it can act as a co-Design and participatory Design tool to work with communities, audiences and populations affected by Design decisions.

The approach is a valuable tool in Speculative Design, offering a structured and flexible framework for exploring a wide range of potential futures – and opening spaces to consider alternative presents. By distinguishing between possible, plausible, probable, and preferable futures, Designers can investigate and communicate complex scenarios, signpost issues, unpack and frame wicked problems and construct critical and reflective arguments about prevailing hegemonic cultural vectors. It can be an important tool to propose different ways of *thinking*, *being* and *doing* in, and for, the world. This futures work often relies on the Designer's ability to identify and reflect on 'signals', which are events that represent larger changes (Büchler & Biggs 2006).

Voros (2013, 2017) identifies a series of levels in future-orientated work, building on the work of Slaughter (1989, 1999):

- Pop-Futurism*, which is the most common, and has a shallow engagement with data and signals. It can often be sensationalist or have a technological evangelical quality to the predictions of the future;*
- Problem-oriented Futures Research *is less sensationalist, and engages with deeper social, cultural or political issues and their causes. It explores how organisations and society might, or ought to, respond to problems, and models what probable solutions might be. This work is usually solution-focused and looks to solve, rather than frame, problems;*
- Critical Futures*, which reflects on social inequalities and hegemonic norms. It explores "how we* create *the problems in the first place through our worldviews and deep, unquestioned assumptions. It is concerned with how we create meaning in a social context, and with what we consider important" (Voros, 2022); and*
- Epistemological Futures Inquiry*, which challenges hegemonic cultural values and core underlaying knowledges. In "unfreezing the everyday life we take for granted" and "identifying new sources of freedom and new ways ahead" (Slaughter, 1989), this futures work troubles core values and assumptions.*

The practice of Speculative Design works on Critical Futures (and when employed deeply can move to more epistemological concerns), which explore the social, political, cultural and ethical considerations that technological progress presents, and what vectors it may propel. The methods follow the similar authorial processes and methods as Critical Design in the authoring of arguments through objects, but the practice is focused on critiquing the futures that more Orthodox Design may inhabit or produce. The method emphasises Design's claims of being a future-focused discipline, but instead of a cultural smoothing and seamless progression of technological and social change, Speculative Design uses the authorial process to critique and satirise the cultural vectors that help to reinforce and bolster the social and political status quo. The practice often draws on themes of technological progress, and the effects of technology on everyday lives in shaping social, cultural and political activity. The speculation opens the audience to different kinds of *knowing*, *thinking* and *being* through critical reflection on the present. Often these artefacts are (satirical) outcomes targeted at critiquing probable cultural vectors that are dystopian; the themes reflect popular cultural anxieties or social and political concerns about the future identified in cultural signals. These dystopian narratives challenge the audience to consider the likelihood of scenarios and events that might occur to produce this future. These can often be complex, 'wicked' social or political problems, such as Climate Change, to help draw attention to, and awareness of, the probable futures. The Designs pose challenging statements,

through Design Rhetoric, which prompt the audience to engage in considerations of the ethical, political, social and cultural implication of the techno-scientific progressions. Their aim is to increase awareness and debate and "advocate a democratic and open discussion into how science and technology is developed and directed" (Malpass 2017:101).

Speculative Design is critical of probable futures, but also questions whose preference shapes them and controls their trajectories. Like its forbear, Critical Design, it is sceptical of hegemony, concerned about technological and social trends, and anxious about material culture. Designers use understatement, distortion, allegory, satire, and hyperbole as rhetorical tools to engage audiences and open space for debate. These rhetorical devices are used as prompts to help shape and direct the audience's engagement with the meaning-making. They often attempt to render mundane futures and alternative presents for an audience by creating a tension between a (perceived) shared present, and an alternative. Speculative Design, through this tension, opens up 'what if' spaces of speculation which can be employed to reconsider and rethink the cultural trajectories and social vectors. The tensions of the 'what if' narratives of speculation create a space for contemplation, consideration, reflection and intrigue.

Speculative Design opens futures and worlds, for the audience to consider what it might be like to inhabit these futures. This process of world-building happens through presenting outcomes in familiar, mundane setting such as reconstructed office, a staged front room, a set that resembles a shed or other domestic setting. The Design is also often surrounded by more familiar artefacts to soften and contextualise the tensions. The contextual set and the choice and staging of it are important to help guide the audience in how they should frame and approach the Design. The tensions between the ordinary, mundane objects and the Speculative Design help the audience in meaning-making so that they can situate the proposal temporarily, spatially and culturally. Situating the future helps the audience to imagine the world in deeper and more meaningful ways. The setting helps to signpost types of engagement for the audience and the desired reading by the Designers. The desired readings are often not as targeted as in Critical Design, but are prompts for thinking, and lead to imaginary departures for the audience that can shape their attitudes towards the future and reflections on the present.

Without the emphasis on promoting 'probable' outcomes seen in Orthodox Design, Speculative Design allows for a greater plurality of views to emerge and, when linked with Design Fiction, could free itself from primarily being displayed in gallery situations, a criticism leveled at Critical Design, creating more culturally entangled artefacts (Coulton, Burnett & Gradinar 2016). Speculative Design often relies on the interplay between the artefact presented, and a series of narratives, proposed-use cases, and user scenarios, to help ignite the imagination of the audience, shape their reading of the rhetoric, and gesture them towards certain

conclusions. These are always open, speculative and rich, but are curated to draw the audience towards a desired way of thinking, feeling or understanding by the Designer as Author. This openness is more in line with a constructivist approach to the (co-)creation of meaning, mirroring Hällnas and Redström's moves in HCI and Interaction Design. The objects and outcomes presented contain arguments authored by the Designers; sometimes these are intentional, and sometimes these come from the authors' own unconscious or implicit biases, which create unintentional rhetorical tensions. These arguments are open to interpretation, and are intentionally open to exploration, configuration, reconfiguration, experimentation and reflection by the audience. The intentionality and reflection needed to craft Speculative Design often requires the Designers to be more conscious of their authorial processes and to be cognisant of their own biases. This has led to a number of Designers' reflections on the importance of a lived praxis, where they embody the politics and ethics that they explore in their work in their everyday lives (Mazzarotto & Serpa 2022, 2024; Carlton-Parada & Prendeville 2023)

Speculative Design resists and critiques the ideas of utility, aesthetic pleasure, or commercial appeal often seen in Orthodox Design; it creates counter-hegemonic narratives to the cultural smoothing and seamless progression of technological and social change; it questions and troubles the cultural vectors that help to reinforce social and political power and status quo constructed under capitalism. When we frame problems like anthropocentrism through Speculative Design, we create a space for plurality, possibility and thinking otherwise about the world. This can open spaces of critical reflection to consider different ways of *knowing*, *thinking* and *being*.

Speculating on Animals

To help exemplify the methods and practices from Speculative Design, a series of examples will be unpacked which are Designed to open up productive spaces in our consideration of other animals. Examples have been selected as case studies that look to build our understanding or connection with non-human animals so that these can be contrasted in approach and as outcomes against the earlier work outlined from ACI. This will help to exemplify how Critical and Speculative Design have explored this terrain and how these methods resist positivist, solutionist methods, embrace mess, ignite imagination, prompt reflection and resist scientism. They offer alternative ways of framing the problem, open spaces for thinking otherwise about our relationships, and offer different ways of *knowing, thinking, making* and *being*.

Being an Animal

One of the most famous Design works to explore the non-human is Thomas Thwaites' *GoatMan* project (2016), in which an exoskeleton was created to allow Thwaites to move on four limbs, enhanced by other extra-human activities as he explores the 'goatness of goats'. This project is accompanied by his Design narrative or reflective portfolio in the book *GoatMan: How I Took a Holiday from Being Human* (2016), which tracks the Designer's approaches to exploring interspeciesism, and what it might be like to transform into a goat. The Design artefacts which help the Designer experience this, and the performance of trying to cross the Alps wearing the equipment, create a goat-like experience for the wearer and a humorous and reflective account for the audience. Thwaites' Research is extensive and he iterates a number of objects to help him experience 'goatness'. By this I do not mean to assert that there is an essential essence to the 'being a goat', but that there are commonalities and differences between the human animal and non-human animals which are explored through prototyping, testing, narrative reflection and iteration, to examine the culturally constructed ideals of 'being a goat'. The project explores the typology of goats, abstracting their bodies, and operationalising their 'goatness' through technological mediation. The largely analogue objects (a frame, a helmet, a stomach) all help to transform elements of Thwaites' body schema to mimic a goat and help him explore the similarities and differences between the body schemas. Thwaites' project is born from an idea of stepping outside the hegemonic cultural vectors of capitalism. This 'holiday' from the drudgery of progress and the malaise of modern living is Thwaites' key focus or argument through his Design practice. He is well known for his critiques of the abstraction of capitalism, and the alienation he feels from the seeming smoothness of culture, and established himself with his work fabricating a toaster *in The Toaster Project: Or a Heroic Attempt to Build a Simple Electric Appliance from Scratch* (2011). The GoatMan project documents Thwaites' journey through the explorative Design process to take a distance from the cultural milieu under Western late capitalism and step outside of being human for a while. Thwaites' argument in creating the project, and proposed through his Design Rhetoric, is not that we need to understand goats better in order to explore more inclusive futures, but that we could take sanctuary in the simplicity of non-human animals and hide there from the oppressive forces and alienation that can become ingrained in those that wish to resist 'progress'. It connects human animals to non-human animals, so promotes connection with other forms of *knowing*, *thinking* and *being* in the world, but Thwaites' authorial objective is to make us consider the absurdity of the current cultural condition, of technological, cultural and social progress. The pictograms that accompany the artefacts and reflections show Thwaites in the Alps among fields of goats, juxtaposing his new cyborgian, posthumanism body with the sleek white hair of the mountain goat. In this tension there is productive humour.

Thwaites explores using Hertzian and magnetic frequencies to dull his meta-cognitive processing so that it may be similar to the way that a goat's brain processes and mimics the immediacy and presence of being a non-human animal. His drive is not to help better understand goats, but to find a space away from having to understand being human under capitalism. For me, the vision of a goat may be important because it helps as a core sense, to explore, experience and navigate the world. That to mediate between the experience of a human, as an optocentric animal, and a goat, helping the human to take the goat's position, and try to navigate its surroundings, could offer further extension to the project and help augment the human experience. There are also possible limitations because when the work is publicly shown the Design artefacts are also worn by the Designer. While documentary evidence and written reflective diaries help to explain the progress and the journey to the audience, they fall short of allowing the reader or audience to experience the 'goatness of goats', to have a shared understanding of the project outcomes with the Designer. There is a personal reflective journey, but the criticisms of Critical Design and its gallery settings might also be levelled at this particular project.

This is a personal journey for Thwaites which he allows us to share with him, two steps abstracted, and retrospectively through a first-person reflective Design diary, as is common in his practice. The audience cannot play with the suit and experience this first hand, and the project does not help us understand how the goat orientates itself using large bulging eyes on the side of its head with vertical slit pupils. It does not help us to understand the goat; the goat is a rhetorical device in the project. It simulates the goat's body, but not its positioned and embodied experience as this is not central to Thwaites' argument. His rhetoric is not one of interspeciesism, but one that uses the non-human animal as a reflective metaphor for social alienation and cultural anxiety – we could holiday as non-human to be outside ourselves. The project asks interesting questions about embodiment, situated understandings, human exceptionalism, anthropocentricism, and the cultural condition. It is also the winner of the Ig Noble prize for Research that encourages audiences to 'laugh and think'. It is an important piece of Design which uses the metaphor of the animal to question our cultural vectors, and offers interesting spaces to consider animality.

If it could be important to simulate some of the sensory and body schema of the non-human animal, to open spaces of reflection and consideration of other species, then the work of Steve North – who has repeatedly called for exploration of interspecies Design and ACI to explore wider methods, including those from Speculative Design – could offer important examples. He presents an interesting approach to exploring interspecies communication in *Umamimi: Robotic Horse Ears*. A set of robotic ears is used by human animals to augment their bodies and communicate 'both intention and emotion' (North 2018). This piece explores the complexity and importance of non-verbal communication in non-human animals, and augments the human body to extend its capabilities. It also challenges human-centredness by situating the

communication on the horse's terms, rather than training non-human animals to communicate to humans using human language, as is often the case in ACI. The work refocuses communication from the anthropocentric bias towards optics and the visual into something contained in the body and gesture. North (2018) explains:

> Umamimi's ear movements are fully customisable via software programming. Subtleties of ear movement expression may be modelled, to reflect the varying personalities found in individual horses. Different profiles could be developed, with variations in the speed, range, frequency (of events) and degree of synchronisation displayed in the ear movements.

Umamimi is Designed to augment the human animal body, and find a space for interspecies communication, using speculative methods and Design to explore how we might better think about non-verbal communication between species. It investigates the limits of our understanding of what could be thought of as the subtilties and nuances of species-specific non-verbal communication. North emphasises the importance of understanding that all animals communicate differently, and indeed that each horse's gestures and utterances may be unique. This recognises non-human animals as individuals, and suggests that we should tailor our Design to the instance, personality and individual. It is important to acknowledge North's commitment to creating more inclusive interspecies futures, and his challenging of traditional methods in ACI with more poetic, alternative, speculative and artistic methods of inquiry.[10]

The Design is important because it does not try to communicate with another species on human terms, but instead tries to meet the horse on its terms as a legitimate and valuable cultural agent that we should converse with, both verbally and non-verbally. The project argues that we have a limited, anthropocentric understanding of communication, of who we should be conversing with, and how we should be meaningfully conversing. The project helps to illuminate a technologically mediated, species-specific type of communication where the horse could better understand our emotions rather than relying on body language, utterances, and non-verbal cues. The project asks us to consider the power dynamics of interspecies communication, shifting the centre to the horse. The project removes or replaces the cognitive mediation between emotion and communication for the human, in that it communicates directly with the horse emotional states in the human that they

10 I contacted North a few times through the development of this thesis, and it turned out that he lived about 20 minutes away from where I grew up – on a hill farm with his horses. We never got to meet, mostly to do with both of our social awkwardness and anxiety, and he died during the write-up of the work. I'll always dream of collaborating with him and incorporating the Umamimi project into the Equine Eyes project. We stayed in contact through social media channels while I worked through the thesis, and it was always lovely to have his support and encouragement.

may wish to mask, or might not even be aware of. This shifts the interspecies communicative power dynamic and centres the horse. Through its emphasis on the horse as an individual it resituates the non-human as something to be reconsidered on *their* terms, rather than on ours, and it fosters a way of approaching that illuminates the complex inter-personal and emotional complexity of the non-humans. It gestures towards kinship, dignity, care and new post-humanist ways of framing our relationships with the non-human. The digital mediation, and that the Design outcomes work for the audience – they can put the ears on and play with them – are important to help challenge the audience and increase their engagement with the Design Rhetoric instilled by North.

Another project that uses more digitally mediated and simulated experiences for the users is *Birdly* (2015), which simulates the experience of a bird flying through a digitally simulated cityscape. The user lays flat on their front on a specifically Designed controller platform, puts on a commercial VR headset and uses their arms to flap the panels and control the simulated bird's wings. The user can flap their arms to soar and glide through the city, and as they glide lower the platform tilts forward and a fan blows air in the user's face to help make the simulation all the more 'real' for the user. The multisensory experience is conceived to help blur the lines between the simulated world and the world outside the simulation to help in the transformation and imagining of the bird. This project provides the user with a very sophisticated simulation of a bird-like positioning, or creates a space for the user to contemplate what it might feel like to be a bird. The view through the goggles, or birds' eyes, offers, however, a human's perception of the cityscape. *Birdly* augments the body of the user to create a bird-like, and non-human, animal experience, but we view this experience with human-animal eyes and human modes of perception. The project does not, for instance, simulate the bird's ability to access a wider spectral range of light, and see in infrared. In this way it might be counter to ideas of interspecies understanding, because it simulates the bird's ability to fly, but the human's ability to see. This misrepresents, or under-represents, the lived experience of the bird, and proposes that it is closer to the human's experience of the world than it actually is. This makes the piece problematic for creating better understanding of birds. It opens speculative spaces for consideration, but through misrepresentation and simulation (in computer-generated landscapes), it could hinder progress in better understanding the lived experiences of non-humans.

Birdly and other interactive projects that open a space for interspecies embodied understanding(s), such as Anne Cleary and Denis Connolly's *Meta-Perceptual Helmets* (2014), Marshmallow Laser Feast's *In the Eyes of Animals* (2015), and Chris Woebken and Kenichi Okada's *Animal Superpowers* (2007), all allow the users to play with the Design artefact and experience the simulated and mediated experiences of the non-human animal first-hand; this feels important in building understanding through positioned, embodied insights rather than through reflection on what the experience may offer us (as in Thwaites' work).

Meta-Perceptual Helmets (Cleary & Connolly 2014) presents a series of five helmets, each of which allows the participant to view the world through the eyes of a different non-human animal. The helmets create a mixed human/animal perception using lenses and mirrors to shape the view of the user. The work is inspired by the early-twentieth-century vision experiments of George Malcolm Stratton,[11] who wore 'upside-down goggles' for periods of time to explore the plasticity of the brain. The work is part of the art of looking series which explores the viewer's position in relation to the art object. As Cleary and Connolly (2014) explain, the audience becomes an assemblage:

> Wearing the helmets, the visitor becomes a hybrid creature himself, part human, part machine, part animal, but also: part work of art. A work of art that challenges those who contemplate the helmet – from the inside or from the outside – to take a new perspective on the world.

The project is not presented as a piece of Speculative Design, but instead a piece of participatory arts practice. However, it promises interesting in-roads into exploring the embodied experience of a range of non-human animals. The project works through creating spaces of difference between the human-animal's perception and a mediated and operationalised typology of other species' ocular experience of the world. The project explores new ways of *knowing* non-human animals, though opening embodiments in situated and experiential modes of engagement.

Animal Superpowers (2007), created by Chris Woebken and Kenichi Okada, is a collaborative body of work which consists of three mediated experiences. The most famous uses cameras attached to the user's hand, producing a live feed to the user's helmet. The live feed is magnified, giving the user the feeling of being 50 times smaller (or ant-sized). The project also features a periscope to give the user the view of an adult (or giraffe), a device that allows you to access the ultrasonic spectrum like a bat, and a headband that tracks home, to simulate a bird's ability to tap directly into geo-magnetic frequencies for homing. Some of these artefacts harness simple solutions to draw on the similarities and differences between the human and non-human animal, and some, like the 'bird', look to augment our sensory schema to help us understand how other species perceive and navigate the world. The outcomes of the Design process are all housed in brightly coloured plastic, and the documentation presents them being played with by children. This

[11] I was lucky enough to take part in a piece of work by Carston Holler for the show *Il Tempo del Postino* (2007) where 14 volunteers wore 'upside down goggles' for 10 days. Participants were not allowed to remove the goggles during the day, and had to transfer seamlessly to blindfolds to sleep. The work required carers to help assist in day-to-day tasks and help participants navigate the city. The piece of work tested brain plasticity and the brain's ability to adapt to the new conditions. Taking part in the work has always been a formative experience on my practice to consider how we may change or augment the body to resituate the idea of the human.

textual and paratextual framing helps to present the Design and experience as playful, fun and explorative. The plastic evokes readings of popular toy brands like Fisher Price, and interactive exhibitions in museums that help audiences engage with complex issues in a participatory and fun way.

These objects open up a space to view the world as an 'animal other' and offer the user a space to experience the world differently. The possibility of new mediated embodiments offers spaces for reflection and contemplation on the limited sensory and perceptual range of humans, and a space to reflect on the process of anthropomorphising animals. These speculative projects that try to give audiences access to the embodied and lived sensory experiences of non-humans create speculative imaginings of the non-human that can be used as productive spaces for thinking otherwise about our relationship with non-humans. This project emphasises the importance of considering the different access to the world that animals' different body schema give them. This emphasis is almost counter to the approaches in *Birdly*, which prioritise the motorbody schema over the position's sensory experience. It is important to consider how we represent the embodied experience of other animals, and that we consider how we position this rhetorically. All of the projects propose different ways to let us access animality through embodied experience, speculation and imagination, rather than building understandings through scientific measurement, quantitative analysis, data extraction and abstraction of the animal into quantified and observed research subjects to be studied, parsed, interpreted and evaluated.

Birdly, GoatMan, Metaperceptual Helmets, and *Animal Superpowers* all foreground building new understandings of non-human animals through embodiment and augmentation. They demonstrate that technology has the capacity to augment the body to help us build new understandings and, in the process, new relationships with the non-human. The access to the experience differs by project; some artefacts are Designed solely for the Designer's experience, and some can be worn by the public. There are, however, other approaches that employ these methods to explore the complex relationships and power dynamics between the human and non-human. All of these projects focus on the Design of systems and technologies that are created as places for interspecies communication – directly or indirectly – and which help human animals build their understanding of the non-human and shift their power dynamics (as outlined in the ACI Manifesto). They could all help to contribute to improving animal well-being in a landscape shaped around human needs by building understanding, empathy and new forms of kinship They create new imaginings of the animal which are embodied, experiential and reflexive.

Austin Stewart's piece *Second Livestock* (2014) is a Speculative Design project which presents a new approach to farming for the digital age. The project proposes that battery farming could use immersive technology to increase animal welfare and productivity by immersing

chickens in a simulated farm environment, while stacking them high in cylindrical urban farming units. It positions itself as a satirical approach which integrates animals into the technological ecology of modern life, allowing for increased productivity. The piece is often presented in the media as a headset for chickens (others have Designed headsets for cows) which are worn by the poultry to give them simulated experiences of the outside world. The staged experience from the Designer, which often does not receive the same level of recognition, has very intentional Design to help foster an embodied experience. Stewart explains (2014):

> The aesthetics of the presentation are intentionally poor – mirroring the presentations frequently given at technology conferences and tradeshows. The live demonstration of the enclosure does not involve a chicken, rather a volunteer from the audience straps on a human-scale VR headset and places their hands on a treadmill. Though scaled in size, the virtual cameras are still aligned at the angles that correspond to the anatomical position of a chicken's eyes. This proves to be quite disorienting for the volunteer, but forces him or her to experience the world as a chicken.

The piece gained media attention, although its humour and satire were lost in many media outlets. The project attempted to use both diegetic and non-diegetic signs to direct the audience, but the imaginary spaces it produced were too compelling for media outlets to read in the intended ways. This can be an issue for some pieces of Speculative Design when they gather the attention of audiences outside of controlled interpretative strategies. The project creates a critical lens which explores how we prioritise animal welfare, and the tensions between cost-effective solutions, animal welfare and the prevailing cultural hegemonic vectors. It uses hyperbole, simulation, satire and embodied experience to open spaces of reflection and imagination for the audience. The staging nods to the project's absurdity and, in so doing, helps the audience to reflect on the potential absurdity of the current cultural conditions under late capitalism. Stewart and Wade's emphasis on the importance of accurately simulating the non-human animal's vision is an important stance. In the difference from human vision lies a space for new consideration, new framings and new understandings to flourish, and this could lead to new ways of *knowing*, *thinking* and *doing*.

Communicating with Animals

To explore the importance of more Speculative and designerly approaches that embrace Design Research as a method over HCI, other examples are useful to juxtapose against the methods and outcomes reviewed earlier in Designing videogames for cats. Westerlaken and Gualeni review the development ethos and research methodology employed to develop the game

– or "object for critical evaluation" – *Felino* (2014). This interspecies toy was developed using underpinning Research in philosophical anthropology and biohermeneutics. This Research draws on the work of Plessner and de Mul to attempt to develop a less anthropocentric Design process for playful interactions as a site for interspecies communication, connection and kinship. The paper outlines the criticised limits of interspecies understanding and Designing, but looks to solve these by developing new methodologies and guidelines for Design that aim to harness (2014:7) the

> natural curiosity of animals and their explorative behaviour [which] can be used to stimulate their engagement with interactive technological artefacts in a research setting. This means that the animal is motivated by the artefact to engage in natural and voluntary 'play'.
>
> (Westerlaken & Gualeni)

This game is positioned as a critical object, one which could sit as a piece of Speculative Design. The Research is a piece of Animal Computer Interaction, and the published exegesis of the Design research reflects on some of the failings of positivist approaches in some of ACI's key popular textual examples. The interactive artefacts are proposed by the authors as more of a Design probe than a solution, using Grounded Theory as a mode of evaluation. The Research lives within the disciplinary canon of ACI, but uses mixed methods as a way to 'trouble the discipline' and draw into question the appropriateness of the prevailing methods. There is an interesting observation to highlight here, which alludes not only to the aesthetic encounters, but also to the anthropocentric nature of logical structures of technology, based on Gualeni's work (2014). The work problematises the binaries and understands the world as already more complex and entangled. The work responds to the ACI movement's dogmatic categorisation of ACI proper, and Animal Technology. Westerlaken and Gualeni (2014:1) state:

> as argued by Gualeni, computers are "ultimately machines characterized by logics which are simplifications, extensions, distortions and repetitions of certain aspects of a human kind of sensibility and cognition" (Gualeni 2014). We argue, however, that there is no reason why the influences and the benefits of such technologies should be contained solely within the limits of our species. We share our anthropic world with animals and we are already arguably affecting their lives with technology in many ways.

This research points to new interface technologies and encounters as important ways to destabilise anthropocentric Design in audio-visual media, but also acknowledges that technology is engrained with human biases. The project recognises and foregrounds the political moves that come from working across species divides, and problematises some of the core

positivist concepts that underpin ACI. The Design outcome, as a critical object, says things about both our relationship to companion species, how we might frame an understanding of welfare, proposes innovative solutions to the research questions within the discipline of ACI, and also makes a counter move by reflecting on some of the positions taken in arguments within ACI. The work of Westerlaken and Gualeni will be revisited later in the study, because it creates healthy dialogues between Design Research and ACI to 'trouble the discipline' by exploring alternative ways of making *for* and *with* other species. *Felino*'s methods, but also its outcomes, sit in contrast to other less Design-led approaches for Designing with ACI playful shared experiences for non-human animals. In many ways, as in North's work, this is a piece of Speculative Design made within the ACI community which raises questions and debates around the ways that we *know* other species.

Other examples of playful, mediated experiences with non-human animals that emphasise the importance of play as important to wellbeing and interspecies understanding include *Pig Chase* (2013), a Speculative Design prototype from a research collaboration between Utrecht School of the Arts, Wageningen University, and Wageningen UR Livestock Research which is Designed to investigate interspecies interaction and how digitally mediated play could open a space for interspecies communication. The project focuses on animal welfare and using games as a means to entertain the livestock and reduce undesired behaviours (such as biting) between the animals. The Danish government introduced an amendment to the law governing livestock which required the introduction of a toy (usually a ball on a chain hanging in the pen) to entertain the pigs. This prototype works as a Design probe to ask questions about play, interspecies communication and human dominance. The project allows human audiences to use mobile devices to move digital objects on a screen projected into the pigs' living space. The pigs can then interact through gesture and touch. The work troubles the ideas of farming, the power dynamics of agriculture and draws audiences to pay attention to the intelligence of pigs – reframing and repositioning our relationship with non-humans. The project finds new ways for human and non-human animals to connect and play, which could shift our relationship with the non-human animals bred, kept and slaughtered for human consumption.

Designing With other Animals

Lawson, Kirman and Linehan (2016) explore the importance of participatory Design practices for developing Animal-Computer Interaction, and explore the importance of Speculative Design Methodologies to raise questions of method. The project – an internet for dogs – aims to propose plausible outcomes for new technologies that are Designed by and for non-human animals. The work is a critique of the limitations of technology to improve interspecies relations, and

the move to commodify technological innovation by Orthodox Design rather than understanding the benefits or impacts on its users. The project highlights the issues with upstream technological adoption (Lawson et al. 2015) and uses Speculative Design as a mode of inquiry to highlight issues in the field of HCI through refocusing their approaches to other forms of user. In their 2016 paper, Lawson, Kirman and Linehan emphasise the importance of shared power in Design and the inadequacies of traditional Participatory Design methods to re-balance the power in the Design relationship in undertaking interspecies projects. The work explores ways to 'trouble the discipline' of ACI, the ways that we include or exclude users in the Design decision, and how they shape the world. The paper argues that the larger technological structures that surround ACI are humancentric and are inscribed with an anthropocentric technological reasoning which restricts their ability to put the animal user at the important centre of the process. The project critiques the processes adopted in ACI that are built to Design for and with other species by arguing (2016:40) that:

> diverging species-specific abilities, human-led co-Design processes will necessarily be discriminatory toward animals, since, appropriating Wittgenstein, even if a cat could Design, we could not understand it. It follows that genuinely animal-centric technology may be inscrutable and impossible to understand from a human perspective, since the interactions would be composed primarily of signals that are meaningful only to animals.

Lawson, Kirman and Linehan's work uses Speculative Design to highlight the limits of *knowing* other species. With a set of Designs, prototypes and playful interfaces – such as a kennel with a dog's bum sticking out – the project questions the anthropocentric biases imbued into technology and process. It troubles some of the ideas in ACI, but also uses the process of Designing for and with animals as a reflective tool to gesture arguments about the wider ecologies and technological innovation. The project presents a series of critical and speculative objects which open spaces of reflection and consideration.

A variety of projects illustrates how Critical and Speculative Design has explored the cultural entanglements of the human and non-human with technology, and some of these directly critique methods and processes found in ACI. These projects can offer new embodied and performative (to a range of degrees) understandings of the non-human which seem to counter the positivist and scientific methods adopted in ACI. Critical and Speculative Design have been used to challenge disciplinary knowledge, and question methods within ACI. The approaches have offered important insights and reflections on our cultural biases and ways to challenge these through creating work that celebrates plurality, positionality, provisionality, complexity, resistance, liberation, social justice, wellbeing, equality, entanglement and inclusion. The work opens speculative

spaces to challenge, resist, and rethink our relationships to other species and how we might open critical debates about anthropocentricism, human exceptionalism, and our relationships to other species in a hope of fostering new forms of kinship across the species divide. Speculative Design could make productive interventions inside ACI to re-emphasise its radical politics, and apply methods that are not about creating solutions, but opening up new imaginaries.

Limitations

Object, reflection and audience

For this study there are pressing concerns about how Speculative Design and its related and interconnected practices engage their audience effectively in the imaginary. This is important because these imaginaries will be useful in helping to cross interspecies divides and to reposition our relationship(s). Speculative Design create objects or proposals that spur debate and raise awareness about future scenarios and needs, through reflection and imagination, rather than through useable and experiential objects, systems or artefacts. Within the discipline there has been a range of calls for more tangible and useable forms of speculation, where the audience can experience the usage scenarios and the artefacts' function. Elsden et al. would term these c*ounterfactual enactments* (2017:5387). The Designs must be useable and must be experienced by the audience so that it can meaningfully interact with the Design output. The audience need to explore what the Designs might be posing about the futures or alternative presents that we might inhabit rather observe an object in a gallery or a Design proposal. The distancing of the gallery standing, as in Critical Design, where the audience must imagine what it might be like to use and experience the proposed scenario or use case, has limitations in its engagement with audiences. This call is for a more experiential form of artefact, that can be picked up, played with, and used by the audience to help in the speculation. This could allow the audience to experience the speculation and view it from the 'inside' and the 'outside' as artists Cleary and Connolly suggest (2014). It could offer more entangled encounters employed to explore different ways of *knowing*, *thinking* and *being* in the world.

This call mirrors the call by Elsden et al. for *Speculative Enactments* – a more engaging and experiential approach, where scenarios are modelled for the participants and the speculation is made tangible by consequentiality. "Speculative Enactments generate consequentiality through both counterfactual materials (e.g. data profiles and the Abacus cards) and demanding social performance (e.g. improv work, dates)." (2017:5391). The audience should be able

to experience and play with the Design artefact, to use it and consider how it might affect their lives. The audience needs to be put at the centre of the work as a Design subject, and we need to craft an experience for them that helps them decode the Design Rhetoric and then open a discursive space for them to interact with and reflect on. This process could be by creating working prototypes that human and non-human animals can play with, or by creating work that is released 'into the wild', rather than the Elden et al. approach of creating work that is heavily performative.

As a Design process Speculative Design (and a wide range of connected processes) has often been criticised for its Eurocentrism, with the dystopian experiences that it renders as possible futures are sometimes the current lived experiences and lives of people in other counties, or from lower socio-economic backgrounds; when they propose a 'preferred' future, they are proposing a particularly Western, globally Northern preference. They can also present scenarios that further marginalise the lived experience of some communities through this Eurocentrism. This is prevalent in work that uses dystopian rhetorical devices to engage its audience and position its arguments. These dystopian narratives connect quickly with audiences, but might not offer obvious pathways to alternative, more utopian, futures.

Coulton et al. call for adopting a world-building approach which utilises narrative framing to encourage engagement and "tell a world, not a story" (2017:172). The Design artefacts create entry points into a world for the audience to explore. This approach helps audiences imagine the possible futures in between the artefacts that work as signposts to help imply the future the Designers envisage. This is not to say that we could create ACI as Speculative Design to build rhetorical worlds for non-human animals, but we could create artefacts, objects and outcomes of a Design process which could be used by human animals that could open a space for critical reflection on their relationship with non-human animals.

Mediating with Methodology

As a disciplinary interloper, it is important for me to position the methods and practices of this study and ground the work in wider dictionary discourses. This positioning will tether the work of the study to Design, and link the interventions that the thesis makes to a network of discussions about *thinking*, *making* and *doing*. The previous two chapters have outlined the Design Context – the discipline of ACI, tracked spaces where Feminist Design interventions could open discussions about the politics of interspecies practice, great new ways of *knowing* across species divides that resist positivist approaches and solutions. Through the transdisciplinary application of methods and tactics that foreground the politics of making and look to open productive spaces of hegemonic resistance, the thesis then maps a broad range of approaches from critical making to explore alternative methods to consider more inclusive futures and new forms of kinship with other species through Speculative Design. The chapter highlights some key areas where the current methods and approaches could be extended or restructured to make deeper interventions through creating working outcomes that could offer more entangled experiences for the audience.

The following chapter will shift focus from disciplinary knowledges to hone working methods to apply to the thesis. It will zoom out on Research through Design, and gradually zoom back in to the particulars of the positioning(s) the thesis will take; this constitutes a 'methodology chapter' as it will focus on, and then apply, my proposed methodology for the Design process to create Design outcomes. This chapter will look to link Speculative Design more directly to ACI as an important coupling, and then shape ways that the practice should be reconstituted to emphasise play as a mode of interaction with the Design artefacts and outcomes. The thesis proposes play as a productive space for plurality, positionality, provisionality, complexity, resistance, liberation, social justice, wellbeing, equality, entanglement, and inclusion.

Research Through Design

This chapter will explore the process and method that the Research will follow, drawing on the contextual outlines of both Research though Design (RtD) and Animal Computer Interaction (ACI). The chapter will outline a series of working methods, linked to a history of 'making' (broadly construed) as a way of *doing* that can contribute to the generation of valid and new knowledge(s). This chapter will track the importance of understanding and positioning the politics and rhetorics of the Design artefact; where the new knowledge becomes ingrained in the 'thing'. In this chapter we must position RtD or the 'making as research' in a broader research context to address why making, and situating the knowledge in an object or experience, might be a more appropriate way than other forms of knowledge generation to explore areas of interspecies Design, make interventions in the ACI Design field, or consolidate the new contribution to knowledge. The chapter will address some of the limitations outlined in Speculative Design and offer methods and framings that may enhance its effectiveness by digging deeper into methods and modes of participation.

If we can consider Research as the generation of new and valid knowledge, then we must consider what are the most appropriate methods to acquire and produce the new knowledge within the Research context. The work embraces ACI's inclusive multi-species politics but will reject the technological rationality, solutionism, and positivism it has adopted from HCI. It will focus on making Design interventions using RtD in ACI, and this chapter will focus on "Design studied on its own terms, and within its own rigorous culture" (Cross 2001:52). The chapter will argue for the importance of Design Research to supplement, augment and extend the core methods of ACI in productive ways. It will offer Speculative and Critical Design as ways to celebrate the political alternatives offered in ACI, and as ways of 'troubling a discipline' with alternative approaches to working from outside of the discipline. It will scaffold the claims from the Literature Review, and situate the proposed practices in an understanding of RtD, and in Reflection, and offer Play as a space for a kind of embodied reflection.

RtD usually starts with an open-ended question rather than a hypothesis, which will be validated or rejected through data collection, and this question is explored through an iterative reflective process of thinking, Designing and making. This process is sometimes described as Problem Framing (Schön 1983). In this methodological exploration the chapter will unpack RtD as the most appropriate way to work through the complex social, cultural and political issues associated with interspecies Design, and explore emerging methods to address the potential problems in RtD and, more specifically, Speculative Design methods outlined in previous chapters. RtD will contrast with the more traditional positivist methodologies used by many Researchers considering

interspecies Design that place most value on quantifiable outcomes (Hirskyj-Douglas et al. 2016, 2018). This chapter will outline alternative modes of inquiry that address some of the issues in the positivist approaches that dominate discourses in ACI, with their focus aimed towards fixity, reduction, singularity, solutions and defined outcomes; this is not the only way Academic Research can be undertaken – more tacit, embodied and reflective forms of knowledge can be explored. These alternative methods from RtD are useful and important in employing the pluralities and multiplicities of new knowledge needed to explore the complex messiness of interspecies kinship.

This study has so far positioned Speculative Design as an important sub-discipline which could address some of the outlined limitations in ACI's approaches to reimagining our relationship with other species. These include foregrounding the politics in ACI, navigating the issues around positivist approaches, and issues of scientism as a singular mono-narrative. The study has so far looked to call into question the ways of understanding the world and our relationship to non-human animals in more established areas of Research, highlighting some core concerns with the existing methodologies and practices. Throughout this chapter we will look at possible methods to address these shortcomings and expand the methods to create new, working, mixed methods more appropriate to the study. Annotated Portfolios will be explored as an approach to shaping and guiding the interpretation of the outcomes, and Play will be positioned as a positive trajectory for Speculative Design to embrace; this will help extend the practice and address concerns raised about the limitations of existing methods.

The study will also use 'reflective interludes' to help underpin the Design Rhetoric and situate the emerging practices within the Designer's own history of making, thinking and being. The aim of these 'reflective interludes' is to make more transparent the influences, thinking and personal histories which shape the processes, and the outcomes[12]. They will be more in-depth than the annotations traditionally found in an annotated portfolio; they will be different in form and link content to the body of the text to try to track some of the personal influences that have shaped the assumptions between conception and artefact; put plainly, these will try to track where ideas come from and understand the outcomes as personal to the Designer.

It is this reflective practitioner approach (Schön 1983) that is often seen as the most significant factor in Design's ability to address the complex societal and environmental challenges we now

12 When I discussed this approach with my wife, she asked if I was trying to find ways to incorporate 'Alany stories' into Academic work. My 'home discipline' is Media and Cultural studies which explores the stories and narratives we construct in culture, but I am also known for long, connected stories, which probably has more to do with my neurodiversity than my Academic work. I think that 'Alany stories' could be really important to Research to help position the arguments and link the personal and subjective back into the work of the Academy.

collectively face, the so-called 'wicked problems'. This framing of complexity, which was originally proposed by Horst Rittel (1972) in relation to urban planning, but popularised in relation to Design thinking (Dorst 2011) by Richard Buchanan (1992). This approach is sometimes referred to as a Designerly way of thinking and acting (*inter alia*, Cross 2001; Buxton 2010; Moggridge 1999). As the thesis sifts through the interconnected methodologies and approaches in RtD it will pose these Designerly ways of *thinking*, *making* and *doing* as productive spaces for reflection, with alternative ways of *knowing* in complex interventions.

In considering how the practice of RtD can manifest, this study places the methodology in the work of Frayling; addressing it from within the context of Fraying's description of research within art and Design (Frayling 1993) which begins by making the distinction between Research (big 'R') and research (small 'r'). Frayling equates the former to the production of new knowledge, whereas the latter is the utilisation of pre-existing knowledge within a Design activity.

So Research (with a big 'R') becomes framed as Academic and scholastic Research which generates knowledge, and research with a small 'r' describes the processes needed by Designers to inform the Design method and process. This offers Researchers a framework to discuss their activities and a distinction between both the intent and outcomes of the activities. To emphasise the problems of understanding the research within Design practice, Frayling highlights how stereotypical views of artists, Designers, and scientists often suggest a clear distinction between these activities, when in fact they are deeply intertwined: "Research is a practice, writing is a practice, doing science is a practice, doing Design is a practice, making art is a practice". Frayling's overall conclusion is that amongst these practices there is a lot of common ground but "there is also a lot of private territory". It is within these 'private territories' of ACI that the study looks to make productive Design interventions using Speculative Design. In concluding the discussion Fraying introduces three characterisations of Design research as: *Research about Design, research through Design,* and *research for Design*. These can be considered as follows (Frankel & Racine 2010):

- Research about Design: *Research focused on the experience of Designers and those who use their products i.e. Design activity, Design behaviour and Design cognition.*
- Research for Design: *The emphasis here is on creating Design knowledge and not the project solution, through an action-reflection approach. It seeks to provide an explanation or theory within a broader context; for example, research in emerging fields of Design.*
- Research through Design: *Research to enable Design where the end product is an artefact, where the thinking is embodied in the artefact.*

These clear distinctions help frame the ground for the analysis of RtD and focus the

scope of the discussion around the connected and interconnected practices and how they manifest in the process of the "*Designerly* way of thinking and acting". In the first section of this thesis, I have conducted a piece of *Research about Design* methods in ACI, isolating what I feel to be some limitations in the practice. I have then undertaken a process of *Research for Design* which explores and focuses on a practice to balance some of the limitations in the concluding part of the chapter. I will use *Research through Design* as an approach to address some of these limitations, applying Speculative Design as a particular form of RtD to the Design Context.

Although RtD and *research for Design* are characterised separately, they are invariably linked within the same artefact (Kroes 2002) and, of the three, they are "the closest to the actual Design practice" (Godin & Zahedi 2014). This should, however, be considered as linked to more Orthodox and commercial Design processes and methods rather than the more culturally critical spaces and practices employed in this study – to the probable futures rather than the preferable ones. Of these two, only RtD is considered by Frayling as producing big R Research and therefore, with this applicability to practice, we can consider RtD as a tool to explore, generate and situate new knowledge about the world, critique our relationships with non-human animals, and generate spaces for post-humanist 'thinking otherwise' about kinship with other species. The artefacts, which are a product of an RtD approach, can be considered as a form of situated knowledge (Suchman 1987) in that that they are bound within a particular instance of Design.

The Design process is an iterative and reflective process which leads to a series of small findings as the Design project progresses, and these are usually reflected through a portfolio and then situated in a research outcome. The research outcome is then the summary of a reflective process which communicates the findings to the audience or user through artefacts, systems or objects. The outcomes are more qualitative forms for new knowledge, crystallised through a research process into 'things'. These artefacts could be considered as the knots in the process for researchers such as Ingold, who examines the wider disciplines of making and craftpersonship as forms of enquiry and knowledge generation (2013). Fraying and Buchanan's approaches to Design are embraced because of their structured frameworks to help argue things about the world – and position arguments – through making. This approach to positioning arguments is important to the study as a way to understanding how we can create speculative spaces to reimagine, rethink and reconstitute our relationships with other species. Alongside the qualitative outcomes as artefacts, it is important to explore the other appropriate methods that connect to the artefact, that help in the reading and interpretation of the meanings or argument imbued into the things, systems and experiences, and find ways to appropriately present both the Research outcomes and the process to an audience to help guide the understanding.

Design Rhetoric

The Designing and making process for this study will embed itself in the work of Buchannan (1985), who explores Design as a communicative and rhetorical process with an ability to author and situate arguments into artefacts and objects, as discussed in the earlier contextual chapter on Critical and Speculative Design. For Buchanan, the Designer can leverage the *technological reasoning* and the Design's *character*, and shape *emotional engagement* with the audience, to communicate how the audience should read the artefact. These approaches can help express what the Designer is trying to communicate about the future. Buchanan's method is situated within product Design, and orthodox fields of Design, where the Designer is usually attempting to convince the audience of the value of the object against their commercial investment in it, i.e. to 'buy into"' the future that that outcome proposes; practically and usually fiscally.

For Buchanan the *technological reasoning* constitutes the logos of the outcome, its logical reasoning to the audience, user or 'reader'. This is the 'backbone' of the Design argument and poses the potential use and value to the audience. The technology here, in the *technological reasoning*, is broadly construed and links to any form of human-made object. It relies on the reader's prior understanding of the world, and in Buchanan's terms the "natural and scientific principles that serve as premises for the construction of objects for use" (Buchanan 1985:9). The technological reasoning proposes the change or shift in value for the audience. In product Design this is usually the use of the object – what it might change in the lives of its owner or the user. If we framed and applied this reading to ACI as the Design Context and method of making, it is linked to the core politics of inclusion and interspecies communication, ways to enhance animal welfare, and approaches to work more productively with other species. ACI as a discipline thus applies technology in ways that promote more inclusive futures.

The outcome's *character* relates to the perceived ethical implications of its production, adoption and use. For the audience this is usually concealed or hard to access. It is also very unpredictable and intersectional, as the outcome becomes entangled socially, culturally and politically. With the rise in complexity of Design outcomes since the seminal work was first published, this area is difficult to quantify and qualify for many users, and is often obfuscated under capitalism, but still plays an important part in the communication of meaning. The character of the work suggests its underlying politics; the character of ACI reframes the non-human as a stakeholder with agency who should be considered on their terms. The character of ACI work re-evaluates our relationships and entanglements between non-human animal, humans and technology. The practice shifts a view on ethics, and our ethical responsibilities of entangled life.

The *emotional engagement* comprises the outcome's aesthetic qualities, or how it engages with the audience outside of the core functionalities, utility and practicalities of the Design outcome. The *emotional engagement* helps to position the reader and influences the way they interpret the object.

These elements of analysis have been extended by Bogost through first his *Unit Operations* (2007) which offers an approach to videogame criticism by understanding the game as a system of connected units which create meaning by interacting with both the player and each other. This is expanded in the work *Persuasive Games* (2010), which explores how games can be used as rhetorical tools to persuade audiences. The analysis situates the meaning and its rhetorical power on the mechanics of the game. The system creates the meaning by putting units into interconnected systems that affect each other and are employed to say things about the world outside the game. The procedural rhetoric interprets interactive systems as rhetorical tools and situates the argument in the rules that govern the interaction and system. The units represent 'things' in the outside world, and the game as a text, then connects them in particular ways to create and encode a message which can be decoded and understood by the players or users. This approach has been adopted outside of games to explore other forms of system and software such as algorithms and what they 'say' about the world by ascribing different values and power relations onto the data that they process.

Often within Speculative Design practice the Designers create tensions between these three or four communicative strategies to construct and craft critical engagements with the world and ask audiences to imagine possible futures and alternative presents. Creating this tension is a productive tool in critiquing cultural presents, and then speculating on what sort of future we want to collectively inhabit. Within the annotated portfolio of work, as authored outcomes, I will explore how Design Rhetoric has been employed and how the tensions between the outcome's *technological reasoning*, *character*, *emotional engagement* and *systems* have been used to construct and convey meaning about our relationship with non-human animals, offering a shared, more inclusive, multi-species alternative present, and preferable futures.

Politics and Design

We can understand that Designing and making in a range of Research contexts is a political and ideological process of authoring arguments through Design Rhetoric into things, rather than constructing arguments through words, as in more traditional scholastic Research. The work of Buchanan makes this authoring more explicit and intentional. All Research constructs ideological arguments, but some disciplines encode their arguments with complex layered

claims of objectivity. RtD is then a largely non-linguistic approach to the generation of new knowledge, where the 'things' embody the knowledge that has derived from the research process and has been generated through appropriate research methods. The research outcome frames the problems, rather than solving them, and attempts to communicate the meaning(s) to the audience through Design authorship. As the meaning is authored in things rather than in language, the knowledge is afforded a multiplicity, a flexibility and a plurality in the meaning or interpretation, which is often a criticism of RtD.

In practical terms, this means that the Design artefact or outcome is usually accompanied with a reflective portfolio and a linguistic exploration that helps to explain the Research, communicate the findings in a clearer way and help in the decoding of the output or artefact. These paratextual outputs, which help the audience read the object, are interpretive frames that can help the Designer communicate more clearly to the audience their authorial intent and the messages they wish to communicate. This is not to say that the new knowledge then resides in the linguistic exploration, as it would in a more traditional scholastic output, but that RtD usually has accompanying paratextual work which offers to give context to the methods, process, and knowledge. As Gaver and Bowers suggest (2012:42), the theory, or written exploration and explication of the knowledge produced in RtD,

> promises generality and guidance but seems inadequate to capture the situated, multidimensional, and configurational nature of Design, and moreover threatens to occlude the potency of unique, embodied artefacts in a cloud of words and diagrams.

Although it is important to consider a range of 'making as research', the methodology for this study is situated within RtD, and looks to trouble or intervene in approaches in ACI, extend and enhance methods in Speculative Design, and explore new ways of building interspecies kinship. There is a broad range of models for 'making as research' and Design as process, but it is useful when exploring process and the scope of this study to underpin this with interaction Designer Bill Verplank's work and his consideration of difference between *craft* and *Design* (2009). Unlike craft, Design exhibits separate activities or modes. These modes inform different stages of the process of Design, and how Design can be used for the construction and consolidation of new knowledge. For example, in an ideation phase, the aim is to produce many alternatives which can be evaluated through testing. The Designer will produce a wide range of responses to the Design Context before narrowing them down through prototyping and testing. Each alternative and testing is followed by reflection, which creates the cycles of *thinking*, *making* and *doing* described earlier. Without this iteration, the wide range of alternatives and responses to the problem is not considered, comparisons are never drawn, and assumptions are never challenged. As Verplank (2009) explains:

> At the core of invention might be a hunch followed by a hack followed by another hunch (craft) but an idea or generalization is needed for generating alternatives, prototypes and tests (Design). The goal is principles, which organize the value of a product which creates a market which creates a paradigm and we are back to a fixed orbit. Design is the 'transfer orbit' that gets us out of a small orbit into a larger one.

More orthodox Design processes, phases and modes of enquiry could be considered as method assemblages (Law 2004), which can ultimately restrict what new and situated research knowledge is created to only that which is facilitated by the method. We need to be conscious and critical of how the modes and means of production can limit or discipline the types of knowledge that are created through Research. As an example of this, the traditionally adopted methods and approaches within positivist HCI shape, discipline and restrict the types of Research in the ACI community; positivist methods promote certain ways of knowing the world and propel the discipline and its solutions in particular directions. By this I mean that if a Researcher knows that the knowledge needs to be validated with data sets, then they are more likely to produce Designs and outcomes which are easily measured. If a Researcher knows that a piece of Research needs to be replicated to be valid, then they will prioritise methods of enquiry that are easy to replicate. This in turn can shape the outcomes, where the methods test the things that the Researcher has deemed as important before the Research has begun, with metrics that are easy to curtail and scale.

It is important for the Designer to be conscious and cognisant of how the method, process and phases mould the development of work, and shape the Research more broadly. The Design process can construct the *technological reasoning*, *character*, *emotional engagement* and *systems* for the Designer as a communicative process of authorship, but the methods that they employ are usually linked to disciplinary-bounded types of Research, which come with particular institutional, cultural, political and social expectations which in turn shape and direct the outcomes. RtD and Design Rhetoric can be employed more broadly across disciplinary boundaries as a method, so is useful in making interventions across disciplinary boundaries. However, its adoption within a discipline may be questioned more broadly, as it sits in tension with the methods already heavily employed to generate and validate knowledge – so RtD and Design Rhetoric could open new important approaches for positivist disciplines like ACI, but the ACI community may resist it because it has established modes of knowledge production, systems of power, and frames for what is considered Research. RtD could be used to 'trouble discipline' by making strategic and targeted interventions in the production and consolidation of knowledge in areas outside of Design, applying its methods to other sites of knowledge production to open productive discussions about how we *think*, *make*, and *know* the world.

As a Design process, Critical and Speculative Design (and the wide range of connected processes) have been criticised for their emphasis on the Designer as author, but also because the methods create objects or proposals that spur debate and raise awareness about future scenarios and needs through reflection and imagination, rather than through useable and experiential objects, systems or artefacts. Within the discipline there has been a range of calls for more tangible and useable forms of speculation, where the audience can experience the usage scenarios and the artefact's function. Some of these critiques are explored in earlier sections under its limitations as a method. Wakkary et al., in their critique of Speculative Design, call these outputs *counterfactual artefacts* (Wakkary 2016), where the object or artefact sits contrary to popular cultural hegemonic discourse and alludes to alternative presents. The object's existence in the world, and the tensions between its form and use, cause the audience to speculate on the alternative presents and plausible futures that could surround the object. These *counterfactual artefacts* create tensions between the hegemonic cultural vectors and the world that the Designer is building through world-building techniques such as diegetic artefacts, stories, usage cases, media imaginings, fabricated news reports, and fictional scenarios. These work as breaching experiments (Garfinkle 1967). What worlds do these objects come from, and what alternative cultural vectors produced these objects? The fictional worlds that created these objects, and the tensions and frictions that their use could cause, create spaces for reflection, introspection and speculation on the possible, plausible and preferred futures that we might collectively inhabit.

I will argue that the Designs must be useable and must be experienced by the audience so that they can meaningfully interact with the Design output. This is important so that the audience can explore what questions it might be posing about the preferable futures or alternative presents that we might inhabit, rather than constructing their own imaginary worlds from an object in a gallery, or a Design proposal. Through 'doing' and 'playing', we can have more meaningful engagements with possible, plausible and preferred futures and alternative presents. This will be a call for a more experiential form of artefact that can be picked up, played with, and used by the audience to help in the speculation. Through performance and play in Design, we can open new ways of *knowing*, *thinking* and *being*.

If, as I have previously outlined, the outcomes of any ACI Design process all say something through Design Rhetoric about how the Designers view the status of non-human animals and the world we inhabit with them, then ACI could create interesting spaces for Critical and Speculative Design to investigate animality and the animal subject through Design objects. If we employ RtD as a process then we could explore more complex relationships, or relationships of complexity; but these objects should not necessarily be dismissed for not producing the desired usability data or 'solving' problems, as they open spaces for reflection and consideration on the process of interspecies empathy, interspecies communication, understanding, ways to address

anthropocentrism and create sites for new interspecies kinships to blossom and bloom. These speculations, as McGrath posits, can "excite the imagination and challenge our understanding [of] the basic nature of computer mediated interaction" (2009:2529). If these Design outputs were more experiential and could be used by human and non-human animals, then they could create a more tangible and embodied discursive argument, rather than the rhetoric built on reflection and imagination in previous types of practice. They could, like other pieces of Speculative Design that use non-human animals as a Design Context, prompt more embodied reflection. This position mirrors the call by Elsden et al. for *Speculative Enactments*, a more engaging and experiential approach to Speculative Design where scenarios are modelled for the participants and the speculation is made tangible by consequentiality. "Speculative Enactments generate consequentiality through both counterfactual materials (e.g. data profiles and the Abacus cards) and demanding social performance (e.g. improv work, dates)" (2017:5391). In Speculative Enactments the Designs are not just outcomes but performances within Design Fictions. This can also be situated in the experiential futures (Candy 2010; Candy & Dungagan 2016, 2017).

Candy's work in foresight and future studies argues that the fields' lack of impact on mainstream culture over the past half a century lies in its lack of experiential work (Candy & Dunagan 2016:26). If Designers and thinkers wish to impact large-scale "social foresight" then they need to embrace what they term the "experiential turn". They argue that to connect with audiences in a more meaningful way, we need to "us[e] the whole continuum of human experience as a palette for engagement". Candy has termed this approach Experiential foresight, and it involves creating experiences that allow people to live through, interact with, and reflect on different future scenarios. Unlike other approaches examined in this thesis, it is not explicitly critical of hegemonic vectors, but Candy argues that the approach contrasts with traditional methods in foresight that often rely on abstract reports and projections. By engaging the senses and emotions, by tapping into the somaesthetic, he argues, the practice of experiential foresight makes potential futures more immediate and compelling, fostering deeper understanding and more meaningful insights.

Candy's *Experiential Futures Ladder* (2016) is a conceptual framework that categorises futures and foresight work into differentiated levels or tiers of engagement and immersion, which are highlighted as important for social change. The model structures understanding of the spectrum of techniques that can be used to bring future scenarios to life and situates embodied, immersive engagement as the most impactful approach to promote ideas of change. In their critique of other practices such as Speculative Design, Candy and Dungagan construct a hierarchical framework which works between the abstract and the concrete/specific; futures work needs to be immersive, performative, engaging, participatory and reflective. Their position structures futures work into different mediated categories:

- Images and Visualisations: *The simplest form, involving the creation of visual representations of future scenarios. This might include illustrations, infographics, or computer-generated imagery that depict potential futures.*
- Artefacts from the Future: *Objects or items Designed to appear as though they come from a future scenario. These artefacts can be used to spark conversations and reflections about the future.*
- Simulations and Role-Playing: *More immersive techniques where participants engage in role-playing exercises or simulations that place them in a future scenario. This can include serious games or live-action role-play (LARP) exercises.*
- Immersive Environments: *Creating fully immersive environments that participants can explore and interact with. These environments might use virtual reality (VR), augmented reality (AR), or physical installations.*
- Live Experiences and Performances: *The most immersive and engaging form, involving theatrical performances, interactive installations, or live-action simulations where participants are part of a dynamic, unfolding future scenario.*

Candy and Kornet (2019) propose models for experiential foresight which encourage work that is immersive, engaging and reflective. They propose crafting environments or narratives that fully immerse participants in a scenario. This could be through physical spaces, interactive media, or performances, but the scenarios should actively involve participants in the experience, encouraging them to interact with and influence the scenario. These immersive encounters are then enhanced by providing opportunities for participants to reflect on their experience, discuss and analyse the implications and their feelings about the future the work proposes.

Candy and Kornet's model for *Ethnographic Experiential Futures* or *EXF* (2019) suggests that Researchers need to work through a cycle of *mapping* (*multiplying*), *mediating* and *mounting* of work to engage audiences deeply, interviewing participants to gather subjective data about their visions of the future, asking prompting questions to tease out stories. These stories, in later models, can be expanded to extend the data set or ideate alternative wider concentric circles of imagination. They then mediate these futures into experiences which are "tangible, immersive, visual or interactive representations" (2019:11), and then mount the work on display for audience engagement.

This active, participatory, managed, curated and Designed process allows the participants to configure and reconfigure the Design Rhetoric in real time, creating imaginations, assemblage(s) or opposition to their lived experience of the world. The speculations become alive and performed. Other Designers such as Tereza Ruller and the post-critical Design studio *The*

Rodina have similar performative practices which they use with audiences to help them enact and interact with the Design Rhetoric. The Rodina terms this type of Design Performative Design. Ruller (2021) describes the process of Performative Design as one which

> considers and works with time and space, it opens Design processes and performative Design has [the] ability to invite others or everyone; so it invites those that want to join in into these Design processes it is open not just for participation but also for co-creation, so it somehow also breaks this hierarchy of the Designer and the one who follows the task, lets say, but its really less hierarchical set up where invited people can co-create. So [the] audience is not spectator anymore in Performative Design but maybe more a player or contributor.

The work of Candy, Dungagan, Kornet, Rodina, Elsden et al. is aimed at creating interactive experiences for the audience where the outcomes of the Design process, or the process itself, are an open framework for the audience to participate in, co-create meaning, and have an embodied, playful, interactive and reflective experience in and with the Design. These performative scenarios create an embodied experimental participatory experience as an outcome (Ruller 2021). The Rodina have used this to help expand participants' engagement with post-humanist ideas which explore our relationship with the earth, the environment and to decentre the human-animal subject. The playful, participatory experiences can help audiences to consider other ways of *thinking* (or thinking otherwise), *acting* and *being* in the world. Experiential Foresight does not always adopt a critical perspective, but for Ruller, the Performative Design experiences are as a resistance to the cultural vectors under capitalism that look to commodify orthodox Design outcomes and the labour of Designers. Performative Design, through its playfulness and imagination, offers a way to think outside of the current structures of capitalism. Through the performed, structured, playful acts, Designed and orchestrated by the Rodina, open spaces for contemplation, re-imagination and re-configuration so we can start to restructure and rethink our relation to the world. The embodied acts are powerful because they form a different type of reflection on the topics through play. As Ruller (2021) states:

> suddenly, through embodiment, right so I'm using these tactics from performance art, through embodiment or roleplay from games [...] you can literally become something else for a very short moment through the performative act. These moments are so special because you might understand different angles at looking at issues or looking at problems. We can embed ourselves and become, lets say embodied ground. I can make people understand through Performative Design how the earth is feeling, for a short moment, but there is this breaking point, there's a breaking moment [...] you've forgot about yourself as human being, as Designer or art lover, or whoever

[...] and you think of yourself as something else.

The Rodina use this approach as a site of resistance against capitalism and offer the approach as a possibility for thinking and being (only for a moment) outside of the prevailing cultural vectors, and outside of the human condition. This performance, play and the imaginative spaces of embodiment offer powerful methods to extend Speculative Design, enhance Experimental Foresight and even extrude out of the Elsden et al. Speculative Enactments new methods and tactics to engage audiences more meaningfully in speculation and 'thinking otherwise'. These methods are Designed to help audiences reconsider and restructure their position on important social, political and cultural problems such as anthropocentricism, offer new methods for understanding other species, and create spaces for new forms of kinship to grow. The audience should be able to play with and through the Design Rhetoric to explore its political ramifications for the alternative cultural vectors.

To build on this approach the audience should be able to experience and play with the Design artefact, to use it and consider how it might affect their lives. The audience needs to be put at the centre of the work as a Design 'subject' and we need to craft an experience for them which helps them decode the Design Rhetoric and then open a discursive space for them to interact with and reflect on it. This process could be by creating working prototypes that human and non-human animals can play with, by creating structured sets of tasks that the audience perform as part of experiencing the work, or by creating work that is released 'into the wild', rather than the Elden et al. approach of creating work that is heavily performative – although this could have huge ethical impacts. In this approach the projects would be released as speculative artefacts for the public to work with and through at performative events.

Meaning-Making

Authoring and communicating meaning

The similarities and differences between Critical and Speculative Design (and the gamut of associated RtD practices) have been explored in depth by Bardzell, Bardzell and Stolterman (2014), among others. Both approaches engender social, cultural and political debates, aiming to invite the audience to reflect on important issues. The work often attempts to create a space for reflection and critical engagement with complex issues – 'wicked problems'. Although Tonkinwise (2015) advises against engaging too deeply in the taxonomy of types of Design, they are useful within this study to position types of critical making through RtD, and observe

how they rhetorically function, or employ Design Rhetorics to engage with politics, author arguments, and shape attitudes. Designers create work that is developed not to solve, but to frame problems for the public to reflect on. The personal politics of the Designer (both consciously and unconsciously) are distilled into the artefacts, and they are deliberately developed to propose questions, create debate and author arguments through visual and Design Rhetoric. The Designers, as authors, render rhetoric in objects and artefacts through making in a wide range of mediums, and imbue the artefacts with meaning(s). Design rhetoric is produced through the authorial process, through the interconnected and intertwined Design qualities of the artefact's technological reasoning, its character and through emotional engagement with the audience. By posing future scenarios and/or alternative presents, the Designer can open spaces for reflection for the audience to consider the personal, cultural, social, and political impacts of the scenario. The creative tensions and productive fissions between the current cultural vector and the proposed alternative by the Designers create a productive space for the development of new understanding(s) in the audience. This is where the 'meaning' is communicated to the audience. The problem is framed and the Designer, as author, can communicate with the audience. The communication is constructivist and uses the artefact's technological reasoning, character, emotional engagement and systems to lead the audience towards particular evaluative outcomes. These three factors work to construct a Design Rhetoric for all Design practice, but their deliberate application and the tensions that they cause in Critical and Speculative Design are the productive spaces for reconsideration and reflection on the present.

Making as an approach to exploring complex issues is often seen as a way that Designers are able to deal with the complexity or messiness of the real-world situations they are primarily engaged with. It is an appropriate research method to explore the complex interconnected social, cultural and political entanglement that we need to examine when exploring interspecies ways of *being* and *knowing* because we do not have means to access the lived experience of the non-human animal in any depth; when we do, we are prone to anthropomophising other species and to anthropocentric ways of understanding the complexity of interspecies and multispecies communication and relationships. ACI has adopted positivist methods to clean the mess and abstract the experience of the non-human into data sets – which is one particular way of knowing the world – but the issue is too complex, too messy. The sociologist John Law states: "If this [something] is an awful mess [...] then would something less messy make a mess of describing it? [...] Simplicity [...] won't help us to understand mess" (2007). His work in this paper and the book *After Method: Mess in Social Science Research* (2004) is centered on a comparison of contemporary positivist methods and approaches in the discipline. These methods utilise scientific techniques that favour clarity, specificity, fixity and repeatability at the cost of repressing the mess. The methods reduce and abstract the complexity of cultural issues and the plurality of

ways of knowing the world. Law argues that social realities are inherently complex, unpredictable, and messy. Traditional methods, which seek to impose order and clarity, often fail to capture this messiness. By trying to impose predefined order through methodologies, we can oversimplify the Design or Research context. In his exploration of scientific method, Law critiques the Social Sciences for their tendency to simplify and sanitise the complexities of social phenomena. These methods often exclude or overlook important aspects of reality that do not fit into neat categories or frameworks. In *After Method*, Law introduces the concept of 'ontological politics', suggesting that the methods that Researchers choose to employ to study the world shape and define the realities we discover. Methodological choices are not just technical but also political and ethical. The tools we use to know the world are important, and the way they shape the cultural vectors and contours of knowledge should be part of our understanding of Research (and its 'findings'). Instead of striving for certainty and clarity, Law advocates for embracing ambiguity and uncertainty. Law sees these as intrinsic aspects of social research, which means acknowledging that not everything can be fully known or understood – that there are some parts of the world, many parts, which we cannot access. He proposes a performative approach to Research, where methods are seen as practices. These practices help to enact realities, and guide vectors, rather than simply representing or documenting them. Understanding and exploring the mess encourages researchers to be more reflexive and aware of the effects their methods have on the knowledge they produce.

These critiques of positivist methods ring true, for me, within ACI's approaches to exploring our relationships with non-human animals but, as I have argued, these positivist methods limit the responses of the Research, hinder our ability to think of other worlds and to 'imagine otherwise'. In more scientific modes of inquiry, ideas of imagination or speculation are treated with suspicion. It is not that these are not important elements of the process, but, as Sheldrake (2021:17) points out:

> Part of writing up research is scrubbing it clean of the flights of fancy, idle play, and the thousand trials and errors that give rise to even the smallest of findings [...] scientists have to appear credible.

Where scientific methods close spaces of imagination in favour of fixity, objectivity, and findings, it may be important to open spaces of speculation to explore the interspecies tensions. The world we inhabit is too messy for clean methods; our relationships are too entangled and complex, the social, cultural and political issues too interconnected, and the world is too intersectional. Mess, according to Law, is almost the opposite of intellectual hygiene; by this he means that everything that is typically removed in order to perform un-biased, lab-based Research can be considered as mess, and the cleaning of this mess affects the quality of claims

that can be made and knowledge that is generated. He argues that this mess makes up a very large portion of the world we inhabit, and in this instance is at the core of the complexities of interspecies understanding and interspecies Design. Mess is highly relevant to the Research in terms of understanding the limitations of the data, but it encourages the iterative (re)defining of the question that your Research is trying to answer. Mess makes things slippery, and affects our ability, as Researchers, to make objective claims.

One of the primary criticisms of RtD is that the subjectiveness of the Designer can often take a leading role. This can form an iterative and reflective process, with research outcomes affected by the culture of, and the knowledge held by, the Designer(s) through the authoring process. Although it is important to acknowledge this criticism, if we understand all knowledge as situated and engendered – socially, culturally, politically and personally – and we learn to explore the ways that we can embrace and magnify this, then we could work productively with a wide range of methods to generate and validate new knowledge (Haraway 1988). Whilst embodying values in Design can be viewed as problematic, it can also be considered as a positive and appropriate method for generating new knowledge when we consider the Design as rhetoric. It is a method that can adapt, celebrate and navigate the mess. If we focus less on cleaning the mess, and more on communicating the complexity of it, saying something about it, letting audiences experience awe in it, get dirty and entangle themselves in it, we could create more meaningful outcomes which propagate new ways of *thinking*, *knowing* and *doing*. We can use Design Rhetoric as a method to say something about the mess, the human condition and our relationship with other species. We could trouble other methods and draw into question anthropocentric biases. By authoring arguments – through the choices we make, being intentional, reflective and thoughtful – we can communicate meaning to an audience. We need to be conscious about the Design decisions we make and find ways to make these developments transparent. The Design Rhetoric is inscribed into the Design with myriad choices that may include the functionality of the Design, its aesthetics, the practicalities of production, and the motivation for making, the identities and capabilities of the people for whom the artefact is intended (Gaver & Bowers 2012). Through embracing methods for presenting RtD that communicate reflection and intentionality, and the decisions we make through reflective diaries, interludes, positions and annotations, we can present some of the messiness of process back to the audience, so that they can read and interpret the outcomes.

Tactics for controlling interpretation

Throughout this thesis a series of 'reflective interludes' has been adopted to help reflect on the personal and professional journeys that may have influenced the formation of the work

and the direction of travel for the study. These 'reflective interludes' embed the work in a personal narrative that shapes the ideas, processes, and outcomes of the study. They link the Academic exploration, interrogation and explanation to the cycles of ideation, iteration and consolidation. It has been important to find ways to embrace the entanglement of the subjectiveness of the Design process, and the way that that rhetoric is formed through RtD. Buchanan has always been open and upfront about the influence of the Designer's values on the process when exploring Design Rhetoric, but in this thesis it has been important to employ methods that explicitly address these, lay them open, transparent and bare. These interludes are formatted and Designed into the document so that they can be read or passed over for a purely Academic engagement with the work, but add additional value in the reading of the outcomes and help to network together the choices that have been made. They work to add an optional interpretive lens, but also to help shape the interpretation. They add mess – a mess that has often been cleaned from Designs presented in Critical and Speculative Design practice where outcomes have been mined, refined, polished and cleansed for public consumption.

The transparency of the reflective process has also been important in situating the work in broader personal, institutional, cultural and industrial moves. It is important to understand some of the things that might have previously been removed in order to consider the work 'done' and ready for public consumption, as these can, and have, consciously (and likely unconsciously) biased the Design process. An example of this may be previous creative work, or creative experiences such as the 'Upside Down Goggles' experiment, or previous work such as the *Theremin Suit*, which extended and augmented the human body. I have tried to include these, and to be open (as much as is possible) about the personal stories such as my children's fascination with the horse in our back garden. These are as important, if not in some cases more important, as the Academic inquiry to the progress and shaping of the work.

For the major outcome in this thesis, a public development blog was established to track the development of the work and 'prototype in public'. The blog worked as a Design journal where Academic work could be unpacked and collated to inform the development, and it could be mapped into the development of the Design outcomes. There are also staggered reflections on process, technical development and prototyping throughout the journal, which help to document process, and link through to the Design reflections. Although this 'work' sits disconnected from the artefacts that formed the outcomes, the knowledge is embedded in the outcomes, shaping its systems, physical appearance, and development process. The Design journal tracks the development of the Equine Eyes project foremost, but the learning from it is folded into the other thesis outcomes. The journal tries to present the messy, the flights of fancy, and the trials and errors that give rise to even the smallest of findings. It presents some of the *Research for Design* outlined in Frayling's writing at the beginning of this chapter and documents the

processes, and iterative cycles of reading, tinkering and testing. There is obviously a process of refinement, mediation and curation of this process, but these logs have helped underpin the more formal exegesis of the practice in the final chapter of the thesis where I formalise the iterative prototyping steps, the intent from me as a Designer, or the practical applied steps in refining the idea. I also cover where the idea was presented for feedback, my reflections on any nudge forward the work has taken, and where it may need to be nudged next. This journaling has helped to document the 'accumulative drifting' (Krogh, Krogh & Markussen 2015:7) which has been part of the Research process. This drifting process to hone towards an outcome has been important in refining the work. There have been instances throughout the study of 'comparative drift' involving testing of other methods and modes of engagement, such as the Interspecies Toolkit, the Interspecies Card Workshops, and Interspecies Personas work, but the findings from these were smaller. They helped to shape the direction of the work, and to test and compare ideas and approaches, but were not as fruitful.

The thesis will produce Design artefacts that can be used by the public, but also produce an annotated portfolio (Gaver & Bowers 2012) as part of the applied methods. This will be used to help the balance between honouring the importance of the outcomes of the process while articulating the intentionality of the Design – how it has employed but also produces and crystallises 'theory' into a rhetorical object. As the outcomes of the thesis will be Designed to be experiential, that audiences can play with and through the rhetoric, it has been important to create a series of 'pictorials' of them (Blevis et al. 2012); these are outcomes that rely heavily on visual communication rather than written to communicate meaning. The pictorials will be used to foreground the artefact and outcome of the RtD process, so that visual media is being employed to communicate the Design outcomes. These pictograms will be accompanied by a small amount of text which will lead or frame the audience's interpretation. The pictorials will form the major method for mounting the work alongside the performances. The notes on the annotated portfolio and the text on the pictorials will attempt to communicate the Design Rhetoric to the audience, although the annotations will attempt to use as few words as possible to help foreground the visual outcomes. These pictorial outcomes will help to showcase the work, and attempt to capture and frame the character of the piece. The short annotations in the annotated portfolio help to guide and shape the audience interpretation, but it is crucial that the work is experienced by an audience and performed (Bowers 2012). This will be unpacked in later sections of the thesis, but has resulted in a number of 'forms' for the outcomes and informed the methods.

The 'work' is a series of artefacts that need to be used by an audience. Much of its 'meaning' has been shaped through iterative cycles, presentation to audiences, and display in public events with discussion and dialogue with attendees, but the work needs to be experienced to be understood. In the *Equine Eyes* project this involves wearing the artefact and engaging

in playful activities, and in outcomes such as the Interspecies Design Cards, working through a toolkit which embeds the meaning in the doing of things. These outcomes are then presented in pictorials (short, flat, visual outcomes) and these pictorials stack to create an annotated portfolio outcome which offers a useful interpretive lens to help the audience understand the Designerly intent, shape the communication of meaning, and guide the interpretation of the piece. The work only really comes into the world when it is actively engaged with and worked through, and the audience becomes entangled in the meaning-making process. Although this might be considered more 'messy', it is the intention of the thesis to embrace the mess, explore it, mine it and navigate a series of interpretive strategies (workshops, pictorials, annotated portfolios, reflective interludes, Design journals, and public engagements) to produce documentation help to control the interpretation of the outcomes.

Exploring Mess

Whilst RtD more broadly is being adopted within other more positivist research discourses, such as the HCI (and ACI) community, and there have been calls for the application of Speculative Design in ACI from Galloway and Caudwell (2018), Hirskyj-Douglas and Lucero (2019), French et al. (2021) and North (2019), it has proved highly contentious for some Researchers. It causes tensions between those who simply conflate it with 'making' and wish to create generalisable models and frameworks (Zimmerman, Forlizzi & Evenson, 2007) and others who wish to maintain its original focus of reflection on process, rejecting the notion that generalisation is applicable or even desirable for Design practice (Gaver 2012). The tensions between the (seeming) objectivity of the scientific methods, and the acknowledgement and celebration of the subjective nature of RtD can be problematic for Researchers who subscribe to narrow definitions of knowledge and *knowing*. RtD and, especially, the processes of critical making, trouble the methods in the sciences and produce different types of knowledge. It is important to find interpretive and interpolative strategies to explore the social, political and cultural 'mess' of interspecies understanding. These threads can be linked back to Law's consideration of mess and the need for very different methodologies used within science and Design to work through the generation of new, and consolidation of existing, knowledge. Whereas sciences' methodologies typically concentrate on the outcomes of the scientific research processes, such as empirical claims, laws and theories, there are other, more speculative, embodied and tacit, ways of 'knowing the world' that could honour, embrace and explore the mess (Hook, 2019). The workshops, pictorials, annotated portfolios, reflective interludes, Design journals, and public engagements are strategies to help elucidate the making process and help in extracting meaning from the mess – both of the work, and of the world. These reflective, and often subjective and situated, ways of exploring and understanding the world are important contributions to untangling (even just a

little), but also contributing to, the entangled, provisional and interconnected mess of the world – these knotty, complex, wicked problems. The methods promote plurality, lived experience, story, complexity, and embodiment.

Whilst HCI (and ACI) research practices have an important role to play within exploring interspecies Design as Research, they produce and propel a particular way of knowing the world through abstraction and measurement. We need to understand the limitations of those ways of knowing the world (outlined in previous chapters) and create new approaches to interspecies understandings that respect the mess and entanglement of the world. The sciences produce particular, clean and refined ways of knowing, but these are abstracted from the rough and tumble and mess. There should also be a place for RtD, as it provides reflection on the processes of Design and explores the complex and messy cultural and political issues around interspecies Design. Exploring these 'other ways of knowing' are important to help build meaningful engagements, but also start to engage and connect with non-human animals on their terms, and in the wild (by this I mean in the spaces that they inhabit), rather than extrapolating and patterning data. It could also offer us new ways of knowing ourselves.

Why is making mess good at exploring mess?

RtD as a methodology in Academic discourse often does not look to solve, but rather to frame problems. When applied to critical making it can be used to surface and outline a social, cultural, or political issue, and then Design in and around the problem to help raise debate, speculation and alternative imaginings of the possibilities this problem presents. RtD is, especially in this thesis, an explorative and probing method which employs Design Rhetoric to present persuasive arguments about the way we know other species, and the limitations of knowing. It is used to trouble other methods in ACI as a Design Context, and present other framings. It leverages the imaginary and the speculative to embrace the mess. It explores and renders other methods that open new lines of inquiry. It situates itself in the subjective, personal and rhetorical and offers new ways of knowing for more scientific approaches to interspecies understanding. As Sheldrake notes(2021:17), it celebrates how

> imagination forms part of the everyday business of inquiring. Science isn't an exercise in cold-blooded rationality. Scientists are – and have always been – emotional, creative, intuitive, whole human beings, asking questions about a world that was never made to be catalogued and systematized.

The Researcher can present the outcomes of the process as a set of artefacts, but it is

also important to represent the process, reflections on the development, refinement and honing of the process to help elucidate the proposed meanings and rhetoric. The process is a messy one, one that can further complicate the issues rather than proposing and offering solutions which propel the social, cultural and political vectors, as with more Orthodox Design practices. This additional mess can be useful in helping audiences orientate themselves within or towards a problem. The outcomes, especially if they are experiential, often go beyond 'attention raising' and instead create a set of outcomes that allow the audience to reflect, discuss and position themselves towards or away from the proposed argument.

The method of authoring arguments into things is one that leaves space for interpretation and accommodation by the audience. It helps the audience build understanding(s) through positioning and reflection. This is a messy process, but the mess and meaning are constructed in such a way (through Design Rhetoric) when presented alongside what I will refer to as 'documents of intent' that the mess can be productive in helping audiences imagine alternative futures. The mess of the work, authored in a way that allows a multiplicity of interpretation and understanding, is key to the politics of making employed in RtD. Creating a 'messy situation' which further complicates the current social, cultural or political discourse is a productive and important process in navigating complexity, entanglement, interdependency, provisionally, the flux and the intersectionality of what Law has called the 'mess' of the world; its social, cultural and political milieu. The mess navigated and created through RtD is particularly well suited to framing these knotty, complex, wicked problems. The subjective lived experience of crafting the rhetoric has been captured in the Design Diary presented alongside the work. This artefact documents the positioned, subjective journey of crafting the Design Rhetoric. It draws on the way that I have shared the development of the work over the duration of the project by drawing on the images that I post, and the captions that accompany them to present the lived experience and the story which shaped the work and my responses to ACI as a Design Context. This diary, as a process log, tries to balance the Reflective Journal which I kept in the online blog by weaving the personal, subjective and lived experience back into the work. All of these experiences shape the outcomes consciously or unconsciously. The book works as an interpretive document which charts the more personal aspects of crafting Design Rhetoric – it extracts the important milestones in the development of the thesis as a curated chronology of mess – mess we usually keep out of Academic work because it may diminish the objectivity of our 'findings'. The diary attempts to position the provisionality of the outcomes, and resist over-reaching and over-extending claims and findings, as a counter-move to traditional Academic publishing and knowledge production which looks to extrude out of the particular to generalise the findings. In its provisionality, however, it can make the claims generated through the work fragile and vulnerable.

OOO and Academic Carpentry

To situate the methods of RtD within a wider discourse of Academic 'making', and to embrace the politics expressed in movements such as post-humanism, it is important to understand how the methodologies employed link into wider paradigmatic shifts such as Object Orientated Ontology and what Bogost has come to term 'Academic Carpentry' (2012). For the Object Orientated Ontologist the mess of the world is made of units or objects that have an interconnected interdependence; the 'things' of the world, units of different scales and rhythms, mould each other and us. The world, both inside and outside, is made of interconnected objects, and these objects hold meaning which can shift as the units are assembled. The approach, and its connected methods, are seen as non-anthropocentric, so that the human agent is not the site of meaning creation – there is a 'flatness' between objects and subjects, both human and non-human, and both with agency to create and shape meaning. This is understood as a 'flat ontology' which does not privilege the human (or non-human animal) subject as the site of meaning construction. This Flat Ontology, also recognised as *object-oriented philosophy* (coined by Graham Harman (1999) as part of his doctoral thesis) and *object-oriented ontology* or OoO (adapted and refined by Levi Bryant (2009)), is an important contemporary shift in framing the world and our relationship with it. The approach rejects the Kantian privilege of the human subject and instead recognises the world as a place where objects *do* materially exist independently of human cognition, so these objects and other forms of life should be considered equal to humans, ontologically speaking.
A key component of OoO is the importance it places on the relationality between subjects (both human and non-human) and stuff, a fundamental foregrounding of the vast networks of systemic physical and biological relationships governing all objects, in all environments – the mess of the world. Through the elevation of the object (or de-elevation of the subject), understanding the world through the frame of OoO entails an ecological rather than a hierarchical way of being in the world, in which everything is network-relational (Morton 2013). The movement resists and rejects the subject/object, subjective/objective divides as part of a post-humanist approach to *knowing*. These divides and binaries are unhelpful ways of cleaning the mess of the world and create structured categorisations and framings that shape our world, and bias scientific inquiry. These dichotomies in the sciences have dangerous othering potentials which over-simplify our entangled, messy world. Sheldrake (2021:47-48) cautions:

> If you're not a human subject, by default you're an inanimate object: an 'it,' a 'mere thing.' If you repurpose a human concept to help make sense of the life of a non-human organism, you've tumbled into the trap of anthropomorphism. Use 'it,' and you've objectified the organism and fallen into a different kind of trap.

OoO and Academic Carpentry give us a way to resist the subject/object divide as a form of anthropocentric bias, and work in new productive ways with RtD, which connects deeply with the positions needed for opening spaces of interspecies understanding, and fostering new forms of kinship.

In his work on OoO, Bogost proposes a new Academic approach termed 'Academic Carpentry'. Similar to the work of Buchanan, Bogost understands that artefacts and objects can be a form of Research outcome; meaning can be explored and expressed through 'stuff' and 'things' as well as through words, and the Academy's reliance on words as the building blocks of knowledge is limiting to the ideas that we can explore, and the knowledge we can forge. Bogost borrows the term 'carpentry' from Harman, who uses it to mean the "metaphysical way in which objects are joined or pieced together, as well as the internal composition of their individual parts" (2005:2). Proceeding from this then, Academic Carpentry is the intentional making of objects or 'things', the intentional joining of things that operate in and on the world. It understands that there are other ways of 'knowing the world', and the creation or authoring of artefacts, systems or objects that, states Bogost (2012:93)

> explain how things make their world. Like scientific experiments and engineering prototypes, the stuffs produced by carpentry are not mere accidents, waypoints on the way to something else. Instead, they are themselves earnest entries into philosophical discourse.

Much like in Buchanan's earlier work, the process of making in this interpretation holds intentionality and the meaning that the maker can author into 'stuff' as important sites of Academic enquiry and Research. Bogost's work though extends the approaches in RtD. In Buchanan's work we see the argumentation for particular futures, linked (likely because of his background in product Design) into commercial arguments about the way the world could and should be – connected to orthodox approaches, markets and capitalism – in Bogost's work it is linked to philosophy.

In Critical Design we see objects that critically reflect on current cultural vectors, in Speculative Design we see a rumination on alternative futures, but for Academic Carpentry there lays an argument that the making of 'stuff' can be a form of philosophic inquiry. Words, as units of meaning, are just one form of *being*, so could indeed be dangerous to philosophy as they are abstracted from the world they describe (Bogost 2012). Just as in previous sections, ACI has been criticised for trying to explore the entangled mess of interspecies understanding through positivist abstraction, here words themselves are understood as a form of abstraction which limit their ability to articulate different ways of *knowing* or *being* in the world. In some cases the making of

'things' could be the most appropriate form of philosophy as it resists the abstractions of language and offers more experiential ways of *knowing*. Through embracing the process of Academic Carpentry, and employing it in the context of interspecies Design, there is the possibility of a return to the original political promise of Animal Computer Interaction through a de-anthropocentric ideological lens which affords space for the authoring of philosophical inquiry, through the making and authoring of things, which create more inclusive futures. These things, as I have written elsewhere, hold a possibility for some interspecies, inter-subjective, subjectivities[13]...or ways to understand our relationships with non-human animals, and forming new kinships (Hook 2019:161):

> Alternative modes of research can open new avenues to explore complex social, cultural and political issues such as anthropocentricism, our cultural biases towards anthropomorphising other species and our relationship to non-human animals.

This study adopts what Bogost calls C*raftmanship* (or Craftpersonship) as a method to address deficits in ACI's approach to interspeciesism and a re-injection of the interspecies politics from Mancini's original manifesto. Bogost (2012:111) suggests that:

> We tend to think of creativity as construction, the assembly of something new out of known parts. A novel is made of words and ink and paper, a painting of pigments and canvas and medium, a philosophy of maxims and arguments and evidence, a house of studs and sheetrock and pipes. Perhaps in the future [...] radical philosophers will raise not their fists but their hammers.

For this thesis, RtD more broadly, and most specifically Designerly work that explores human and non-human animal entanglements, new forms of multi-species kinships could use the notion of carpentry to produce philosophic inquiry and Research outcomes that embrace the politics of the practice and put them to work in meaningful ways for both human and non-human stakeholders (both subject and object).

13 This framing of the project and process – as "interspecies, inter-subjective, subjectivities" links closely with the concerns of the discipline-specific languages and framings in Media Studies – where mediated experiences create inter-subjective spaces between two subjects. This mediated experience is where empathy can be fostered. There are lots of framings which are more appropriate for the work but for this particular publication, and work/life outside the thesis, this framing and language was 'useful'.

Play

Introducing play

I have argued in previous sections for the importance of imagination, speculation and experience to create immersive, engaging and reflective objects when we map, mediate and mount our Design Rhetoric. I posit that the uncertainty and messiness of interspecies communication, collaboration and kinship may require other ways of *knowing*; that through embracing the experiential, we can deepen engagement and impact of the rhetoric, to create reflective, embodied and responsive encounters for audiences, and create speculative spaces for interspecies 'thinking otherwise'; that where disciplines like ACI clean the mess, we need to embrace the mess, and indeed through making more mess we might create new understanding(s) of other ways of *being*. Through embracing experience and embodied reflection, through the use of RtD, OoO, and Design Rhetoric, we can ignite the imagination and create more spaces of possibility. In the work of *EXF* and Experiential Foresight there is an acknowledgement of the importance of performance, and a playful type of experience, as a productive site for new imaginings which deepen our understanding of the world. In this section I will look to explicitly add emphasis to the importance – to this study and to my method – of play as a way to experience the work. Playful encounters can bring about new imaginings and insights, and provide a way to engage with the Design Rhetoric. Through play, new meaning can be created and experienced; we can (re)configure our relationship to the stuff of the world – the units of OoO – and the possibilities this holds. Through play we can (re)imagine new relationships with the world and to other species. These possibility spaces, both physical and cognitive, are productive sites to reconstitute our understanding of other species, to resist hegemonic vectors, and trouble discipline discourses. Play favours plurality, lived experience, story, complexity, and embodiment as approaches to imagination and interaction. Leading play scholar De Koven (2020:39-40) writes:

> Our Imagination brings us close to something like pure possibility. We can imagine, or at least pretend, anything. Literally anything. As we move from imagination to creativity, we, of necessity, begin to limit the possibilities we are ready to consider. It's like moving from just playing around to playing a game, or from doodling to making art. Once embracing infinity, we seek the finite. We do this because it is more rewarding, more fun. We get to make something out of the world and ourselves.

During pervious sections of this study, I have proposed that the outcomes of the process of RtD in areas of critical making such as Critical, Speculative, Adversarial and Discursive

Design, can often form what we could consider 'reflective objects'; outcomes that are artefacts and objects rather than interactive, participatory experiences, which the audience can configure and reconfigure. I have also proposed, drawing on work such as Candy's *EXF* and Ruller's proposition of Performative Design, that these approaches emphasise the importance of the outcome of the process embracing performance, play and imaginative spaces of embodiment. At the heart of this call is to create more playful, interactive, performative, participatory experiences as the outcome of cycles of *thinking*, *making* and *doing* critical making to promote different ways of *knowing* and *being* – outcomes that audience can pick up, test, use, wear, taste, sniff and feel, with their hands, their brains and their hearts.

This playfulness is important to help the users configure and reconfigure the simulated rhetorical meaning imbued in the object, to become entangled in the creation of the meaning it produces, and to become implicated in the meaning-making as part of the rhetorical structure, allowing them to configure and reconfigure the knowledge generated by the Research. The outcomes of the process, in order to be playful, must have space for the audience to encounter them on their own terms and become embedded and integral in the meaning-making process; the audience becomes part of the work.

Play is key to helping the user explore the possibilities and limitations of speculative future or alternative present. Play, and playfulness, also link well with Critical and Speculative Designs' reliance on humour and satire as rhetorical communicative positions to create tension between the lived experiences of the audience and the alternatives presented to them. Indeed, speculation as a process is a playful process, playing with the possibilities of the future.

Sicart offers play as a way of "being in the world" (2014:3). In this work it is proposed that this playful 'being in the world' could make us more open to the possibilities of new knowledge and new understandings of other species. The space that playful encounters leave for the audience, and the freedom that they can embrace through play, could help us explore the meaning (through Design Rhetoric and Carpentry) constructed in the Research. If RtD embraced play and playfulness alongside Academic Carpentry as a method to generate new knowledge, then it could create outcomes that have space for openness, co-creation of meaning, and more open interpretive strategies. Meier states (1980:194) that the openness of play

> offers obvious opportunities to explore alternative modes of awareness, to develop insights into and knowledge of new modes of being, and to explore radically different possibilities perhaps not readily available elsewhere.

These alternative modes of awareness, and new modes of *being* could be a fruitful space for interspecies understanding and the tensions caused by some more pronounced

interspecies positivist Research in practices such as ACI. Indeed, in many existing interspecies pieces of RtD such as *Birdly, Animal Superpowers* and (to a lesser extent) *GoatMan*, we can already see the adoption of playful encounters for the audience (and Designer) as a mode of speculation about interspecies entanglements. In *Birdly* the audience can lay on the simulation table, adorn the VR headset (often associated with play and games) and perform as a bird. In *Animal Superpowers* the audience, mostly children, can put on the headset and run their hands/cameras/eyes through the grass for an ant's-eye view of the world, and that large red plastic housing is reminiscent of toy producers such as Fisher Price. Through their Design Rhetoric, through the shaping of the material form, through the "manipulation of the materials and processes of nature, not language" (Buchanan 1985:7), through the character, and shaping the emotional engagement through signifying play, these Design outcomes invite us to play with the artefacts, and play through the Design Rhetoric.

Frameworks for understanding play

Play Studies has a long history in the Humanities and Social Sciences and deep links to self-reflection and self-realisation (Henricks 2006, 2014, 2015, 2019, 2020). This study links into these histories to help embed the discourse into a wider understanding of play as a mode of interaction, and its usefulness to re-positioning, re-thinking, and re-constituting ways of 'being in the world'. It holds the possibility of engaging experientially with the imagination, to foster what Julian Bleeker calls a need for "imagining harder" (2022). This study will draw on the work of two main scholars of play to underpin the thesis. The work of Sicart, from his work *Play Matters* (2014) and Henricks' work *Play: A Basic Pathway to the Self* (2019). Both texts synthesise the long histories of studying play in structured ways, drawing threads from a range of disciplines and developing these arguments into something contemporary, political and thoughtful. For both scholars, play has a plurality that sits well with RtD methods and Feminist methods. Writing for the *American Journal of Play*, Henricks states: "Play is not simply the joyous ramblings of children; it is central to all forms of creativity and communicates the highest ideals for communities" (2020). Play is at once frivolous and important.

It is not important to this study to draw forward taxonomies like Cailliois' understanding of *agron*, *alea*, mimicry, and *ilinx* (1961), or Huizinga's links to ritual from the seminal text *Homo Ludens* (1950), as the social, cultural, political and technological context, and the nature of play, have shifted. These foundational texts have informed and shaped the discipline, but have been recontextualised into new social, cultural and political contexts by later scholars. These classic texts inform the work of Henricks and Sicart, but these scholars link their thinking

to contemporary context, and contribute new framings and understandings to the cultural and contextual shifts that play has encountered. The study will link into Sutton-Smith's seven rhetorics of play from his work (2001) to help position the trajectory, but, as Henricks highlights, Sutton-Smith's work often takes the stance that play is 'frivolous', and while it can be, and there is value in frivolity, it is not important to the arguments that need to be made to posit play as 'important' to Design and critical making; if anything, focusing on the frivolity of play, and applying it directly to often-useless Design objects (in that they are often non-operational and reflective), means that there is a risk of magnifying areas that this study finds problematic.

Henricks' stance is that playfulness or playful expressions are "fields of relations" (2015:3) which link together the environment, the body or embodied experience, the psyche, and the context that these units operate in – society and culture. Playfulness and playful experiences all share similarities in that they are important in order to facilitate what he terms "self-realisation". If this self-realisation could be a reconstitution, where we re-imagine and reconstitute ourselves as more entangled with other species, as human animals linked to non-human animals, then we could help to de-centre the human. Through play, imagination and experience we could help understand non-human animals, build new modes and models of empathy with them, consider more inclusive futures and explore new forms of kinship. For Henricks, this is a little more instrumental than is proposed in this study. He summarises his own thesis in an interview for the *American Journal of Play*, stating that human animals while playing are "essentially, comprehending the situations in which persons find themselves, the pertinent capabilities they possess, and the action-strategies they can effectively pursue" (2020:120). In his analysis, Henricks understands play as a set of affordances of the subject, within a set of constraints. This type of systems and network analysis of play can be fruitful in particular contexts, but it is important to understand play's contribution to the imaginary, performance and the possible as an embodied form of reflection.

Play has important links to the ability to imagine and redefine. It works in possibility spaces, in, around, and against rules, and is the "laboratory where individuals exercise and refine their abilities to comprehend and manage the world" (Henricks, 2020:126). There is something more embodied and embedded in the way we engage with arguments and possibilities while we are 'at play', something more entangling. There is something more plural, experiential, complex, embodied, vulnerable and provisional about our place in the world when we are at play.

Many have positioned play as diametrically opposed, or facing away from, deep, critical thought (maybe because of its links with frivolity highlighted earlier), but in Henricks' work he makes a counter-move, one which could be the site of possibility and productive space for the Design Rhetoric. He states (2020:128):

> Players are thinkers; but they also are movers. This combination leads to acts of doing and making – not only of objects of many types but also of thoughts, feelings and behaviours.

He also warns, however, that the different cognitive levels of engagement and action can try to impose themselves on lower, more basic, patterns and functions. These lower patterns can challenge, confuse and overwhelm the high cognitive levels (2020:130) that he covers in considerable depth in *Play and the Human Condition*. These higher and lower cognitive levels are the sites of productive reconfiguration where we can produce new ways of *knowing*, *thinking* and *being*, and where we can excite new feelings about our relationship to the world. The way we 'feel' as a lower cognitive level could be troublesome to new ways that we 'know' at higher cognitive levels – but this tension, this plurality, could be useful, because in this dissonance is a possibility space. To better apply play as a mode of experiential engagement with the Design Rhetoric, we need productive frameworks to incorporate play and playfulness.

Sicart (2014) outlines the core tenets of play as *Contextual, Carnivalesque, Appropriative, Disruptive, Autotelic,* and *Creative*. In this work, the disruptive and creative facets need to be emphasised to help engage the audience and help them consider new possibilities. As with other scholars (*inter alia*, Bateson & Martin 2013; Deterding 2017; Stenros 2015), for Sicart (2014:22)

> play is an activity, while playfulness is an attitude. An activity is a coherent and finite set of actions performed for certain purposes, while an attitude is a stance toward an activity – a psychological, physical, and emotional perspective we take on.

There are many different types and forms of play, from highly structured game systems to imaginative play objects. Each Design approach, and the affordances for experience offered to the audience through the Design outcomes, helps to shape the playfulness. It is the playful attitude that is paramount here, as it links through to Henricks' ideas of possibility and reimagining. We would want audiences to play with outcomes, creating a playful experience for them where we can play with their social, cultural and political framings utilising Design Rhetoric as a mode of authoring arguments.

For Sicart, play can also be highly political, but he denounces highly structured political moves in the persuasive games movement in favour of less-structured playfulness as political expression and resistance. For Sicart, "the true political effects of these objects take place when we occupy them, that is, when they become instruments for political expression" (2014:73). Again, linking back to Designers such as Ruller and approaches like *EXF*, we encounter the importance of embodied playful action: to play with and through the Design Rhetoric imbued into the object, in the playful space left for the audience to explore, become entangled, and be

implicated as a co-author of the argument, through constructivist approaches to meaning. Play is an important tool for reconstituting our relationship to other species and embracing the core political shifts in movements like ACI. By incorporating playfulness as the emotional engagement in Buchanan's Design Rhetoric we could create more effective, performative, and embodied speculation and reflection.

How could play enhance RtD?

The openness to different possible futures through fiction and imagination gives Speculative and Critical Design its power to engage audiences in debate through critical dialogues with new and emerging technologies and cultural practices (Elsden et al. 2017:5346). It imagines new possibilities and presents us with tangible objects that help us speculate on other ways that the world could, or should, be. Elsden et al. differentiate Speculative Design from Human Computer Interaction (as a future-orientated research discipline which uses making as a form of new knowledge production, entangled with emerging technology), as Speculative Design does not focus on preferable futures but often takes a critical, satirical and sceptical view of the possible futures that the technology promotes or suggests. The playful satire in Speculative Design helps the audience position themselves to the Design outcome and helps in the interpretive process. Speculative Design already adopts playful grammar in its argumentation, but what is argued for here is that this characteristic needs to be extended and extruded further into adopting playful interactions to create experiences for the audience.

If Design worked to embrace play and performance with the Design artefacts it creates, it could increase the audience's engagement with the arguments it proposes by entangling them and implicating them in the creation of meaning. The openness and messiness of the problems that critical making, Critical and Speculative Design frame, produced by prevailing cultural vectors, with no fixed answers or solutions, where every solution is probable and partial, are perfect spaces for play to occupy. The openness, and spaces in and between the problems, are fruitful spaces where audiences could have corporeal and embodied, participatory, reflective experiences employed to configure and reconfigure ideas, explore new possibilities and investigate the implications of possible outcomes. They could create new ways of *thinking*, *knowing* and *being*. The embodied reflection could resist abstract framings through language or data. The body, at play, allows us access to new ways of *knowing*; it situates us as and allows the types of embodied reflection that Feminist Designers understand as important sites of resistance and reconfiguration. It constitutes us as "undivided and reflexive body-mind-spirit-social-relational beings", siting the body as a locus of learning (Halstead 2021:47). Recognising that incorporating the playful

body into a Design Rhetoric that is interactive, participatory and experiential opens sensory modes of knowledge through embodiment. He adds (2021:48):

> The body gives us direct access to embodiment and, in so doing, becomes a locus for learning. Internal proprioception (cognizance of the movement and composition of one's own integrated body) grants us access to our emotions, sensations, and desires. To acknowledge these sensory modes of knowledge is to resist binary oppositions like subject/object, mind/body, and nature/culture.

This resistance to binaries is central to Feminist thought, Object Orientated Ontology, and Post-Humanist discourse, and embodied reflection, through play, could be the most important approach to exploring new ways of *knowing*, *thinking* about and *being* with animals where the messiness of interspecies communication, empathy and understanding create complex barriers to new types of kinship.

Reflecting on possible futures through engaging with objects, artefacts, proposals and probes in a gallery setting, on a plinth, behind a barrier, next to a 'do not touch' sign, away from the contexts that the Design may be deployed into, in a space that prohibits play, limits the audience's ability to engage in meaning-making and possible social, cultural and political implications. It makes for reflective objects, rather than embodied experiences. These experiential Design outcomes open spaces for reflection and consideration, but without the ability of the audience to experiment, perform, appropriate and examine the alternative presents and preferable futures that Speculative Design creates. The practice of authoring reflective objects, or outcomes such as paper proposals, reports, or other outcomes' future down Candy's 'Experiential Futures Ladder' limits their impact and ability to affect audiences. Whereas play and playfulness, as particular modes of experience, have a potential for a different type of encounter, a different position for the audience, and offer a place for meaning to emerge through entanglement. Where Candy and Dungagan call for experience, it could be important for that experience to be playful, and that engagement to be through play, to emphasise imagination, possibility and the ability to resist cultural vectors and 'imagine otherwise' about the world. Henricks (2015:42) adds:

> [I]n play people conceive possibilities for their own actions in the world. These are implemented, evaluated, and refined. Often, modifications occur as sudden adjustments to situational shifts. Pointedly [...] play sometimes takes the form of studied, careful manipulation of a relatively inert object world. It may also emerge as a pattern of resistance or rebellion against the world or, differently again, as more distant (or marginal) exploration by the imagination.

Using play as a form of interaction with objects allows the Design audience to

participate in the co-creation of meaning and explore the possibilities of the futures that the artefact proposes. By playing with the argument and rhetoric that particular Design artefacts pose, an audience can enact and perform embodied encounters with meaning. Speculative Design invites us to be open to other possibilities, to think through the current decision-making processes that the current cultural vectors point to (at different scales), and the possible implication of those decisions in creating different types of futures. Through play we are open to possibility and imagination.

Embodied, playful encounters with speculative counter-presents and plausible alternative futures could help us imagine new forms of kinship, and trouble fixed methods, offering alternative ways of *knowing*. These artefacts need to be in a dialogue with how the non-human animal experiences the world and could, for instance, offer an embodied and mediated simulation of the non-human animal. We need to create interface objects that can be used to help explore an interspecies entanglement. The creation of these simulations and virtual worlds, at different scales of mediation, could, as Gualeni suggests, create new ways of thinking (2016) which would be difficult to encourage using linguistic modes of new knowledge production. These new ways of thinking and experiencing the world could step towards what Nagel suggests, "an objective phenomenology not dependent on empathy or the imagination" (1974:449), and could drive even further and deeper to help propagate empathy and understanding of other species' ways of 'being in the world'. This would require an immediacy which could be offered by more experimental and experiential modes of Research.

By creating these experiences which open up a playful, embodied and interactive encounter of the non-human animal – which I have previously referred to as inter-subjective subjectivities (Hook 2019), but here we will think about as new forms of kinship – we could create new ways of *thinking* about the non-human, new ways of *being* with them, and new modes of Designing *for* and *with* them. This troubling of ACI with methods that are preoccupied with positivist objectivity is Designed instead to encourage and embrace a more speculative and open research methodology, offering new approaches to *knowing* other species which celebrate plurality, embodiment and openness. These new methods could help Designers engage with some of the core politics and ideology within ACI, and explore new ways of generating and situating knowledge about non-human animals. Outside of applications for troubling a discipline, there are implications for wider reframing and rethinking of our relationships to other species, and how embodied reflection can create new ways of *thinking* and *knowing*. Interactivity and play will be key to helping audiences be open to new ways of *thinking* and *being*, to open new horizons for exploring our relationship with non-human animals. We need to be conscious of how animals perceive and experience the world, and we need to find new tools or, to emphasise the importance of play, new *toys*, to help us experience these different ways of encountering the world. RtD can allow

researchers to explore alternative modes of knowledge production without limiting the knowledge to linguistic modes of exploration, communication and interpretation. Through Academic Carpentry and Design Rhetoric we can author arguments into objects, artefacts and experiences which can help to resist and challenge hegemonic cultural vectors. This can allow Researchers to create new approaches to Designing *for* and *with* animals and explore interactive and playful new knowledge which would be impossible to explore through more traditional scholastic practices, such as writing. Using Speculative Design can help us explore counter-factual artefacts for alternative futures (and presents), or explore counter-normative political approaches to culture, intentionally inscribing a politics into artefacts and objects to express the ideas that they are exploring, and allowing complex issues to be framed rather than solved. These outcomes cannot rely on imaginary or reflective engagement; they must be experiential, playful and interactive. This approach can help us imagine harder, resist current cultural vectors, and consider alternative, more inclusive, presents.

Mounting with Making

How will form promote interpretation?

It is important to understand that an annotated portfolio consists of a range of outputs, and comprises a range of forms as a 'multi-component output'. This means that the new knowledge generated by the process and the 'work' is situated in, but also between, the easily recognised and identifiable outputs of the process. The annotated portfolio can contain prototypes, writing, notebooks, images, video, reflections and failings which coagulate and constitute the Research through Design over the duration of the project. The Research findings can vary in scale, shift in context and can also contribute to material knowledges through making. This can look like 'a mess' to more traditional scholars and Researchers, but as I have argued, it is important not to clean the mess and fall foul of the critiques of the Sciences in their purification of the process, and their denial of the imaginary and speculative. The more recognisable Research outcomes[14] are punctuation marks in the process, points to pause and reflect as the mapping and mediation

[14] Here what I am pointing to directly is the idea of easily institutionalised forms of new knowledge which we call 'Outputs' in the context of architectures like the Research Excellence Framework. These well formulated, cleaned, tidy and contained outcomes are important in some Research contexts as they make the significance, reach and rigour of the Research easy to verify, quantify or qualify by external judges, but they also shape the contours of new knowledge, and they can hamper the processes. It is important to this Annotated Portfolio that we can acknowledge this power and how the outside influences and institutional contexts can frame knowledge in particular and peculiar ways, and that we can be honest, reflective and transparent about this power. It has shaped and influenced some of the formalised outputs in odd ways which will be addressed through this chapter.

processes drift, but the reflective notes and annotations that help to illuminate the findings and help to signpost the intentionality of the Designer are the important site of consolidation. These (digital) notebooks are the sites of production, where the creative and ideological fissions and tensions are explored. These notebooks are where the reflections on mediation are produced and where the Researcher and maker has mapped the knowledge. Through this reflection, the intentionality of the work can be honed, the rhetoric refined, and the progress logged.

This annotated portfolio approach is used to draw together and make transparent the Design Rhetoric in the work, and the Research Diary will map the progress towards the outcomes of the RtD process. To render transparent the creative decision-making and intentionality of the Designer through reflective notes, linkages and framings of the development process and the prototype outcomes in the Research Diary; to create a body of work that reviews and consolidates the Research for consideration. There are some elements of this body of work that have particular audiences, and this shapes the way the Research is framed and articulated,[15] but the Research outcomes, and the shaping of the knowledge through critical reflection, consideration of the personal politic and the understanding of how the positionality of the Designer, consciously and unconsciously, shape the meaning communicated, are presented throughout. For the politics of the work, it has also been important to reflect this process alongside the Academic writing, linking the more traditional Academic forms to the reflective practice helps to communicate the situatedness (and some of the provisionally) of the knowledge. In this thesis, reflective interludes are used to map where the personal experience as a maker and Academic have shaped the direction of the work. Sometimes these are conscious shapings of the rhetoric, and sometimes these are unconscious, but are surfaced through dialogue and reflection.

As the work progressed it was important to present the outcomes and prototypes at a number of conferences, symposia and in-person events to gather feedback, allow the work to be experienced, and to help shape the interpretation of the work by the audience. It was important, because of the hybrid methods and the dialogue in the work between disciplines, to present to a

15 This is largely to do with my dual professional personas as a Senior Lecturer in Interactive Media which returns to what was the institutional REF panel 34 in REF2014 and REF2021 for Media, Communication and Cultural Studies. Research in these contexts is framed differently by the community of Scholars and sometimes producing work across a spectrum of stakeholders means that there are inconsistencies in languages, the body of knowledge and scholastic history that the writing locates itself within and the way this is communicated. A direct example of this is the article Hook (2019), where I refer to work as creating an 'Inter-Subjective Subjectivity'. Most of this article's reference to RtD was removed through the editorial process and the invited paper was framed as Research through Creative Practice (RtCP). The article, shaped to submit to REF panel 34, uses the term 'Inter-Subjective Subjectivity' to link to bodies of knowledge and discourse in Media Studies; through this work I refer to an 'Interspecies Kinship'.

wide range of Academic and public events.[16] This helped in gathering feedback from a diverse range of Academic and professional audiences. The spaces for dissemination will be listed in the Research Diary, but an attempt was made to present to audiences from more scientific backgrounds which favour positivist outcomes, but also to Arts and Humanities, Social Sciences, HCI, Psychology, and Design. This was a useful process to feed in wider directions and considerations into the process, but also to help in the reflective process to help surface my own biases and talk through them with audiences.

The outcomes will be mounted in a series of forms. There will be:

- *Artefacts*
- *Pictorial Boards*
- *Reflective Diary*
- *Video Documents*

There will be physical outcomes from the processes as the world uses Design Rhetoric and critical making to mount arguments about how we might think otherwise about other species, resist positivist abstraction, and embrace embodied reflection through experiential and playful work.

The Pictorials will foreground the visual outcomes of the Design process and present them in an easy-to-interpret form. They will be large 2D sheets, which present the outcomes. They will have a series of small annotations, and where possible the words will be kept to a minimum to honour the form and outcomes. Each will be accompanied by a maximum of 300 words to help shape the interpretation of the visual rhetoric and communicate the intent of the work. This will be important in framing the outcomes because they are experiential and are Designed to be played to create experiential rhetoric. This form will be used to present the work to Academic audiences and will frame the work and outcomes using particular language to communicate the intent of the piece.

The Research Diary will formalise the notes taken during the process. They will expand on some of the notes taken at the time of production to add critical reflection on process, and communicate intent. These logs will link to the original postings for context, outline the prototype stage and what is being honed in the work at each step, the venues for presenting the work – with appropriate thoughts on the feedback – and a short reflection on the stage, what it achieved, and the next iterative steps to stack and deepen the knowledge(s). They will have reflective interludes in break-

16 I have however tried not to present work which is still in development to the ACI community at their annual conference. I have been approached a number of times by Academics from the discipline to share the work more directly, but it has been important to also keep a critical distance from the sites of intervention.

out boxes – presented here as footnotes – which will try to communicate positionality and how the Designer's personal and subjective experience has shaped the direction of the work and disciplined the accumulative drift (Krogh, Krogh, & Markussen 2015:7) as the outcomes and rhetoric have been honed through iterative prototyping.

As the work will be experiential and playful, there will also be a short video to present the work to audiences who are unable, or uncomfortable with, interacting with it. The video will work as an interpretive frame for the outcomes but be Designed for public consumption. This will shape and dictate the type of language that will be used, and the pacing, tone and poetics of the video.

How will the process be managed?

It has been important at the start of the thesis to log and catalogue the development of the prototypes and to balance the study against competing commitments. These logs are part of the learning, and substantiate the creative milieu that helps to structure and form, consciously and unconsciously, the direction of development. At the beginning of the study to help ground the work, supplement and extend my Research purview, and to cross disciplinary boundaries, I needed to start to catalogue an adventure into an adjacent subject discipline, and log reflections on my Research Context (ACI). This process helped to map the field and its approaches to 'knowing' other species. The Research Blog cryptoludology.com was developed to help structure and record the work in a regimented pattern to document and map the engagement with a number of new areas.

This entailed reading new articles between 16:00-17:30 each day, highlighting key ideas and sentences. Then the following day between 09:00-10:00 generating a new post which summarised the interesting elements, typing out the key quotes, and then copying any bibliographic trajectories or new directions that I felt could help patch knowledge gaps in my understanding. This processing and archiving of the underpinning scholastic work that informed the development of the project through a series of structured digital notebooks has helped to make transparent the engagement with scholastic work and Research, and map the range of underpinning sources that informed the early prototype stages. These open notebooks are important in showing the influences on the projects as they developed. Although these posts in the notebook are not formally part of the 'annotated portfolio' they are extensions of it, and allow audiences interested in the work and process to drill deeper into the Academic milieu which shaped the ideation of the thesis and informed process.

Alongside this parsing of Academic work which informed the thinking for the project,

there is also a series of prototypes logged in the notebooks that helps to chart the iterative cycles of *making, thinking* and *doing*. These notebooks will be formalised in this chapter to help frame the development of the outputs. In each stage this chapter will review a prototype, explain the steps taken to iterate the project in functional terms, and unpack the intent in the steps. If the work was disseminated and discussed, then any feedback will be reviewed, and finally a set of reflections will help build understanding of the direction of the work. The chapter will present a framework which honours the mess and drifting of process, the positionality of the Designer, and the intentionality in the Design Rhetoric embedded and authored into the outcomes. These original, informal and documentary posts are linked below alongside the more formal write-up and reflections so that audiences can drill down into the process and work, and access the knowledge at different stages, with varying tones and rhythms.

The Equine Eyes Project

Threaded through this thesis are a number of interventions through RtD which look to foster playful engagements with core elements of ACI and re-politicise the practice through an engagement with cultural studies, post-humanism, object-orientated ontologies and speculative Design. There are a number of prototypes and artefacts that try to frame and shape the methodologies in ACI, to trouble the positivist and solutionist approaches to 'making' and the scientism inherent in the discipline, but also open the audience to new ways of thinking about other species, resist anthropocentrism and anthropomorphism, and start to understand other ways of *knowing*, *thinking* and *being* to foster more inclusive futures, new entanglements and new kinships.

The major intervention in practice is the project *Equine Eyes* which has iterated between 2017 and 2024. The project began as an answer to a call for exhibition, and a reflection on ACI, but expanded over the eight years of Designing, iterating, drifting, honing and shaping the work, into an artefact with deep personal significance. The project was originally outlined as one of three outcomes, alongside a short exegesis of work for this study. However, through a set of events outlined below and in the Research Diary, it grew in significance and created a space for deep reflection and introspection around process, RtD, situated knowledge and a pivotal object to consider alternative, more speculative, approaches to understanding other species, and to explore new types of kinship. The headset explores new ways to *become with* other species (Haraway 2008). The project experiments with new approaches to becoming more attentive to the lived experience of other species, alive to the way they experience the world, and opens spaces to imagine them otherwise. Through reflective embodiment the project celebrates plurality, positionality, provisionality, complexity, and playfulness to offer audiences new tactics for *thinking*, *knowing* and *being with* other species.

Design Context

While developing the initial ideas for the thesis, orientating myself in the RtD discipline as a way to trouble ACI, building and mapping the contextual knowledge of the field of Animal Computer Interaction, the first steps for the project, which is now called *Equine Eyes*, were developed in response to a call for submissions to the *Seeing* exhibition in the Science Gallery Dublin. At this point in the study there had been a number of initial responses to the ACI movement in sketchbooks and in supervisory conversations. Initial ideas for mediated experiences that could be experienced only by non-human animals because they were situated outside of our spectral range, or were built for other types of non-human bodies, were discussed.[17] There were initial ideas of creating games to play with other species, VR headsets for cows, ways for companion species to have more dominance and control of domestic settings (like being able to dictate the heat). There were proposals for interventions where other species could communicate on their terms. The spark for the piece which became the major output for the thesis was in response to a call to *illuminat[e] optics, perspective, and comprehension while exploring enhanced and augmented ways of seeing, artificial eyes, and radical alternatives to vision*. Following underpinning research in Interspecies Design and ACI which advises working with animals you have ready access to (that you live with, or are companion species, or who you work alongside, etc) as this helps to reduce the assumptions and abstractions caused by the interspecies divide.

During the ideation phases of the project to respond to the call our family had two types of pets, a hamster called Freddie, and a tank of fish. Although there was some initial scoping of projects, such as 'iPad games for fish', progress was stunted. However, beyond the fence in our back garden there was a patch of wasteland where developers had started to build more houses but the development had stalled after the initial infrastructure was installed. On this wasteland, members of the traveller community allowed their horse to graze. My children (Ronan, three, and Meabh, four) spent hours feeding the horse and asking the interesting naive questions that children ask about other species. These questions, which usually sit outside normative cultural conditioning, allowed different framings and different ways to access the horse. Questions like "If I have to wear a coat because it's raining, why doesn't the horse?", "Does the horse go to school

17 We discussed how the knowledge could be examined and evaluated. I thought it would be really interesting to create experiences which were species-specific and could not really be accessed by me, an examiner or a human public. There have been a number of very interesting works in this space while I have been honing the Equine Eyes project, such as art exhibitions for dogs, which claim to embrace canine aesthetic sensibility. I have tried to remain unskeptical of the Designers' intent in work like this but many have criticised them publicly as marketing ploys or gimmicks – the same as Cat Fishing – but even if they are gimmicks to attract paying human audiences, they could also be important aesthetic encounters for other species.

like I do… so how will it learn to read?", "Does the horse get lonely?". These playful questions prompt different framings of the otherness of horses, and different access to the lived experience of the other species, that sitting outside of the cultural conditioning of anthropocentricism, my children were freer to ask sometimes sillier, and sometimes more astute, questions which helped to prompt the ideation. As Latour writes in his foreword to Despret (2016): "Silly questions create silly animals read by silly people who become even sillier; clever questions reveal clever animals able, through the transcription of their feats, to render readers more intelligent about the world". These playful and probing questions, which may seem silly at the surface, helped to inspire new ways of approaching the topic and revealed new pathways for investigation. Reframed, these questions might open spaces to 'imagine otherwise' which is important to Feminist-informed Design practice.

The practicalities of the horse, following the Design approaches of Thwaites (2016), allowed for easier production methods than the other companion species that I had direct, day-to-day access to (Westerlaken 2016). The horse had clear similarities to the human-animal body, such as two eyes, but simulating and mediating the similarities and tensions could create a space to reconsider our relationships and explore new types of subjectivity and kinship.

The project had initially started as a single, low-fidelity, low-investment, prototype which could help the user build some understanding of the way that horses, and in particular this horse, saw the world. The project has drifted and progressed since then. The horse has moved to new pastures, and the wasteland is now a busy cul-de-sac full of young families living in identical two-up, two-down, modern houses. The response to the call was unsuccessful, but through a series of personal and professional developments, the start of a project – to help us reflect on the embodied and lived experiences of another species, to help build understanding, empathy, and explore new approaches to kinship, and resist the positivist and solutionist methodologies to know other species from ACI – developed.

Prototype 001 - Science Gallery Call

Using an Oculus DKII development kit on loan from the Computer Science Department, some standard definition 480i web cameras, and some linked-together tutorial files in Unity, the first version of *Equine Eyes* created a glitchy, low-res, unrefined version of the headset for the project pitch video. The prototype fed two webcam live feeds into a laptop through wired USB. These were then rendered onto two plane polygons in Unity as live video textures, so each plane polygon showed a live feed from an individual webcam – the left camera feeding to the left plan, and the right to the right. Then, using early Oculus VR tutorials and the VRTools framework, these planes were linked to the two viewports for the Oculus DK1. This linked

each viewport, or eye, directly to the webcam output. Culling was used to make sure that the left eye, inside the Rift, could not view the right plan, and vice-versa, using virtual cameras and filtering. The webcams were mounted onto the top of the headset at an angle that mimicked the vision of a horse from desk-based research into science-based Academic sources.[18] This prototype allowed the user immersion in the experience, using a commercial development kit, and allowed a live feed into the headset. From a user perspective this felt like looking out of the sides of your head like a 'prey species'. The headset could offer, through analogy, access to a wide range of prey species through a simulation of their semi-monocular FoV and a mediation of human vision. The prototype could form the basis for access to a whole range of performed embodiments and situated ways of viewing the world [Reflective Diary Page 10-11,19-23]

Dissemination

This prototype was presented at the *If You Weren't: Playing with Realities in ARG, AR and VR* symposium, Stanford University, 23 May 2017, as part of a presentation on play and interspecies understanding organised by Antero Garcia and the founder of The Centre for New Media at Berkely and Professor of Media Innovation Greg Niemyer.[19] I had travelled to Stanford to present work on Alternate Reality Games and World-building which I had written two years previously, but when the organisers found out about the new work I was prototyping they asked me to switch presentation. The feedback was very positive and was presented alongside Academic work in interspecies play – games for microbes – and a range of work that relied on world-building, immersion, and experience. [Reflective Diary Page 12-13]

18 For this thesis I will not render the research into horses as part of the thesis. It is covered and linked in the Design notes online, and is deemed to be Research For Design (Frayling 1993). There were key texts which informed my reading of horses and our historical social, cultural and political entanglement with them, such as Walker's text *Horse Equine Vision and Its Effect on Behavior* (2010) or journal articles such as Montivon's *Equine Vision – A review of current knowledge and how it affects our relationship with the horse in terms of learning* (2023) and Roberts' *Equine Vision and Optics* (1992). This research (with a small 'r') informed the development of work, but is not important to the core thesis.

19 When I returned from the conference in Stanford, the horse on the wasteland was heavily pregnant and gave birth to a foal at 5am the following month. The horse struggled, but eventually we had two horses, and my children called the new addition 'Grassy Stripes' and the original horse, the mother, 'Captain America Horse'. Helping in the birthing of the foal was an important and formative stage in the process of thinking and making, which bonded me to the prototyping phases of Equine Eyes and the project's eventual outcomes. This type of positioning is important in order to understand the personal as well as the professional investments we make as Designers, and to understand the positionality of the knowledge generated.

Hook, A. (2017) *Interspecies Play as Speculative Design*. If You Weren't: Playing with Realities in ARG, AR, and VR, Stanford University (US) http://www.ifyouwerent.org/

Reflections

The prototype (and the application for development and exhibition funds) were largely unsuccessful. There were a number of core issues with the prototype, including the resolution of the cameras, the field of view, the chroma range, lag in the stream, and the disorientation.

The test cameras used were too low resolution, which hindered the immediacy of the embodied experience and gave a grainy, pixellated image feed. This meant that the user was always conscious of the mediation.

The cameras have a linear lens which mimics the focal range and field of the human animal eye. This takes in a 4:3 ratio image with little distortion. Most commercial webcams are broken into three categories: 28 degree angle is a narrow angle, 53 degree angle is mid-range, 90 degree angle is wide angle. These cameras have roughly a 53 degree FOV for each lens, which compares to the 220 FOV of a horse's eye. The horse's vision crosses at the front to create a cone of binocular vision for depth perception, which could be important to the user experience.

The cameras have a full chroma range because they are Designed to capture the full range of the light spectrum accessible to the human animal eye. Horses have a dichromic colour palette which means that they 'cannot see red'. Their vision spans yellow to blue. To help to simulate the equine vision, the red palette needs to be crushed in the image to limit the colour and tonal range.

Due to the processing power of the computer taking in two live camera feeds, into the graphics card, feeding this to the Unity build, scaling them to cover the whole eye in the software, and then live rendering out onto the headset, the prototypes were subject to lag and latency. This dissonance between the user's lived experience, movement and orientation and what they visually experienced caused disorientation and nausea.

The headset mimicked seeing out the side of your head, which was expected, but it created an uncomfortable and disorientating experience for the user. This was expected but needs to be taken into account for future development.

Prototype 002 – Chroma Range

Through the first prototypes, a system that allowed for two live-feed cameras into a laptop, into the Unity software, and back out into a commercial VR headset, was

retained, but through desk-based research there were additional factors to build into the system to move closer to simulating equine vision. Due to the retinal cones in horse eyes, as with many animal species, the horse sees in a dichromic colour range between blue and yellow. This means that the horse cannot see light in the red spectrum or colour-space.

Within the software system, a post-processing stage needed to be implemented that would map the tonal ranges from red to green/grey, to match the images produced to represent horse vision in scientific research journals. A software plugin developed for colour correcting and grading video game worlds was installed into the system so that a set of Look Up Tables (LUTs) could be iterated to map out the red tones. [Reflective Diary Page 24-25]

Reflections

As this was an early-stage prototype, it was important to develop and test approaches. Proprietary systems that were easy to use and implement meant that the prototype could be tested quickly, iterated and adapted without lengthily deploying cycles. The Amplify Colour Plugin was used as it could be applied easily to the system, and then new LUTs added to the plugin to colour-map. The plugin allows tone mapping, grading, colour volumes and depth mapping. The approach to reducing and shifting the colour range is unstable and limiting, but does allow the user to view the world live, in mixed reality, with a shifted colour range. The limits in the system are located in the software Design; because the plugins are Designed for game post-processing they are encoded with particular logics and workflows shaped by the Design Context. Implementing this system outside the Design Contexts means that there are limits in the flexibility, affordances and implementation. This is appropriate for an early-stage test and low-fidelity prototype, but may need to be addressed in later stages of development. The system can shift most, but not all, hues and saturations of red, meaning that there are some small tonal ranges which are still present in the live view. This can cause a rupture in the immersion which disrupts the rhetorical structures of the work in very particular contexts.

Prototype 003 – FoV

It is important to attempt to replicate the field of view (FoV) of the horse so that audiences can explore the tensions between the horse and human. Through desk-based research in scientific papers on equine vision, a series of parameters and conditions was drafted which helped to structure the necessary outcomes. Each horse's eye has a wide FoV (between 200-220 degrees), and the eyes' position on the sides of the head are angled to create a depth cone at the front of the horse. Scientists speculate that this allows the horse to see stereoscopically while

focusing and moving forward, but also monoscopically to either side. The position and FoV of the eyes allows the horse to see almost 360 degrees, and it can view everything but its own back. At this stage the prototype attempted to implement and integrate the new cameras into the system, and then as the next iterative step, address the angles and overlaps.

A number of attempts were made to address the wide FoV through lenses and adapting commercially available cameras, but little progress was made using proprietary solutions, which meant turning towards more bespoke or maker-based solutions. The cameras that were used have a 180 FoV on each camera, and input into the PC laptop through USB.

They have some limitations in focal range, and allow only fixed focus. On first implementation this felt limiting, but through cycles of Research and adaptation, it emerged that the cameras' fixed and limited focal range is close to the horse's own sight.

Reflections

The wider FOV of the cameras is very disorientating and has a fisheye distortion. There are a number of projects that attempt to simulate equine vision, such as the *Horse Vision Video* by Haras de la Cense, which demonstrates the widened FoV. These make good reference points for production; however, the immediacy of the immersive medium, and the crafting of embodiment, means that the audience experience is disorientating, confusing and destabilising. The technology used has some tensions between the scientific papers' outlines of the vision, and the simulated outcomes, but these are largely issues around the 180, as opposed to 200/220, FoV, and the fidelity tensions between the camera feeds and the screen resolution in the headset. These can be addressed in later iterations as the process is honed, but as the direction progresses it is important to consider issues caused within audience experience, and what that may mean for display contexts, freedom of movement, and play.

Prototype 004 – Headset

After securing working 180 FoV cameras, linked into the Unity system, streaming live, with no (or very minimal) red tone, it was important to start to consider housing these within a framework that could angle the cameras to match the position of the eyes in the horse to create the cone of stereoscopic vision. The first cardboard prototypes mounted the cameras at a 20 degree angle, allowing for the overlap. The prototype outcomes had some issues in the overlap due to the smaller FoV, but the focus of this prototype was to test what this did for the user experience. Once the mounting was prototyped, it was developed into a simple horse-like cardboard housing. The horse-shaped housing had no practical application in the system, but it

offered advantages supporting other priorities. This step linked into what Buchanan would call the emotional engagement of the work. The horse shape helped to frame the experience for the audience as the headset and mask evoke ideas of transformation, performance and play. [Reflective Diary Page 23-24]]

Dissemination

This prototype was tested inside the university labs with my children[20] and colleagues from the School of Communication and Media for initial feedback. The School comprises a mix of scholars from Arts, Humanities and the Social Sciences. It spans Philosophy, Media Studies, Cultural Studies, Counselling and Therapeutic Studies, Advertising, Linguistics, and Communication. This broad range of Academic fields offers a wide range of disciplinary lenses on the work, but largely from the same angle.

Reflections

Initial feedback suggested that housing the systems within a horse-shaped architecture helped to signify to the audience what they may encounter inside the headset, and framed the experience for users. The horse-shaped housing helped to prepare the audience – what I would refer to as 'ramping in' in other media contexts – for the experience, and also linked to more performative and playful histories of mask-making. At this early stage in development there are a number of approaches to explore which help to signify playfulness and our connections to horses.

The intention at this stage was to focus on function and systemic logic – the technological reasoning and procedural rhetoric – but when early-stage testers were presented with the prototype they requested some alterations and something to help signify the 'horsiness' of the experience before they adorned the headset. The signification of the horse helped frame the experience for users and helped them transition between two states, with the housing and mask positioning the emotional engagement with the work. The housing was rudimentary, but feedback from testers suggested that it was important to the experience for the headset to 'look like a horse' in some way. There are two main prototypes to explore and test, two potential directions for the work. The first is a mask structure and the second is a hobbyhorse housing, where the user could pilot or puppet a device that allows them to move the head separately to their own.

20 This testing, at this early stage, was really important to the development of the work. My children's questions about the horse sparked some of the original ideas and inspiration for the work. Although the piece had drifted since then and taken on new conceptual models as I deepened my understandings of ACI and RtD, having feedback from my children was important (and emotive).
Children also have a wider capacity for forgiveness in early-stage, low-fidelity prototypes.

Prototype 005 – Cardboard Headset

To construct a robust headset that could be worn by users, a series of paper and card prototypes was produced to create a structure to hold the Oculus headset, cameras and wires. There was a series of unsuccessful attempts to prototype the structure mask through folded card. This approach was easier to create out of thicker card, but when constructed from plastic was unsuccessful because of the change in material, the line-bending process and the lack of access to fabrication equipment. [Reflective Diary Page 26-27]

A slotted Design, which could be fabricated from sheet material and pieced together, allowed the flexibility to create angled slots (to facilitate the 20 degree camera mounting), offered a solution to fabrication at the prototype stage, and a method to create working prototypes. Studies from books and life drawing with horses created a series of core shapes and structures to reproduce in the cardboard. This approach allowed for rapid prototyping, at low cost and a low price point. A series of models was created to attempt to balance robustness of the frame against the weight, attempting to factor in the differential between card and sheet Perspex.

Reflections

Although these prototypes were functionally successful, through supervisory discussions a bespoke solution drafted from scratch offered some benefits in that it could be tailored to the components, it allowed more options in production, and presented a crafted solution. The benefits were, however, outweighed by the labour and time costs in fabrication. The thesis is not aimed towards a material knowledge, or new methods in fabrication, so the development of bespoke, ground-up solutions to the housing is not important to the core of the work. This approach would be useful if the outcomes and remit included priorities such as 'batch or mass production', but the planned outcome was between one and three headsets. None of the core research questions required the development of a bespoke solution, and although there is a draw, and even a romantic draw, in crafting the headsets from the ground up, this approach was not taken with the systems which leveraged existing proprietary solutions linked together to address the core systems issues.[21]

[21] Some of the proposed solutions for the end housing discussed in supervisory sessions included a *very* wide range of solutions, including the use of a taxidermised horse's head which I had found on eBay for £120. Through my 20s I had a large collection of taxidermised specimens from old science departments. Although I have always been drawn to these objects, it was pointed out that the draw was not experienced by all users, and that it might produce a barrier, especially for areas of ACI that focused on animal welfare, interspecies justice and more inclusive power dynamics – thank goodness for supervisors.

There are a number of existing craft-based solutions which can be adapted and shaped for the work, both slotted and folded materials, which can be shaped to progress the project further, quicker, allowing focus on the core questions of the project.

Prototype 006 – Hobby Horse

It was important to test different types of embodiment, and what different configurations and possibilities for the project could be. Alongside the main development timeline to create the finished *Equine Eyes* project there were a number of iterative tangents that explored alternative possibilities for the work. The main alternative to the finished headset was an outcome which allowed the user to be separate from the horse's head, put on a VR headset, and then see through the eyes of the horse's head – potentially viewing themselves from the outside-in.

A slotted set of plates was modified from a commercial product, to develop a large-scale prototype. First in cardboard, and then in plywood, laser cut, and slotted together. The prototype was developed so that the horse's head, holding the cameras, could be displayed on a stand, or could be puppeteered by the user. The outcome was largely unsuccessful, and was drawn back into the main production pathway to reclaim the material, process and Designs. [Reflective Diary Page 28, 30-31]

Dissemination

This outcome was presented for feedback at the *International Conference on Virtual Systems and MultiMedia (VSMM)* in 2017, a leading conference in virtual reality technology and mediated experiences. The community is very HCI-focused but the conference was hosted between Ulster University School of Computing and the Belfast School of Art. This was part of the conference workshop series and presented the outcomes as an application of immersive technology to push creative thinking alongside artist Julian Stadon.

Stadon, J. & Hook, A. (2017). *Oblique Strategies for Mixed Reality Art*. VSMM2017 International Society on Virtual Systems and Multimedia, Belfast, UK. http://vsmm.org/workshops/

This prototype alongside the previous paper and card prototypes featured in the TEDx talk *Exploring the borders between human and non-human animals* and was featured in the TED Ideas article.

Hook, A. (2018) *Exploring the borders between human and non-human animals*. TEDxBallybofey, UK. https://www.ted.com/talks/alan_hook_exploring_the_borders_

between_human_and_non_human_animals?delay=0s&subtitle=en

Halton, M. (2019) *Need a fresh perspective? See the world like a horse does (or a cow or a cat or an ant...).* Ideas.TED.com. *https://ideas.ted.com/need-a-fresh-perspective-see-the-world-like-a-horse-does-or-a-cow-or-a-cat-or-an-ant/*

Reflections

Much of the material for the headset was superfluous and it added additional physical weight to the outcome. This hindered the freedom of movement afforded to the user and prohibited more playful interaction. The head was too heavy to wear but could be mounted on a stand. This configuration presented the work so that the user stood in close proximity, put on a VR headset, and could see themselves at a distance through the eyes. This allowed for a semi-embodied and playful experience, but users' focus was on viewing themselves from the outside-in. This resulted in audiences positioning themselves in the middle of the convex lens to minimise distortion and waving at themselves. Their attention was drawn away from the simulation of the similarities and differences and directed towards the uncanny feeling of viewing yourself anew. The users tended to provide feedback on what they thought that they looked like to a horse, which seemed to promote anthropomorphising the horse. This nudged the work, and the rhetoric, in the wrong direction as it shifted or skewed the technological reasoning.

The prototype did help produce some new display contexts for audience testing later in the project, with the headset mounted onto a stand, and occasionally outputted to a 16:9 TV screen, but again this framed the piece differently for the audience and shaped their interactions with the work.

Prototype 007 – Stripped-Back Headset

Alongside the development of larger versions of the headset, because of the popularity of the project, it was important to develop some frameworks for dissemination while travelling. The project was invited to present at University College Cork, and submitted for presentation at the Nottingham Ningbo campus in China. It was important to draw in feedback from a wide variety of sources and Academic communities, so developing a 'stripped-back' version was key in allowing mobility and unlocking access to wider views. Travelling with the full headset while it was in development was difficult, but to gather feedback through its iteration it was important to present to a range of Academic audiences.

In its most stripped-back form, the project has been presented with two shaped wedges

behind the camera boards and mounted to the sides of the Oculus Rift, or two camera holders shaped from Perspex which hook the cameras onto the sides of the Oculus headset. [Reflective Diary Page 34-37, 40-41]

Dissemination

The project was presented for feedback at the *Film and Screen Media Creative Practice Symposium* at University College Cork, the *Designing Empathy* presentation at Falmouth University, and the *Playful Encounters* symposium in Ningbo in stripped-back form.

Hook, A. (2018). *Designing Empathy: Understanding Non-human Animals*. Falmouth University, UK. https://www.eventbrite.co.uk/e/alan-hook-presents-Designing-empathy-understanding-non-human-animals-tickets-52810377260

Hook, A. (2018). *Speculations on the Human and Non-Human Animal*. Film and Screen Media Creative Practice Symposium, University College, Cork, Ireland. https://www.ucc.ie/en/media/Academic/filmstudies/files201718/CreativePracticeSymposiumMay2018.pdf

Hook A. (2018). *Speculations on the Human and Non-Human Animal Through Play*. Playful Encounters, University of Nottingham, Ningbo, China. https://www.nottingham.edu.cn/en/internationalcommunications/playful-encounters.aspx

Reflections

Audience feedback relating to the overarching project, when the stripped-back headset was presented, was largely positive, but as the project progressed, and the headset developed a visual grammar and identity, audiences expected the project to be presented in full. The project, however, tended to degrade and hit issues when presented in other areas. There were core issues with the underlying systems frameworks that linked together existing preparatory systems, as they required network authentication, operating systems updates and plugin supports. This made the project unstable for presentation outside of the UK. These instabilities are not due to the stripped-back versioning but became apparent during the presentation of work outside of the UK at symposia in Ireland and China.

It is interesting to present the project internationally because it challenges the Eurocentric positioning of horses and opens the project to a range of questions and challenges from different cultural positionings. It has also been productive to present the project to a wide range of scholarly backgrounds, mainly from Art, Design, Media, Cultural Studies, Philosophy, and the Humanities but also wider disciplines from HCI and the Sciences. Each subject-specific framing of

the work has drawn out different emphases and understandings of the work's aims, agenda and methods. The project has also been presented to other Academic and public audiences, which will be discussed later in this chapter, and this has illuminated other insights and progressed the thinking in and around the development process as the project iterates, drifts and takes form.

Prototype 008 – Headset

Although previous versions of plastic-crafted headsets were unsuccessful, the material was returned to with different fabrication techniques to develop a new working prototype. It has material properties that are useful for the brief in that it is robust, malleable, can be lightweight, and easily cleaned after use by the public if they pick up and play with the work. There are practical considerations in the brief which has led the Design in this material direction, but also aesthetic considerations. Using a white plastic gives the mask form, but the lack of colour removes some of the focus on the shape and directs the attention towards the function. There are also considerations in the character of the work and its links to other speculative augmentation devices in the canon. Materials that were considered in the making process once the material option was made were white, black, transparent, and a matt grey plastic. Each material was loaded with connotations which direct the character and emotional engagement of the work. Black presented as too sleek and masculine, it gestured towards more sinister sci-fi futures and masculine presents. The transparent plastic obscured the form, and although it created a strange hybrid shape, revealing the human under the mask, feedback from audiences was that they felt more vulnerable and conscious of their human body under the structure. The grey plastic and white plastic had similar aesthetic direction, but the white plastic linked closer to existing work, and for me evoked more positive futures, and linked visually to work like *EIDOS* (Bouckley, Clive-Smith, Kim & Sugawara 2013), *Touched by Time* (Inbar 2016), *Sensory Interaction Aid* (Frankl 2015), *Dementia Simulator* (Peng 2016), and *Batphones* (Ries 2008). The white plastic helps to situate the character of the piece alongside a history of body augmentation in Speculative and Critical Design practice for those with a discipline subject knowledge, and for those without, it suggests something from a slightly more positive future, a product alongside the current models of VR headsets.

The main aim for this prototype was to create a lightweight version to increase the movement and comfort for the audience. The previous prototypes had demonstrated how disorientating and destabilising the experience can be for audiences. The future prototypes must be very lightweight, wearable and resemble a horse in 3D. The prototype should be slightly abstract, communicate a potential future or alternative present, linked into the wider aesthetic canon of Speculative Design, and be practical to produce.

A number of alternative patterns were purchased and tested to house the component parts and attach to the Oculus headset as the foundation and supporting structure. After trials, the headset was produced in a white polypropylene material. This allowed for hand cutting and shaping from a modified pattern, has very light weight, and could be fabricated with little access to specialist tools or training. I collaborated with the original Designer on its modification and sought approval on the Design outcomes. The prototype headset became a showcase piece for their Design on Etsy. [Reflective Diary Pages 52, 54-55, 62-67, 71-73]

Dissemination

Hook, A. (2019). *Speculative Methods for Interspecies Design*. Imagine! Belfast Festival, Futureproof: Real Research in a Virtual World, Ulster University, Belfast, UK. https://imaginebelfast.com/events/futureproof-real-research-in-the-virtual-world/

Hook, A. (2019). *The Politics of Interspecies Design, Technology*. Culture and Politics Workshop, Ulster University, Coleraine/Belfast, UK.

Hook, A. (2020). *Augmented Futures*. Future Tuesdays @ FutureScreensNI, Belfast, UK.

Publication

Hook, A. (2019). Exploring Speculative Methods: Building Artefacts to Investigate Interspecies Intersubjective Subjectivity. *Alphaville: Journal of Film and Screen Media*, (17), 146-164. DOI: https://doi.org/10.33178/alpha.17.09.

Hook, A. (2020). *Case Study: Equine Eyes*. SpeculativeEdu *https://speculativeedu.eu/case-study-equine-eyes/*

Moraes, Flavia (Director). (2023). *Visions in the Dark* [Film]. Filmland International. (Available on Vimeo.)

Reflections

The project still suffers from the underlying problems ingrained in the systems, which makes it unstable for adapting commercial proprietary technology as the foundations of the headset. There are two core issues in the prototype. The first lays in the use of the Oculus headset and the plugins for Unity, because both require continual updating and internet connectivity – functional considerations in the display, longevity and stability of the work – and the second comes from the large surrounding technological infrastructure that that headset requires in order to function. The cameras feed in through USB into a laptop, and the headset requires the

laptop to have the Oculus tracking cameras connected. This tethers the experience to the laptop, a power supply, internet connectivity, and particular places and spaces of exhibition. The use of existing technologies also shaped discussions at dissemination events in unproductive ways, prompting questions like "What is the spec of the laptop?" "Why did you use a Rift instead of a Vive?" or "I think Razer Laptops are more powerful than Alienware – have you considered using a higher spec machine to counter latency?"

The functional considerations have caused a number of issues in the display and dissemination of the work. The work was displayed as part of the Symposium on Creative Practice at University College Cork, a conference in Media and the Humanities which aimed to build capacity in PhD through Practice at the institution. Before the demonstrations of the work, the Oculus required updates (which were locked due to institutional admin and policies). This caused issues in the presentation of the work, which was displayed in its stripped-back form for ease of transportation, but was accompanied by images of the full headset and a presentation of work which later became the publication *Exploring Speculative Methods: Building Artefacts to Investigate Interspecies Intersubjective Subjectivity* (Hook 2019).

The work at this stage in prototyping was also selected for presentation at the *Playful Encounters* symposium in Ningbo, China. Again, the project hit a number of functionality issues in the connection to servers, plugins, and SDKs. Both demonstrations, in stripped-back form, were fruitful and offered productive feedback from the Academic community, but further refinement of the core technology and its stability could help to address the issues in display contexts and also link directly to the rhetorical positioning of the work. The presentation was useful, and it was useful to get feedback from scholars such as Wirman who gave the keynote and attended the presentation; they are well known and established in the ACI community for their work with interspecies play and contributed to the publication *A report on the first international workshop on research methods in animal-computer interaction* (Zamansky et al. 2017).

Feedback from the presentations from audiences focused primarily on the tethering to a laptop, and all of the surrounding network and physical infrastructure, which restricts the audience's ability to play, move, enjoy and explore the work. It means that when the work is displayed, for instance at the *Beyond* conference, it requires supervision. Any users need to be largely stationary, seated, indoors, in a space with wifi, a table, a chair (for health and safety reasons), usually behind a tensor barrier. These hinder some of the central thesis and rhetorical shaping of the work. It allows the user access to only very constructed and orchestrated encounters, of spaces and situations which would be unusual (or impossible) for a horse to experience.

Discussions after conference papers, symposia presentations and exhibitions offered

productive feedback which highlighted the importance of continuing the development of the project further so that it might become an untethered experience. Users were largely unaware of the functional and logistical issues posed by the foundational technologies, but many users at the *Imagine!* Festival in Belfast and the *Beyond* conference felt that it would strengthen the outcomes and potential impact of the work if users could move more freely, experience the work in other display contexts, and be enabled to 'meet horses' while experiencing the work. The latter point raises many practical, safety and ethical concerns for the project, but could offer further potential avenues for inquiry. The feedback, largely because of the Academic audiences from the Social Sciences, Psychology, and Biomedical Sciences, questioned what positivist methods would be employed to measure the success of the work – with offers of collaboration for user testing, data capture, models of measurement and success.

During September 2019 I was contacted to be interviewed by Flavia Moraes, a Brazilian documentary filmmaker, in Dublin as part of their film *Visions in the Dark* (2023). They contacted me after viewing the TEDx talk and felt that the work made a significant contribution to the film which features segments from the famous Academic and animal behaviourist Temple Grandin and 'Horse Whisperer' Monty Roberts. As part of this filming, I was able to discuss the project and thesis with Denise Heinlein, the chief instructor in Monty Roberts' school, and gather feedback on the Design outcome's practical application. The film explores non-violent ways to train and live alongside horses. Heinlein's feedback on the project was practical and linked to her role. She saw productive ways for the prototype to be employed in equine training with participants in the school, and for building understanding of their methods. She helped to confirm and corroborate the desk-based research on equine vision and the simulation. Although she agreed that the representation of horse vision was not perfect, it offered a productive imaginary space to consider and reevaluate preconceptions, and reconsider our cultural positionings of the horse.

The headset was selected by SpeculativeEdu as a case study of best practice in Speculative Design. The SpeculativeEdu project, funded by ERAMSMUS+, aimed to strengthen speculative Design education across Europe by

> collecting and exchanging existing knowledge and experience whilst developing new methods in the field of speculative Design. Its scope is to collect, exchange, reflect upon, develop, and advance educational practice in the area of speculative Design and its self-critical approach.

The headset structure, cut and folded from lightweight polypropylene, also constrains the display of the work because it is not robust enough for users to wear freely. It offers a lightweight, easily constructed and batch-produced outcome, which balances between weight (for

freedom of movement) and form, and which progresses the rhetorical aims of the work. It is not robust enough for continued, prolonged, or repeated use by the public. The pattern and shape need some refinement in future iterations and the rigidity could offer a more stable user experience.

The stability and rigidity of the headset are important to reassure users, offer them the confidence in the work and their freedom to play in and with the headset. Feedback from users said that they felt the work was fragile and they were worried about how they would use it without damaging it. These types of response limit the potential for freedom and play. The work needs to inspire confidence, and users' concern about these factors has the potential to hinder immersion and the flow of the work.

It will be important to retain the look and feel of the prototype as it evolves, since it has developed a defined character and aesthetic with a white semi-futuristic plastic shell Design, but users have also suggested that it has the form of other equid species, so some refinement of the shape could enhance the direction of the project; focusing on the shape of the ears, eye sockets and jawline could distinguish this as 'horse like' rather than resembling a donkey, pony or other equid species.

Prototype 009 – Wireless Headset

To explore the potential for wireless, untethered prototyping, and reduce the friction in the user experience caused by feeding the data back and forth to the laptop, wireless IP camera technology was explored to address user feedback. Some early-stage prototyping was considered to pass the camera signal from two IP cameras to Unity, and then mirror the screen back to the Oculus headset. This could address the issues around tethering, and freedom of movement for the user. [Reflective Diary Pages 45, 74-75]

Reflections

The initial steps in the prototyping process were successful, with IP cameras fed back to the laptop, and back out to the VR headset, but the signal can be unstable and works only in limited display contexts. As the immersive technology has progressed, other Design avenues have opened which could offer alternative routes of inquiry that address a number of prototype constraints. The new iterations will need to be wireless, battery operated, light, robust, and allow a greater freedom of movement.

Prototype 010 – Stereo Pi Development

To explore other development approaches that link directly into the fundamental concerns of the project, a new development platform was adopted, employing maker technologies to develop a bespoke solution which does not have heavily gate-kept proprietary technology. These open, iterative and non-proprietary platforms help to emphasise the technological reasoning in the work. There are a number of core deliverables which will transition from the first full prototype, but this direction will add additional deliverables and priorities for discussion after dissemination events.

As the headset, through its prototyping phases, has been presented at a number of conferences and has a recognisable art direction, this will be retained and modified for the redevelopment so that it is still visually part of the same project for audiences familiar with earlier iterations. I will address feedback on the form, reshaping the jawline, removing the nostrils, addressing the shape of the ears, and develop ways to make the headset more robust for users.

The new headset will need to draw forward the FoV, the colour range, and the immersive experience, but should allow more freedom of movement to help audiences play. Ideally it will be completely wireless, battery operated, not require networks or external sensors and be self-contained. The previous headset required a lot of specialist expensive equipment (a powerful laptop, a commercial VR headset). It was expensive to produce, bespoke and hand-cut, so labour intensive to create, and this limited the quantity and the scalability of the project.

The need for the resolved project to be wireless and battery powered but have large computational power for live video stream, led to the adoption of Raspberry Pi as a platform. It allows heavy modification, bespoke programs, runs from an external battery power supply, and has a low price point. Through extensive desk-based research, there are a number of existing maker-based immersive solutions that adapt a specialist Pi board called Stereo Pi. The board is commercially available but developed to support stereoscopic photography (3D) by mounting two cameras parallel to each other roughly the same distance apart as the human eyes. The FoV of the cameras is only 160 degrees, but as the system is modular and adaptive this was easily addressed by exploring cameras with wider lenses, seeking higher quality sensors, and adapting the electronics.

To support the development of the first prototypes, a series of tutorials to build a ‘stereoscopic third person’ project gave the outcome its initial foundation. These underlying developments and step-by-step guides produced by other Researchers, and released freely online, gave a core structure allowing the two camera feeds from two new 220 FoV cameras to feed directly into a wireless VR headset. The system could be powered by a USB power pack, and has

a small physical profile, so could be worked into the headset. The boards were also lightweight, which allowed for broader freedom of movement for the wearer. The next stage, building on continued work between the Stereo Pi team and Researchers, removed the commercial VR headset and replaced it with a small HDMI screen, reworking the code to reduce the latency (>10ms), which is important to minimise additional disorientation and nausea from the Design experience – the user feels the project responding quickly to their movements, which reduces motion sickness.

I worked with support-forum communities on approaches to remove the red tones from the headset as the final stage in the project specification, but this required a deeper knowledge of OpenCV and Python. To develop this deliverable from the previous prototypes, collaboration with an expert software engineer, programmer and maker was required to draw in specialist coding knowledge. After securing a small collaborative arts grant – part of the COVID-19 recovery funds – I was able to facilitate some additional expert knowledge to assist the development. Through collaboration with Simon Hewitt, we were able to help remove the chroma ranges from camera feeds.

The headset prototype simulates an approximation of equine vision through two wide FoV cameras mounted so that they have a cone of stereoscopic overlap at the front. It feeds two 220 FoV cameras to the Raspberry Pi board, which removes the red tones, to create a dichromic colour feed. It delivers two fisheye feeds onto a small, high-definition HDMI screen side-by-side as split screen. The screen is mounted in a plastic VR headset Designed for mobile phones which delivers a single image to each eye, through a domed lens, to wrap the portrait image to the curve of the human eye. The HDMI screen and the Raspberry Pi both require power through a USB cable, and the component parts are more delicate than the previous iterations, but the modular nature of the platform, and its lower price point, balance this – and the components will be housed within the headset. [Reflective Diary Page 76-79, 88-89]

Dissemination

Hook, A. (2021). *Equine Eyes: An immersive experience to promote interspecies empathy and understanding*. Beyond Conference, Belfast, UK.

Hook, A. (2021) *Blinkers Off: Seeing the World Through Equine Eyes*. Beyond Conference, Belfast, UK.

StereoPi blog (n.d.). https://stereopi.com/blog/horse-vision-humanoid-telepresence-robot-and-other-cool-projects-stereopi-owners

Reflections

The headset was presented at the *Beyond* conference in Belfast in 2021, but due to COVID restrictions the audience were not allowed to use or play with the headset under government guidelines and event health and safety. Instead, the headset was mounted for display on a stand, and the HDMI internal screen was replaced with an external TV screen so that audiences could see themselves through the headset. This display context replicated earlier experiments in the process, and presented similar issues and tensions.

This display context shifted the audience interaction, and although it was playful in its nature, and involved a lot of waving at the cameras, it did not engender the embodied experience to which users gave such positive feedback in early prototypes. The project and display still directly linked to the core concerns for the 'experiential turn' (Candy and Dungan 2016) to be interactive, and extended this to encourage a playful encounter, but the audience were less entangled with the meaning-making. The effects were novel but lacked the depth of impact on the audience outlined in previous dissemination of the work. The display context removed the embodied reflection in the work and reduced the capacity for play – while remaining playful.

The work was presented to the (then) Northern Ireland Communities Minister Deirdre Hargey who praised the work for building understanding of non-human relations and its ability to shift audiences' concerns out of the immediate political context in Northern Ireland, to think deeply about our relationship with the world and what she termed 'nature'.

The headset delivered the core requirements of the specification, but the plastic mask still needs to be refined in the final iteration so that it is more robust, solid, not hand crafted, and the issues in the shape are refined. The headset also has a difficult boot configuration which requires it to be manually booted through the commands structure. This means that the headset 'works' as intended, but that it is hard to display and use by galleries or the public where they can experience and play with the work.

Prototype 011 – Centre for Design Innovation

The project prototypes – after the TEDx talk, the Beyond presentation, and the case study for SpeculativeEdu – gained the attention of a number of museums and galleries that were keen to show the work. These included the National Race Horse Museum in New York, and the Centre for Innovation and Design in Hornu, Belgium. Both venues were interested in visitors experiencing the headset, which would require a rebuild of the mask housing to hold the components. Audiences also gave feedback that they thought it would improve the experience and

enhance the playfulness if they could experience with friends collectively. This mirrors models from Candy and Kornet (2019) that suggest spaces for reflection and discussion are important to deepen impact. This would require the production of multiples. Although this was part of the original vision for the project, it had been removed from the development spec for financial reasons. With the lower cost of components and collaboration with a fabricator who could laser-cut and 3D-print elements of the mask, the project could develop further and reach a larger audience in the way it was intended.

I worked with the fabricators Poli Productions, to 3D-scan the inside cavity of the mask, and to create an internal slotted skeleton for the polypropylene exterior. The supporting structure makes the headset more robust, and there are now 3D-printed elements such as the nose cone, which in previous prototypes was a particularly vulnerable section of the Design. The eye sockets were reshaped and mounted so that they could house the camera, and remove the vulnerabilities from the adhesive. Small rivets were added at vulnerable points to reinforce the adhesive, and a laser-cut mounting section was added in the framework to support the cameras at the appropriate angle. The mask section of the headset now has a set of digital files which can be sent to print and fabrication easily to produce the headset in a range of materials.

I reengaged the software engineer and the user experience was further refined. We implemented the v2 version of the Stereo Pi which has a lower profile and wider functionality. 200 FoV camera lenses were added which still align with the outcomes of the desk-based research on equine vision and offer a better user experience. The boot issues were addressed so that when the two USB A cables receive power the headset boots automatically for the user. The files for this prototype can be found in an open github repository which others can use to produce and experience the work. [Reflective Diary Pages 93-101]

Dissemination

The piece was shown alongside a series of Speculative Design outcomes at the Centre for Innovation and Design in Hornu, Belgium, after curator and scenographer Benjamin Stoz contacted me to develop a display. The work was selected because of its focus on thinking differently about what 'better' might mean in Design that augments the body. It is the final work in the curatorial path for the show, and the only piece that visitors can wear and play with.

Superpower Design (2024) [Exhibition] Centre d'Innovation et de Design, Belgium, 24 March 2024 – 25 August 2024.

Reflections

The headset in its final form offers users a disorientating and confusing, immersive, embodied, reflective and playful experience. They have the freedom of movement to play in and with the headset, wearing a USB power pack at the waist. There are now three identical headsets, which take two live 200 FoV feeds, mounted at 20 degree overlap angle, with a <10ms latency. The live camera feeds are passed to the Raspberry Pi which removes all of the red hue and tones from the image, and passes this through an HDMI cable to a mounted mini-display as two side-by-side portrait images. The HDMI display is mounted in a plastic headset, which partitions the two sides of the screen, delivering one to each eye through a domed lens. The headset is replicable so that any damage in the gallery use is easy to address and fix. It is produced at a low price point so that if the headset is damaged though user interaction in the gallery, through participation, it can be replaced.

There were some sacrifices in the priorities of creating the final iteration, the most significant being the colour saturation. Although the Raspberry Pi can remove the red hues from the image, the feed has a very high contrast ratio and high colour saturation compared with images produced in scientific journals and previous prototypes. This means that the accuracy of the simulation is less than the previous Oculus versions, which gave more nuanced control over the image colour management. As the device is far from a scientific simulation this sacrifice was made to enable the more important qualities to the central thesis.

The shape of the headset addresses audience feedback to make it sleeker, with forward facing ears, a more defined jawline, and the removal of the nostrils from earlier card-based prototypes. These adaptations are Designed to make the headset look more abstract. This has enhanced its rhetorical position as something from a ‘near future’ or alt present, and linked it visually to a more Design Fiction or Speculative Design aesthetic.

Audience and venue feedback has been very positive, and although the headset instrumentalises non-human animal perception, it is Designed to create a playful, interactive, embodied, reflective experience which opens a space for imagination, reconfiguration and thinking otherwise.

Conclusion(s)

All Research projects come from a tension, and a curiosity; it is important to let them drift, for them to be exploratory, messy and knotty. Throughout this thesis the Research has taken many paths, and through a mixed network of units, of different scales and rhythms, I have tracked the most significant to me personally and the narrative that offers the most insight and understanding. The project started in a classroom, discussing how we feel about 'videogames for cats' and then became an attempt to find a language to speak about these cultural artefacts and oddities. The analysis used a variety of frames from my 'home discipline' to attempt to articulate the complexity of the interactive encounters. It started with textual analysis, with observation, with trying to understand how I could map my existing knowledge of play and games, drawing on proceduralist and ludological lenses to try to unpick the messiness of the playful processes of *becoming with* that happen between human and feline, using media and technology as spaces for connection, wellbeing, and community. For Haraway, when we *become with*, in interspecies (and technological) entanglements we create "a contact zone where the outcome, where who is in the world, is at stake" (Haraway 2008:224). In these entanglements we can make and remake, world and re-world, build new configurations, new understandings, new knowledges.

The project started with the most commercial example, and from here spread outwards to find new analytical lenses, discover new Academic communities working to make the world more inclusive, explore new non-hierarchical framings of animals, map new Academic disciplines, new ways of *thinking* about Research, new ways of resisting, new ways of *knowing* other species, new ways to articulate my practice, new ways of *being* in the world. The thesis has allowed me to explore new ways of *thinking*, *making,* and *doing* which honour and celebrate complexity.

The study, as a piece of Feminist Design, celebrates plurality, positionality, provisionality, complexity, resistance, liberation, social justice, wellbeing, equality, entanglement, and inclusion. It adopts tactics that resist some Academic traditions in writing, and celebrates

the subjective positioning as an important site for making and crafting meaning – the lived experiences of the Designer, their positionality, their journey, and the thing that they think are important *are* important. They are important to the work because they shape the Design decisions that we make, and these lived experiences should not be cleaned from Academic life, Design and knowledge production; all knowledge is situated and shaped and crafted, impacted culturally, socially, institutionally. For me this process of reflection and applying tactics to the rhetoric, both written and Design, is important as "it matters what ideas we use to think other ideas" (Strathern 1992: 10). As Designers, we need to become more reflective, positioned, critical and understanding. The work we do is important but the way we do it could be even more important because it shapes the world around us and the views of our audience(s). The way that we know the world, and what we use to know the world, is on important sites of meaning: "It matters what thoughts think thoughts, it matters what knowledges know knowledges, it matters what relations relate relations, it matters what worlds world worlds. It matters what stories tell stories" (Haraway 2016: 35).

The thesis explores and maps Animal Computer Interaction as a discipline and an important site of cultural resistance to anthropocentric bias and discipline which has pioneered approaches to foster more inclusive interspecies futures. The map tracks some of the core contributions and disciplinary turns as it has matured and developed its own disciplinary discourse. The underlying politics of ACI are important; they are important sites of resistance to hierarchical thinking, spaces where the act of *thinking*, *making* and *being* close the culturally constructed schisms between human and non-human animals, communities where Academics have allowed themselves to imagine animals otherwise than they are constituted under hegemonic cultural vectors. ACI pushes for more respect, more understanding, more empathy, and applies this push directly into the lived experiences of human and non-human animals. It reimagines and remakes the world in more inclusive ways. It concerns itself with the lived experiences of other animals. It is caring, kind, and compassionate. It resists many of the Design constraints that are traditional pressures on more orthodox Design practices. It champions Designing *with* its users. It resists many of the considerations around scalability under capitalism, instead choosing to Design with a single user, one user at a time, crafting and honing the outcomes to a particular body, personality and preference. Through studying and mapping of the discipline, a number of tensions and limitations surfaced through the way that the Academic traditions discipline knowledge by prioritising particular methods and approaches to making and shape a politics of inclusion.

The discipline focuses on solutions to problems, honing, crafting and applying technology to promote animal wellbeing. These solutions are usually ways to address human-made cultural issues which have grown from long histories of subjugation, marginalisation and control. These solutions ease some of the tensions caused by the current hegemonic vectors and create

new ways for animals to work alongside and with humans. This approach to *thinking*, *making* and *doing* is important; it addresses immediate harms that we collectively inflict on other species. The practice builds better futures, and the solutions challenge us to imagine animals otherwise, take their lived experience seriously, and consider them as important cultural agents.

The practices with ACI push against important issues and are a concentrated site of complexity, where many of the tools and methods that we develop as Designers to shape and guide our practice are called into question. If, as Designers, we need to understand and empathise with our users, how does this empathy cross species divides? If, as Designers, we need to understand the lives and motivations of our users, how do we communicate and understand their lived experience? If, as Designers, we need to know how effective our outcomes are, how do we measure and know if what we have made is working the way we anticipated? If, as Designers, we are creating the future, what future are we making through the work that we give to the world, and what type of world do we make?

For me *making* is more than solutions; we need to be conscious and attuned to what we may be saying with our work. Design makes arguments about the way the world could be through Design Rhetoric – Designing is political, and we need to be conscious of what we communicate and to whom. The ways that we are *thinking, making,* and *doing* all inscribe meaning, consciously or unconsciously, into the work that we put out into the world. Within the discipline of ACI the thesis maps two spaces for intervention. The first is the importance of the politics of ACI; this needs to be foregrounded, elevated and championed. The second is the discipline's focus on positivist discourses and solutionism. These limitations are hereditary, and grow from the intuitional histories of disciplining knowledge in the sciences, but there have been calls for alternative methods to address these framings – ways to challenge *thinking* about and *knowing* other species. ACI is a form of critical making because of its counter-hegemonic politics, but because of its methods and lineage, because of institutions' ability to shape, form and discipline knowledge, there are more privileged ways of *thinking, making,* and *doing* within ACI which shape the discourse. Galloway and Caudwell (2018), Hirskyj-Douglas and Lucero (2019), Steve North (2019), Fiona French et al. (2021) have explored the importance of Speculative Design to ACI to help nudge and trouble the discipline and move it forward. This thesis uses RtD as a disciplinary intervention into ACI to explore how different types of *thinking*, *making* and *being* across disciplinary boundaries might create new ways of *thinking, knowing* and *being*. I have never seen the work as a criticism of ACI, but as a way to contribute to the discussions, discourse and methods. If ACI could be productively troubled by Speculative Design (or other forms of critical making) then what types of critical making might be most effective, and how might they be best applied. Are there limitations to the ways that the disciplinary knowledge operates, approaches that it privileges, modes of knowing that it propels?

As part of this troubling, I have developed the work 'in public', with research blogs, reports of the development process published on public social media channels, conference talks, and scholastic Research on the project published in Academic journals. It is hard to track the effect of the work, and the impact of the interventions on a discipline as diverse and sprawling as ACI, but the work and project have been cited by a number of prominent members of the ACI community including Stefano Gualeni, Michelle Westerlaken, Fiona French and Clara Mancini.[22] It is important that the work that has been published out of this thesis has not only had effects on the ACI community, but also on wider post-humanist discourses around planetary thinking, the Anthropocene, our relationship to other species, and each other.

The thesis maps a trajectory through a history of critical making to explore what types of interventions might best challenge the discourses in ACI. The writing charts a (one) history of Speculative Design and a network of connected practices that use the authorship of the Designer as a space of cultural, political and societal critique. The narrative works through how the practice uses Design Rhetoric as a method to construct arguments and open spaces of possibility and imagination. It outlines the tools and techniques that the method uses to construct its techniques, and uses this as a way to chart some of the practice(s) limitations to make disciplinary interventions in Speculative Design and wider acts of *thinking*, *making*, and *knowing* used for cultural critique. To exemplify the practice, the work explores spaces where the discipline has made important interventions, through making, to help us reframe our understanding of non-human animals in interesting and important ways. I have explored some of the issues in a selection of these projects in other publications (Hook 2019) but here they work as example and inspiration. The thesis argues that Speculative Design could work more productively if the crafted outcomes were interactive and playful. Audiences could become more entangled and enchanted by the rhetoric crafted into the Research if they could play with and through the arguments that they propose. Through play we are more open to possibility, imagination and speculation, because play has a capacity to 'imagine otherwise' about the ways that the world could operate. In speculation there is potential; potential for *thinking*, *doing* and *making* otherwise, potential to imagine, potential for other ways of being with each other and the world, potential to play with the 'what ifs'. In play there is potential; potential to play with disciplines, to play with other ways of *thinking*, *knowing* and *being,* to play with embodiment and ontology. Playful encounters help us speculate on more inclusive worlds, where we can have more caring and attentive relationships with other ways of

22 A list of these publications is added to the appendix after the conclusions, the publication was for a journal in Media, Film and Cultural Studies but has made some impacts within a range of disciplines. The work has also gone on to be exhibited in international shows (by invitation) and I have been contacted by the National Race Horse Museum of America and Hall of Fame in New York who have asked to add the headset to their permanent collection.

thinking, *knowing* and *being*. As Designers and critical makers, we need to craft new theories for the world, crafting the rhetoric into the things and experiences we make. We need work that has a capacity to "gather up the complexities and keep the edges open and greedy for surprising new and old connections" (Haraway 2016:101). They are open, greedy for time and attention, flexible, responsive and have the potential to evoke new ways of knowing the world through reflective embodiment. Play is powerful and potent.

The thesis explores how play can work on audiences and magnify the effectiveness of speculation. Through the methodology chapter I position my particular approach to Speculative Design and how it will be applied to the project, noting how practices like *EXF*, Performative Design and Speculative Enactments can be used to strengthen the interventions made, and deepen the effectiveness of the speculation. Reflective objects, Design proposals and non-functioning artefacts open spaces for speculation and critique, but the more messy, complex and entangled the hegemonic position is, the more engaging, interactive and responsive the work needs to be to help the audience imagine otherwise. I have crafted a series of Design outcomes throughout the making which explore ways to make open and greedy work. I have created satirical workbooks, based on the Microsoft Inclusive Design Toolkit, which spoof key early contributors to interspecies philosophy, and workshop cards that encourage play and performance. I have Designed and delivered workshops which twist and distort established orthodox Design methods like Design personas and empathy maps. All of these have helped me reflect, build and grow my thinking – and exploring different approaches to work with audiences has made them more attentive to the lives of others, more willing to explore new approaches to interspecies kinship.

In many ways the conclusion(s) to the thesis are inscribed in the artefact *Equine Eyes* and its interpretive documents. The project has a personal, professional and positioned narrative which has shaped the Research, and the Research has shaped my personal, professional and positioned narratives. The work has developed and redeveloped alongside my thinking on Speculative Design; it has been Designed, developed and honed to shape and craft the rhetoric and to explore the productive spaces that Speculation could offer disciplines like ACI. I have used this process to exemplify ways of working that present the mess of Research, the subjective reflections, personal encounters, the intimacies and failures. The artefact has great subjective significance, but also offers alternative ways of *thinking*, *knowing* and *being* through play, which helps us be more attentive to the lived experience of other species. The headset could have been (m)any animal(s) through the development, but the work is personal and linked to personal narratives of me as a Designer. The headset, as the outcome of the cycles of *thinking*, *making*, *reflecting* and *doing,* honing the rhetoric, experiments with tactics to *become with* other species (Haraway 2008). The experience promotes ways to become more attentive to the lived experience of other species and imagine them differently. Through enhancing the effectiveness of Speculative

Design by embracing play, the outcomes offer audiences new tactics for *thinking*, *knowing* and *being with* other species. The work opens a space for speculation and play. It offers an embodied experience which is used to spark imagination. It frames the problem of interspecies understanding and kinship, but resists solutions. It opens spaces of possibility and play which work as productive spaces of *thinking*, *knowing* and *being* otherwise.

The headset is an ontological tool, or, to emphasise its playfulness, an ontological toy, for imagining with. It explores how Designing and making can promote new forms of kinship, and new types of knowledge. By better understanding the horse, we can reimagine it, and our relationship to it. As a piece of Academic Carpentry, it applies Design Rhetoric to craft an experience for helping audiences become more attentive to other species, specifically horses; but in so doing, they learn to *become with* other species – and the world – in new ways.

By applying philosophies from Object Orientated Ontology to the making process, to build experiences which nudge towards the flatness it strives for, the project tries to craft philosophy. The project as a whole employs Feminist methods to question the ways in which we discipline and situate knowledge; what ways we construct our knowledge(s) of other species and the world. The annotated portfolio platforms situated, subjective, positioned and crafted knowledge through Research through Design as a way to trouble discipline, the way we know the world, and our relationship with other species.

The project is Designed to explore different ways of *thinking*, *doing* and *being* with the world. It applies tactics from Feminist Design to build a playful, immersive, ontological experiment which promotes post-humanist discourses of *thinking*, and re*thinking* other species. The device uses the ambiguous spaces opened by play to experiment with different ways of *thinking*, *knowing* and *being* with horses, and the wider world. The work resists positivist rational ways of knowing other species, and champions plurality, positionality, provisionality, complexity, resistance, liberation, social justice, wellbeing, equality, entanglement, and inclusion to craft a Speculative Design that is open and greedy at the edges.

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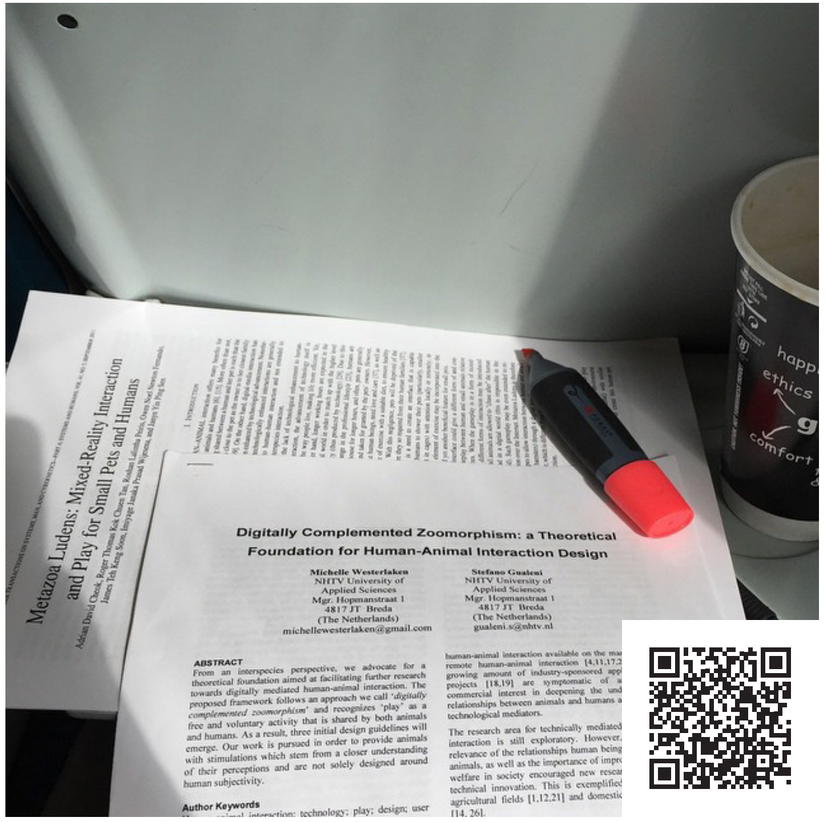
Imagining Otherwise.

A Reflective Diary which documents the development of the project *Equine Eyes*

This reflective journal is part of a multi-component piece of Research, and documents the crafting of the piece *Equine Eyes*. The images, and image captions have been drawn from the social media platform Instagram, and displayed alongside the dates that they were posted. These images and captions werent posted with the intent to be included in the thesis so, during the write up process they were collected, collated and displayed alongside some reflections on the development of the work. Each image is linked to the orignial post using a QR code so that any online discussions, comments or reflections can be viewed by the reader.

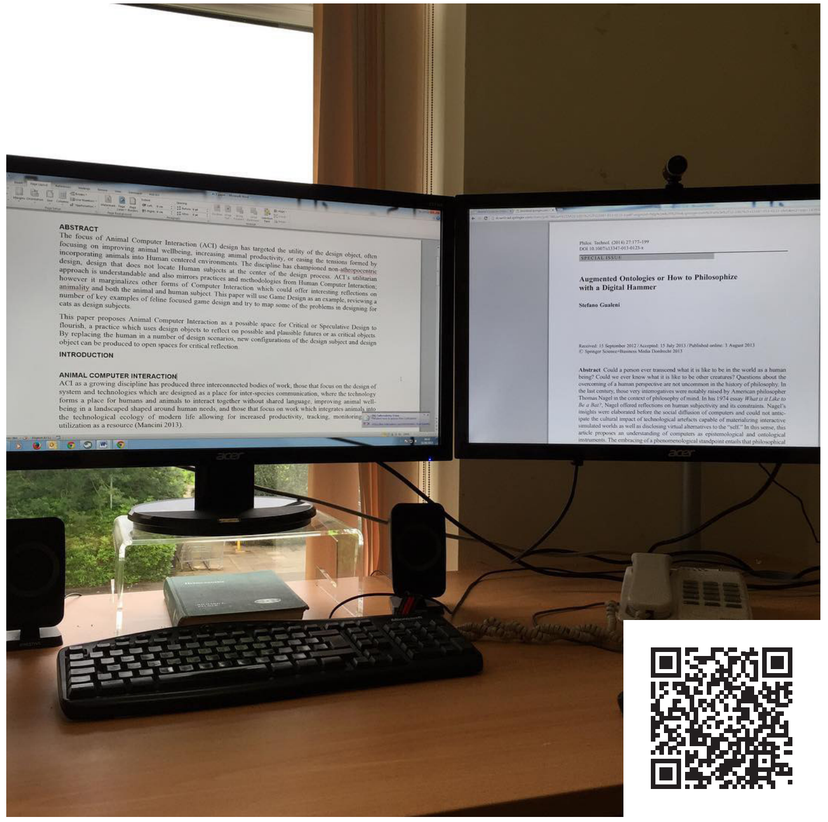
This document accompanies the artifact, pictorials, video summary, and augments the written exegisis with reflective and subjective accounts of making.



26/06/15

Train Office on the way to Belfast.

The thesis started as an exploration of digital play in human and non-human animals; exploring how we might think about the complex social, cultural and political implications of playing with animals across cognitive, communication and physical divides. The project started in a seminar room, born from conversations with my students about 'art-games' and if we considered games designed 'for cats' to be important. We used games like Cat Fishing 2, and video examples of games available for other non-human animals to explore and discuss our feelings about these mediated experiences. After the first supervisory meetings it was clear that I needed to structure my analysis and understand the frameworks for analysis. We discussed, at length, ideas like immersive experiences for animals, and to which human animals had only limited physical access. We discussed if the cat was actually playing or if these experiences were more about power, interspecies dominance and curiosity. The goal for the beginning of the study was to explore if this would be a study linked to Design, or methods more traditionally found in HCI. This led to a lot of exploration of underpinning method, and a deep dive into ACI as a discipline. This helped to map out the design context for the study and spaces of consideration, intervention, and play; exploring ACI, but also Researchers who tried to make considered nudges to the emerging discipline.

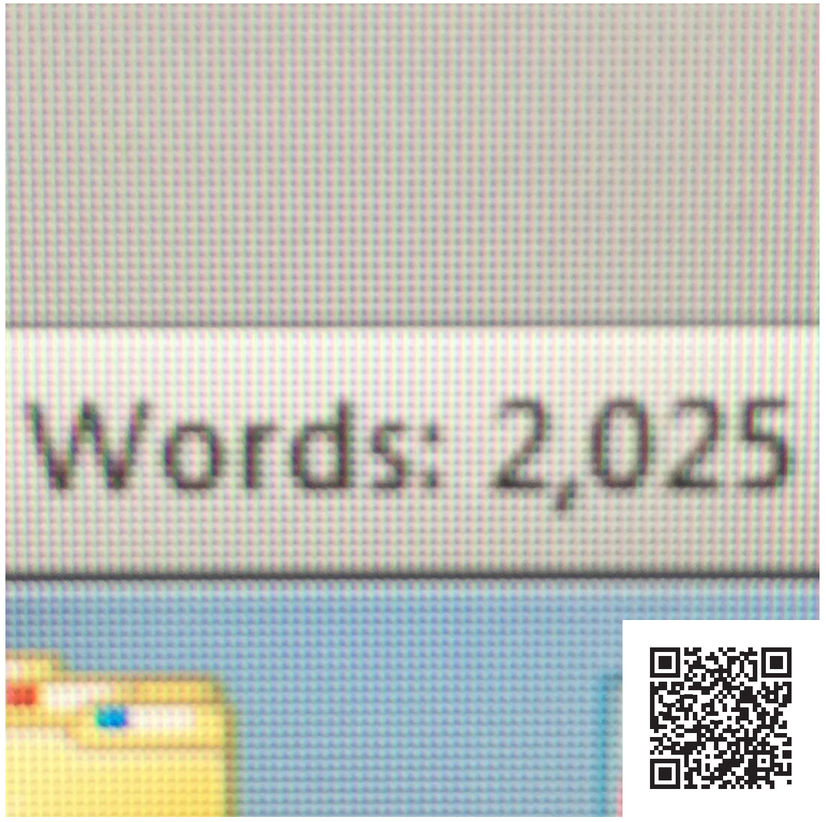


11/11/15

I have been trying to write all day...
I have only achieved 691 words.
Today has been trying.

To start to map out the disciplines and orientate myself, I tried to write. I used the tools I had from Media and Cultural Studies to start a textual analysis of 'Games for Cats' for a new journal on Human-Animal relations. The article was... not very good, not very well received, but the first piece of solo writing I had done for a while, and stretched me in ways that I hadn't anticipated. The exercise was good. The paper was never published, but through the processes of writing – and a good schooling from Reviewer 2 – I started to get a foothold and to think about what the study could and should be.

I'd soon learn that 691 words in a day was actually really good, and that when i did manage 600 words, I'd end up polishing them down to 300 words the next day anyway.

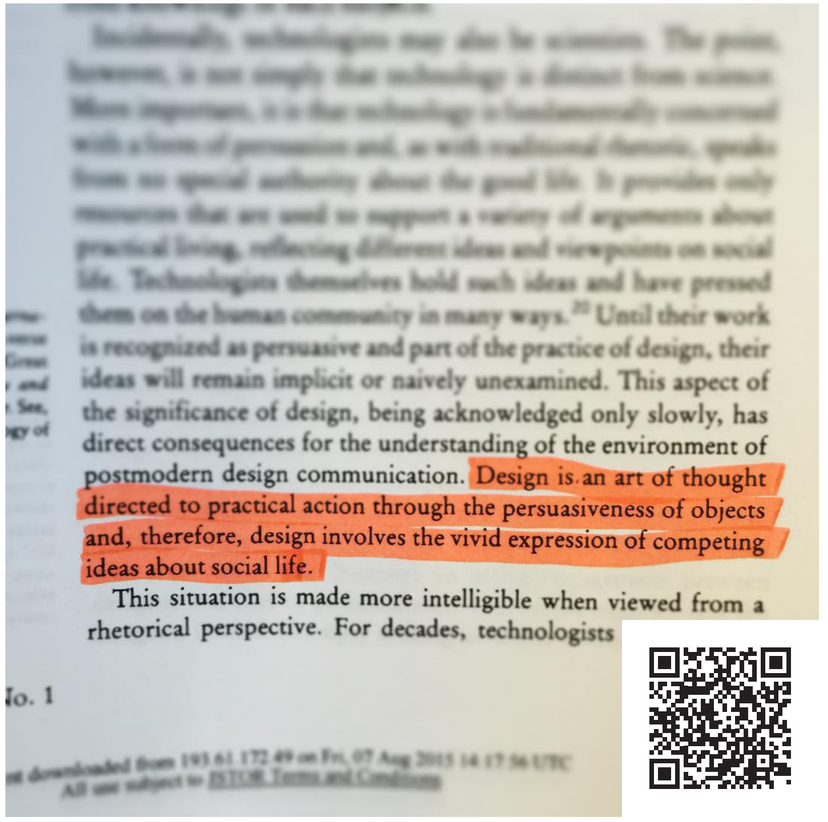


12/11/15

Getting there...

Writing has always been a struggle, and chopping away at 2000 words in two weeks felt like a massive achievement. Posting my progress and working in the open has always helped me progress and focus. Some days, and these were few and far between. It felt braggy and boastful because I know that a lot of my colleagues and peers would love the space to write and aren't afforded it.

Writing has never really been pleasurable for me, but helps me structure my thinking and make connections.



Incidentally, technologists may also be scientists. The point, however, is not simply that technology is distinct from science. More important, it is that technology is fundamentally concerned with a form of persuasion and, as with traditional rhetoric, speaks from no special authority about the good life. It provides only resources that are used to support a variety of arguments about practical living, reflecting different ideas and viewpoints on social life. Technologists themselves hold such ideas and have pressed them on the human community in many ways.[20] Until their work is recognized as persuasive and part of the practice of design, their ideas will remain implicit or naively unexamined. This aspect of the significance of design, being acknowledged only slowly, has direct consequences for the understanding of the environment of postmodern design communication. Design is an art of thought directed to practical action through the persuasiveness of objects and, therefore, design involves the vivid expression of competing ideas about social life.

This situation is made more intelligible when viewed from a rhetorical perspective. For decades, technologists

No. 1

While mapping out what became my design context for the thesis, it was also important to build my understanding of the core texts which would go on to inform my method and process. Coming from a discipline concerned with rhetoric, analysis, and form, Buchanan's work was impactful in helping to ground the study, and to build productive spaces for analysis and considered interventions..

I work a lot with Rhetoric in my teaching, so this paper and Buchanan's work really connects well with wider professional dialogues for me.

17/11/15

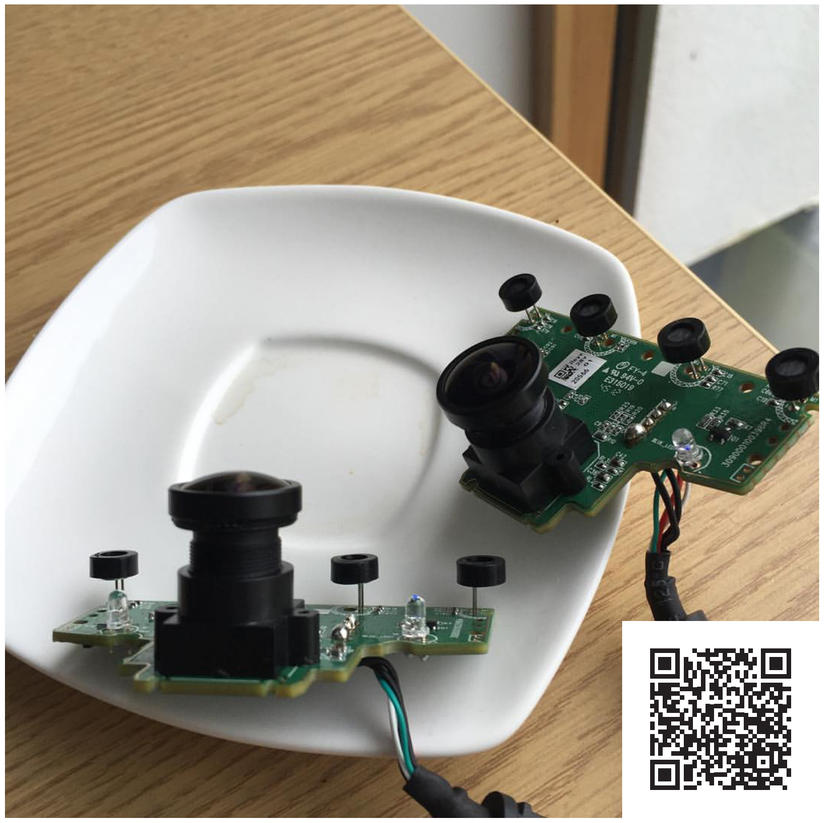
"Design is an art of thought directed to practical action through the persuasiveness of objects and, therefore, design involves the vivid expression of competing ideas about social life" (Buchanan 1985 p7)

04/02/16

Rónán playing iPad games that are designed for cats.

I don't live with a cat, and have never really been fond of them. I don't think I have ever seen a cat play Cat Fishing firsthand, but my son Ronan always really enjoyed playing it as a toddler. When we took him to restaurants he would play away on his iPad. Parents like to share what their kids are playing on playdates. There's something a little competitive about it which always feels really uncomfortable to me.

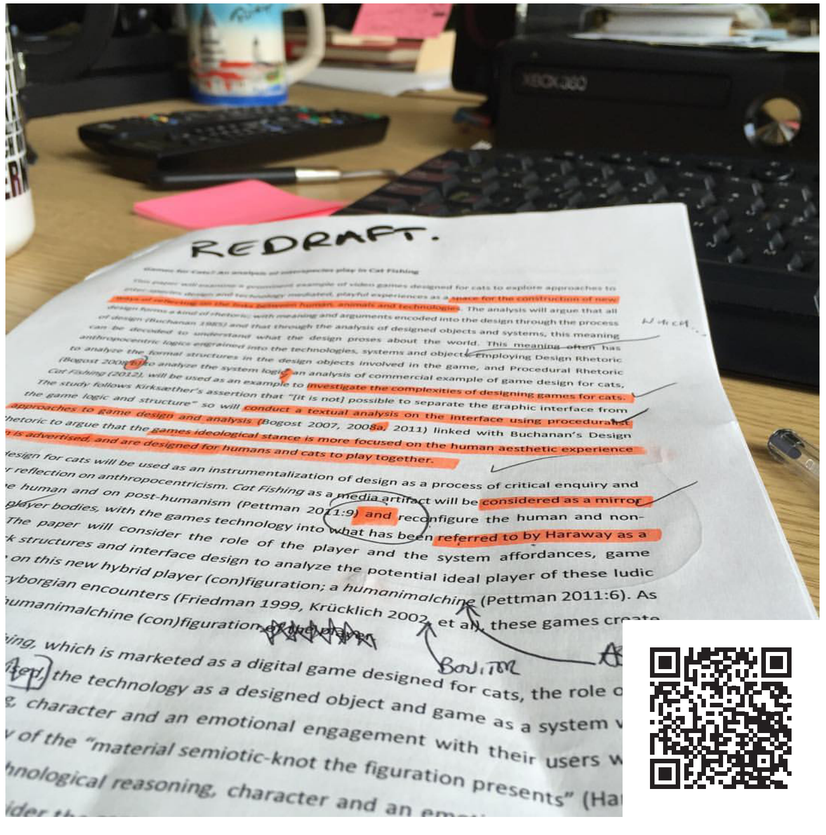
It always amused me when other parents asked for recommendations and I had to explain. At this point Ronan also liked to interact with the touch screen in unconventional ways, licking it using their feet or face which always tickled me when I read ACI researchers' work about allowing nonhuman animals to interact with technology on their own terms.



19/04/16

Installing some new 170 degree FOV lenses on PS Eye camera today for a hardware hack I'm working on.

The first experiments which led to the Equine Eyes project started here, trying to hack together some PlayStation USB cameras. I used tutorials that were developed for EyeBeam. They had hacked together cameras to create eye trackers for a graffiti artist with a disability. It offered eye tacking and control which felt like it might be useful to start to mediate the experiences of other animals. The project never worked, and I think it is still in my office drawer. It started me making and tinkering, through, reading academic work and mulling it over while I hacked together different pieces of technology and played with what I might build.



07/07/16

Drafting-Redrafting-Drafting-Redrafting-Drafting-Redrafting-Drafting-Redrafting

The ‘Cat Fishing’ article rejection was tough, but necessary. I now know what I was trying to map out, but I didn’t at the time. I had just picked up Haraway’s work again, starting where I left – with the cyborg manifesto – and tried to think about the game as a space for assemblage, a space which I’d now call a place for starting to ‘become with’ the cat, through the technology. It was all very muddled and poorly worked. The writing got the ball rolling on the study, though, and pushed me towards some of the newer work from posthumanist discourse.

11/07/16

New book day! Excited about some non-academic reading about experiencing being other species.

Throughout the study I have tried to read broadly, and some of it has been... unuseful... but Thwaits’ work really grabbed my imagination. I didn’t start reading it for a good while after this, but mapping the journey of making, linking the making back to your life, working as a designer to unknot tricky knots, and giving yourself to your work always struck me as worthwhile.

One day in the car with my wife Rachael and my kids Meabh and Ronan, they asked me what the perfect or ideal outcome for the horse’s head would be. I replied with something along the lines of “well, I’d probably wear it for 10 days straight, in a field with other horses. Something like the upside down goggles experiment.” They asked what I’d wear for these 10 days apart from the headset. I replied “either naked or with overalls on”. I loved Thwaits’ commitment to process, his dedication to discovery.

24/05/17

Inter-species empathy through Design talk at Stanford University.

I first started to craft the Equine Eyes project as a response to a call for the Science Gallery in Dublin. Having some outside pressure on the process helps me focus my work and aim towards more immediate goals. The call also offered some development funding to refine and exhibit the work – access to resources for making and the tools to craft physical work has been a struggle throughout the thesis, and the work at this time did not sit well inside my department. I had pitched the ideas for the thesis in a Research away-day and the other Researchers in my unit laughed and mocked the idea, so institutional funding from my employer was off the table, and I was studying remotely so didn't have access to the tools and expertise I would need for fabrication.

As part of the submission, I had to create a pitch video to accompany the call. The video was of the early, unworking prototypes, and at this point I really didn't know how I would build and make a headset. The headset was a prop at this point, some old web cams stuck on a DK Oculus headset. Early work with the EyeBeam tutorials was unsuccessful. I had travelled to Stanford University to present some research on worldbuilding and blended reality fiction; a book chapter on This Is Not A Game as an aesthetic encounter in Alternate Reality Games (ARGs). A piece of writing I'd completed a few years earlier and it had taken a long while for the book to be released. In the break before my paper the organiser and I chatted about the project and he asked if I was excited to present. I explained that I'd largely given up on ARGs, and I was working on some new projects. He asked me if I could present some of it as fresh new work. I grabbed some screen grabs from the Science Gallery video and took to stage.

25/05/17

Photos from my inter-species design presentation at Stanford's #playingwithreality symposia

The paper was well-received and there was a range of Researchers present who were making interesting work which intersected with the project. The paper before mine was a Researcher from Stanford who was making games that you played with microscopic life using digital microscopes. The Q&A was full of interesting questions about life, play, immersion, embodiment and how new digital, mediated experiences could give us new experiences and framings of the world.

I also had the pleasure of hanging out with Greg Niemeyer (one of the edited collections authors) and Jeff Watson, whose work I had always admired, and who unfortunately died a few years later.

04/06/17

Méabh attempting her own take on inter-species empathy this morning with the horse out back in her PJs

This is one of the pictures I always come back to in the thesis. This is my daughter Meabh. I had chatted to her about what I wanted to build and why, and one morning after breakfast I found her in our small back garden. She had a unicorn hat that we'd bought for her fancy dress box and she was trying to coax the horse from the field over to chat to it. We'd obviously talked a lot about the horse in the past, and she and Ronan had asked a lot of interesting questions – outlined in the written body of the thesis – but this was the first time she'd tried to communicate directly with it.

20/06/17

Last night I helped a horse give birth, it was neither magical, nor enchanting... it was gross and smelt like blood and shit.

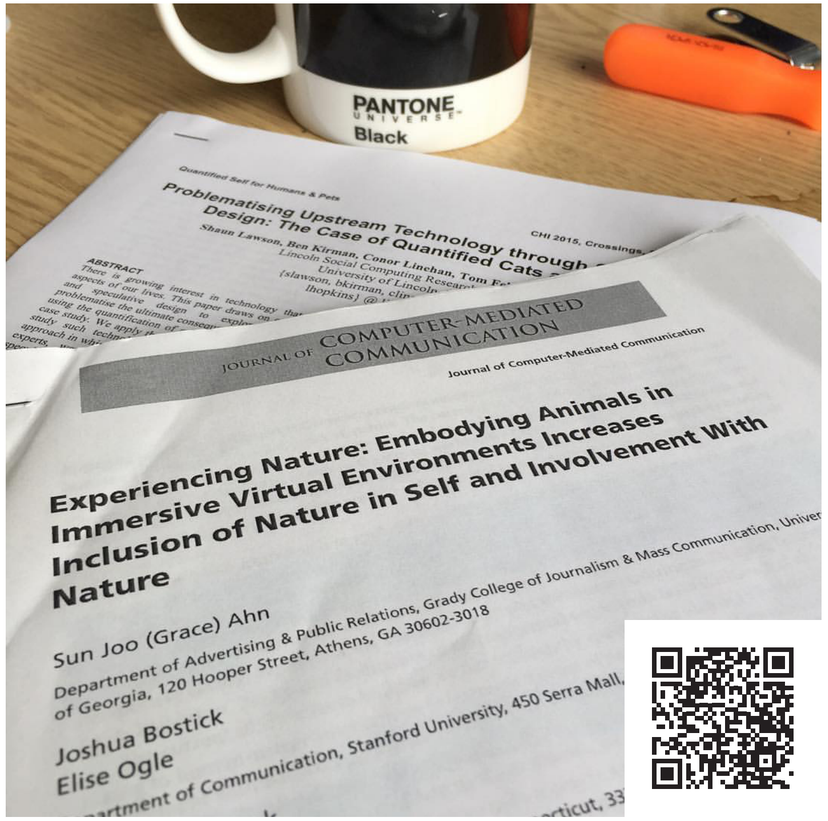
I have told this story in the past, and I always remembered waking in the night with jet lag from being in Stanford, but it was actually a month later. In the night, there was a horrible noise outside. In my PJs and with my phone torch, I went to investigate. The horse in the back field was giving birth. She was laid on her side, screaming and panting. After the foal was born, I went back into the house and sat quietly until the rest of the house woke up. I have only been at three births in my life. My two children, and this foal. It was messy, visceral and overwhelming, nothing like the long protracted labour for my daughter or my son's water birth.

The picture is really low quality becasue I used the digital zoom on my iphone to take it.

26/06/17

Captain 'merica Horse and her baby Sparkles are doing well

It took some time for the horses to settle, and my children named them, fed them and looked after them. They weren't in the field or our lives for long after this but it will always be a really important event in my life.

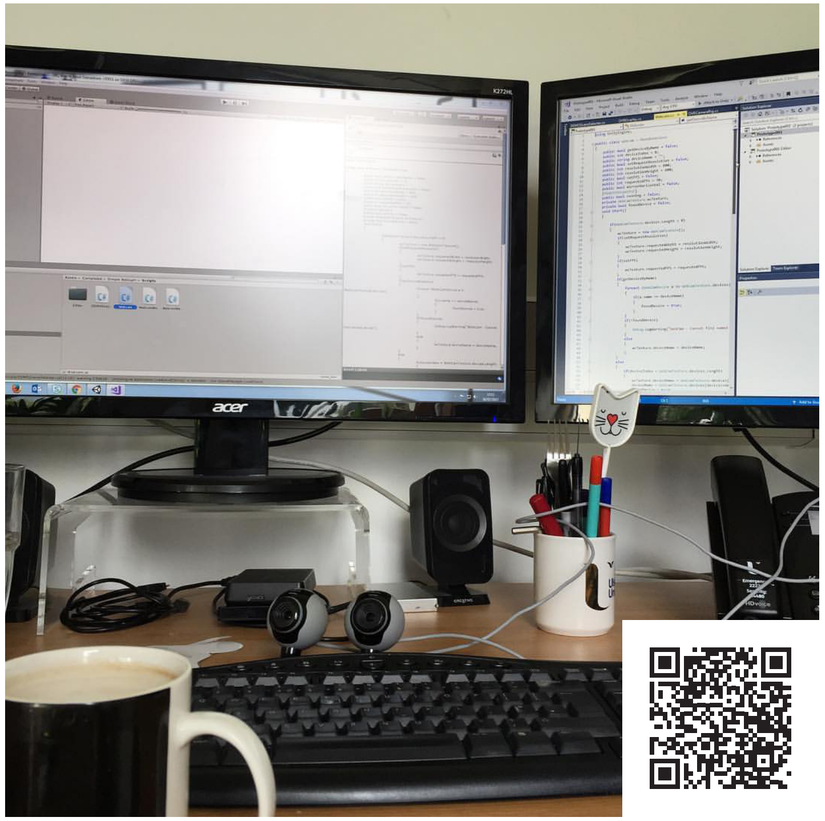


21/07/17

Everyday I'm Hustling

I started to collate Research together. Balancing a full-time role in the University and a part-time PhD has always been tricky, but I worked a lot on disciplining my process (ironic given the study's resistance of disciplining knowledge). I would block out sections of my day. Reading an article a day between 4-5pm before I picked up my kids and started the parental 'second shift', I highlighted sections that grabbed me. Then that evening between everything else, I would mull over what I'd read, semi-forgetting most of it. The next morning before teaching started, I would write a post in the Research Journal. I would try and summarise from memory what I thought the paper, and then type out all of the quotes by hand to help me reflect on them. Then at the end I would put links from the bibliography of any Research papers that had come up that I hadn't yet read as 'future trajectories'. At this point I had considered the PhD as a series of low fidelity prototypes to help inter-species thinking, a type of inter-species philosophy through making.

The work was laborious, and I find reading a real uphill struggle because of my dyslexia, but I was building a back catalogue to draw from, a database of Research to help structure and connect my thinking. There's loads of packages that do this for you now, but I enjoyed the fact it was public, and networked together. The pattern and the process helped.



26/07/17

Today, I think I've built something AMAZING! but have to wait until tomorrow to test it

This was the first prototype using the low res cameras. I used a series of tutorials in Unity to start to piece together some live feeds. All I had managed to do at this point was take a tutorial on video textures for integrating webcams into games, and combine it with a simple tutorial for a VR headset. So there were two live camera feeds, side by side, applied to two video textures, on two plane polygons, stuck onto the two viewports of the VR headset. I was one of the first things I had build in Unity that wasn't a 2D game for the module I was teaching on Serious Games and Procedural Rhetoric.

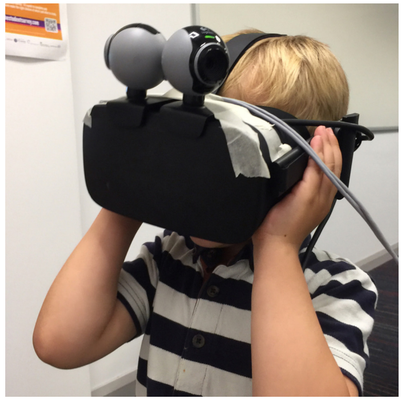
This was still the basis for the headset for the next two years, past the upgrade viva, and a lot of the user testing.

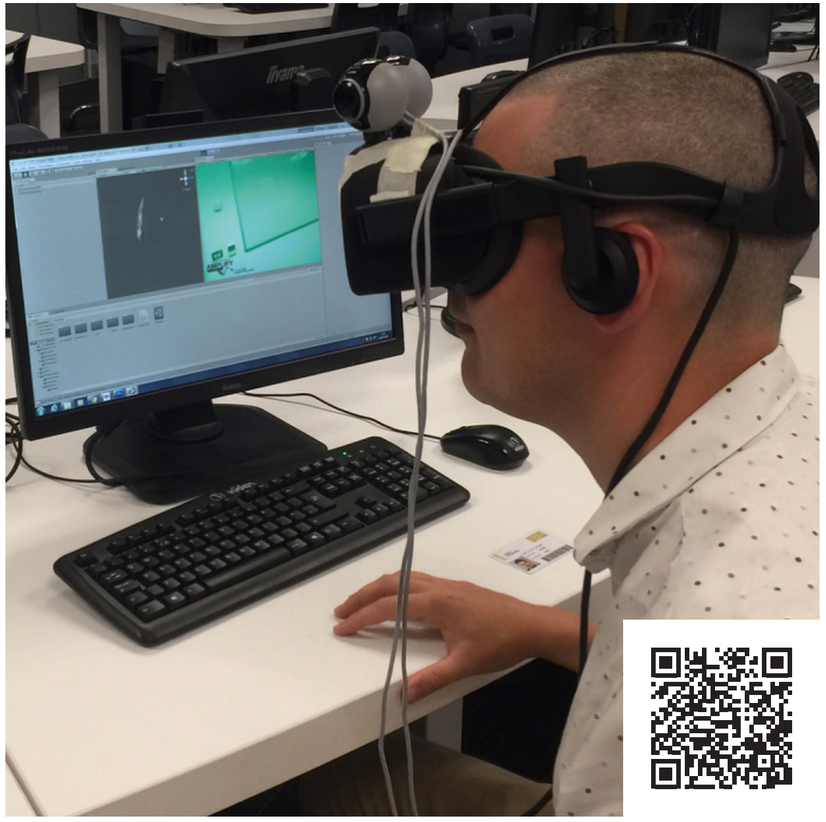
27/07/17

Meanwhile in Coleraine

It was really useful to play with low-fidelity prototyping at the early stages of the project. At this stage, I hadn't really planned what the device would look like, because I still didn't know how it would work, or if it would be worthwhile investing time into.

Trying to line up a selfie, while looking through a 480 camera feed with one eye closed, was difficult and interesting.

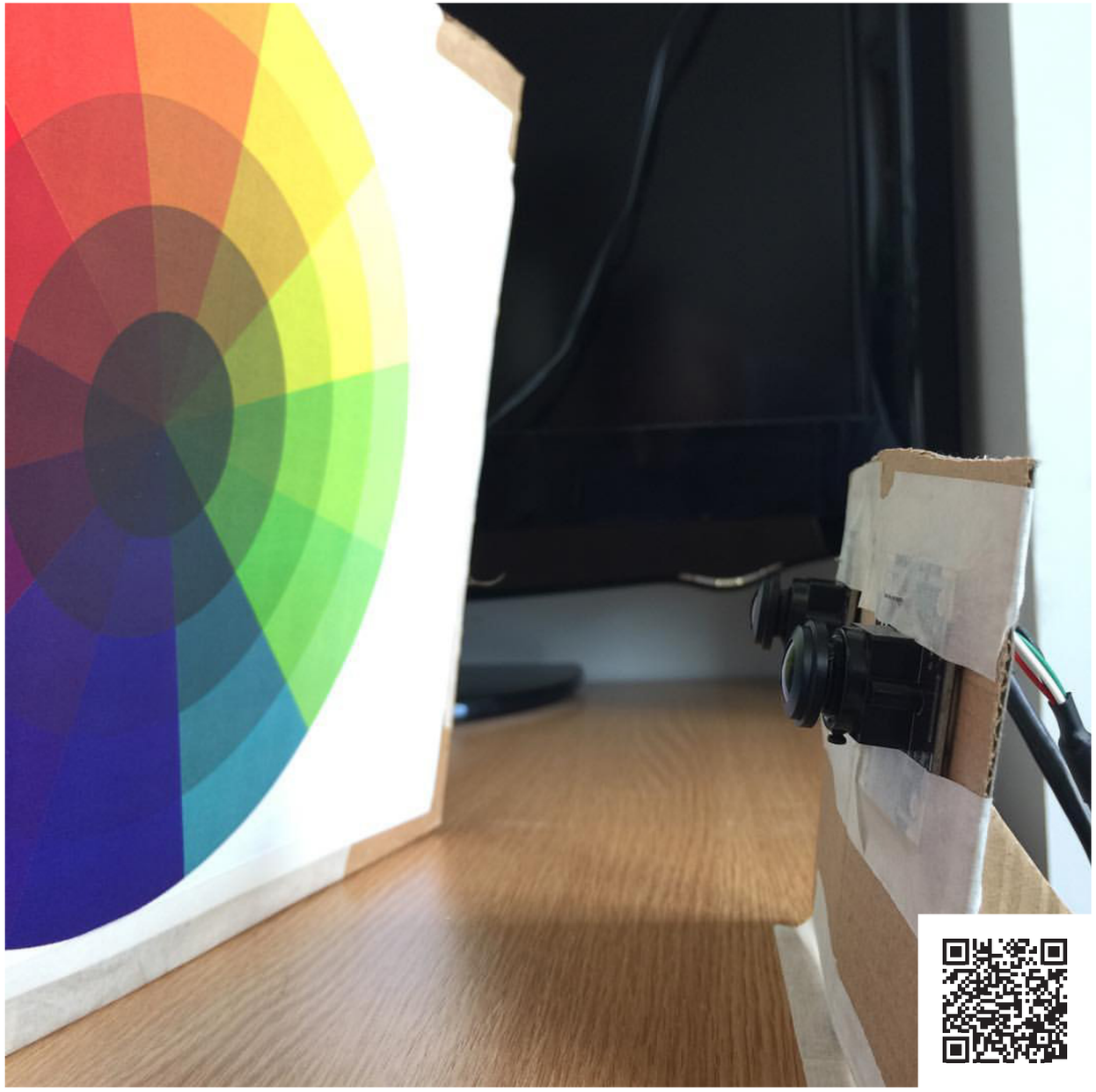




My first testers, Meabh and Ronan. I took them to the lab to show them what I'd' been building. I had worked with LUTs to shift the colour gradients and chroma during the day, and this was the first time anyone – including myself – had tested it to see what it might be like to 'see like a horse'. The chroma range wasnt 'right' yet, but in principle, I had a working first stage prototype.

28/07/17

New prototype up and running with some user testing in the labs. Almost full horse vision, just need to expanded FoV which is arriving on Monday for 350 vision

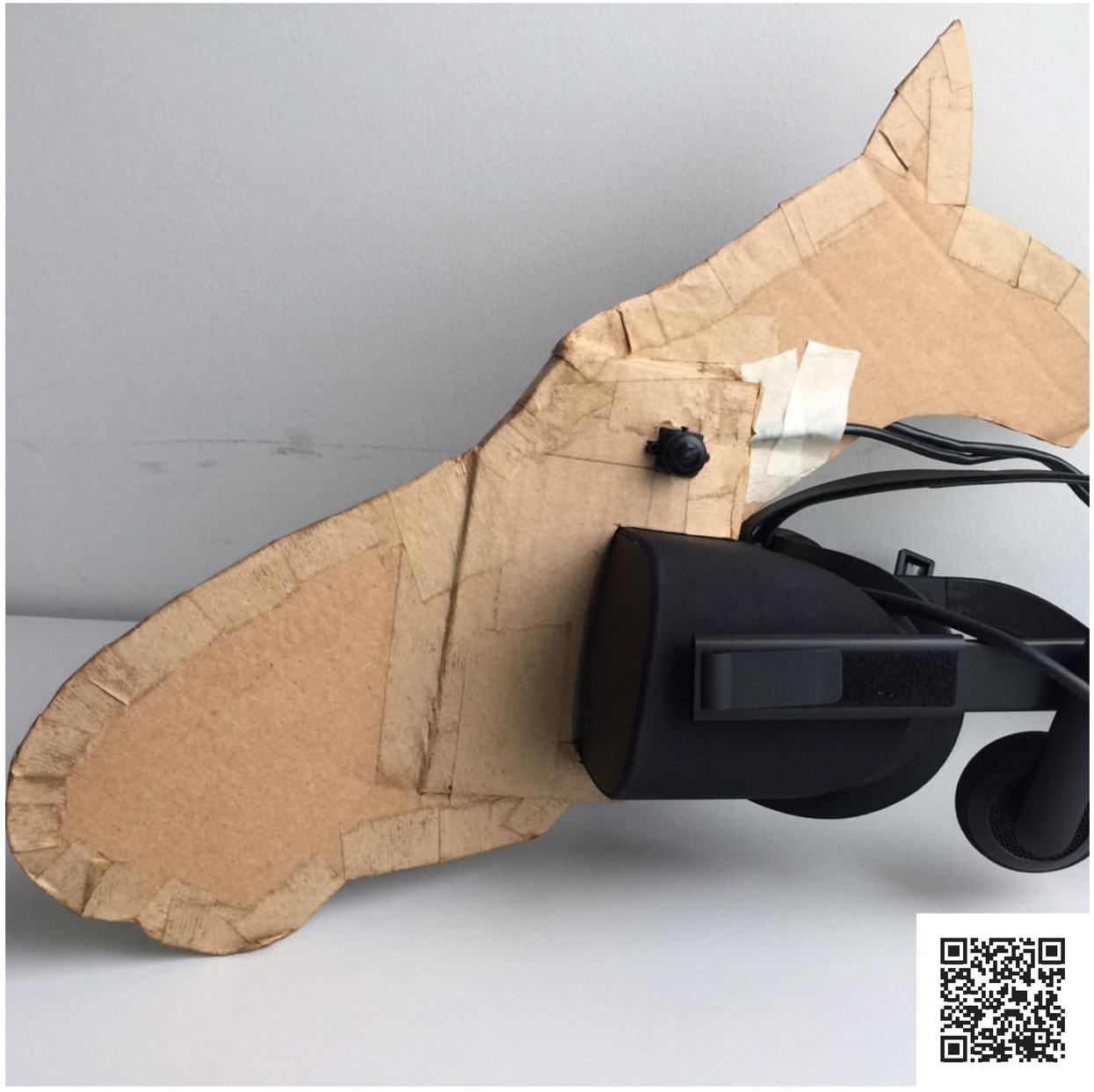


31/07/17

Testing... how do you make webcams not see blue.

There were limits to what I could access in terms of FoV of the cameras and what I was trying to simulate. Most commercial USB webcams have a set field and dynamic focus. I managed to find some webcams from maker sites which had a manual focus by adjusting the screw lens, and an adjustable FoV by replacing the lens. There was something interesting around the limits of what could be purchased easily, and the design spec – what there was market demand for, and specialist needs – which drove me towards maker cultures.

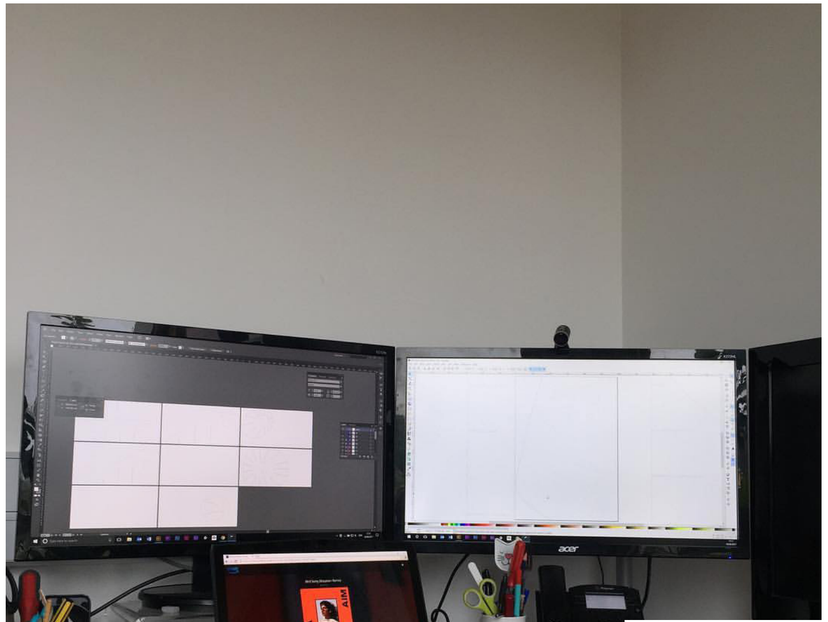
These cameras were fed into the laptop, as video textures, and a LUT applied to shift the colour space. Again there were proprietary logics baked into the technology which meant hacking together the headset was difficult and always limited by market availability. I used colour wheels to help in the testing and refinement of the process until pure #FF0000 showed as red, and all other values were dispersed across the colour palette.



01/11/17

Prototyping all day again

Using anatomical drawings of horses, I built a simple horse shape which connected to the front of the Oculus headset, with angled card mounts for the new cameras. Building in card allowed me to adjust the lenses and overlap so that the project matched research from scientific journals and existing representations of horse vision found through desk based research.



16/08/11

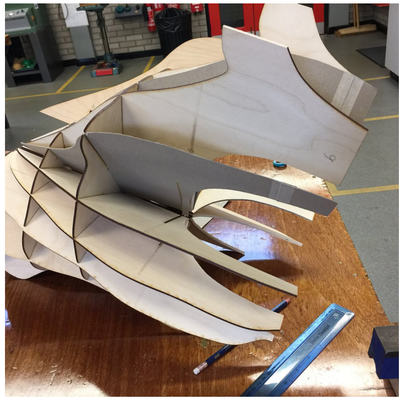
new workstation klaxon

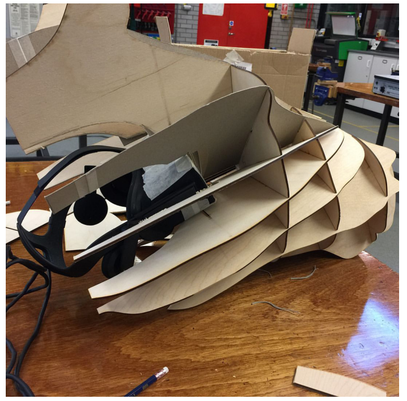
01/09/17

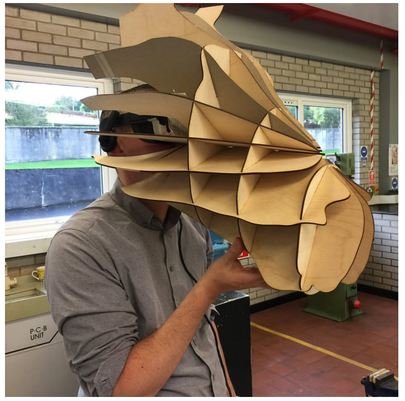
F U NAGEL

I started to build a slotted framework for the headset, piecing together the sections in Adobe Illustrator. This would later become the plywood head. I laser cut the pieces using the equipment at local high school.

The same week I presented some of my Research locally, and an audience member challenged me with Nagel's phenomenological essay around inter-species understanding. In this same week, I found a 'bat hat' in Ikea. I love the essay, and for a while it was a central narrative in the thesis until I had a working headset which I could sit with and imagine. I realised that the work wasn't about 'simulations' and 'verisimilitude', that there were more important ways to propagate interspecies understandings.







I worked with a friend, Lynda Somerville (@lyttlebirdfly7) whois Head of Design and Technology at a local school. We played with a number of different materials to balance weight, strength and rigidity for the slotted headset, playing with the measurements to try and match the scale of horse/human. It felt important, through testing, that the human head was completely enveloped and obscured by the mask.

11/10/17

Prototyping in the workshop this afternoon with @lyttlebirdfly7 now have a rough sketch to translate back into AutoCAD.

12/04/18

I'm Britney bitch.

Through my work with transmedia and blended reality experiences, I was contacted to give a TEDx talk in a very small town called Ballybofey, on the border between Northern Ireland and the Republic of Ireland. While small, Ballybofey is surrounded by a strong local arts and agricultural community. The theme for the event was 'beyond borders' and I was invited to talk about games like [in]visible belfast which are participatory, playful narratives. I asked if I could present something drawn on my new work, and discuss the borders between human and nonhuman.

The presentation was a little naive compared to my thinking around interspecies kinship at the end of the project, but the platform was useful in that it gathered attention to the work and the project more broadly. This talk unlocked a lot of other opportunities for the project, and connections to other makers.

This picture was taken in the toilets before I went on stage because you aren't allowed to photograph the event - but I love any talk that supplies a head-mounted 'Britney mic'

03/05/18

In a B&B in cork trying to get tomorrow's secret demo working

03/05/18

Red Wine has not improved my ability to write C# code.

I was invited to University College Cork to discuss my project in a symposia on PhD by Creative Practice. The university was expanding their portfolio of courses, and had started to offer PhDs which presented the Research in other forms. They invited a range of guest speakers to discuss their work, and how knowledge is constructed in Media and Cultural Studies. The speakers from the symposia were then invited to present their work as a Journal Article for a special issue of *Alphaville*.

I stripped down the headset, and travelled across Northern Ireland and the Republic by train to present the work. The day before the presentation all of the drivers, plugins and devices needed to be updated, which meant having to recode sections of the experience in my B&B before, and then after, the speaker dinner.

04/05/18

Showcasing Equine Eyes to help promote inter-species empathy and understanding at UCC today.

The presentation in UCC was really well-received, and attendees were able to try a stripped-down version of the work and give feedback. Some of the attendees were longtime friends, and ex-colleagues who had started teaching at Ulster the same month, but then moved institution.

The work and experience were really limited by being tethered to the laptop. Attendees had to sit and discuss the work, what they saw, and how it made them feel. This feedback from experienced academics in Film, Media, Drama and Cultural Studies was really valuable in helping to think through how to deliver the experience to audiences and what to prioritise in the next steps of making.

Exploring the borders between human and non-human animals | Alan Hook | TEDxBallybofey

68 views

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TEDx Talks
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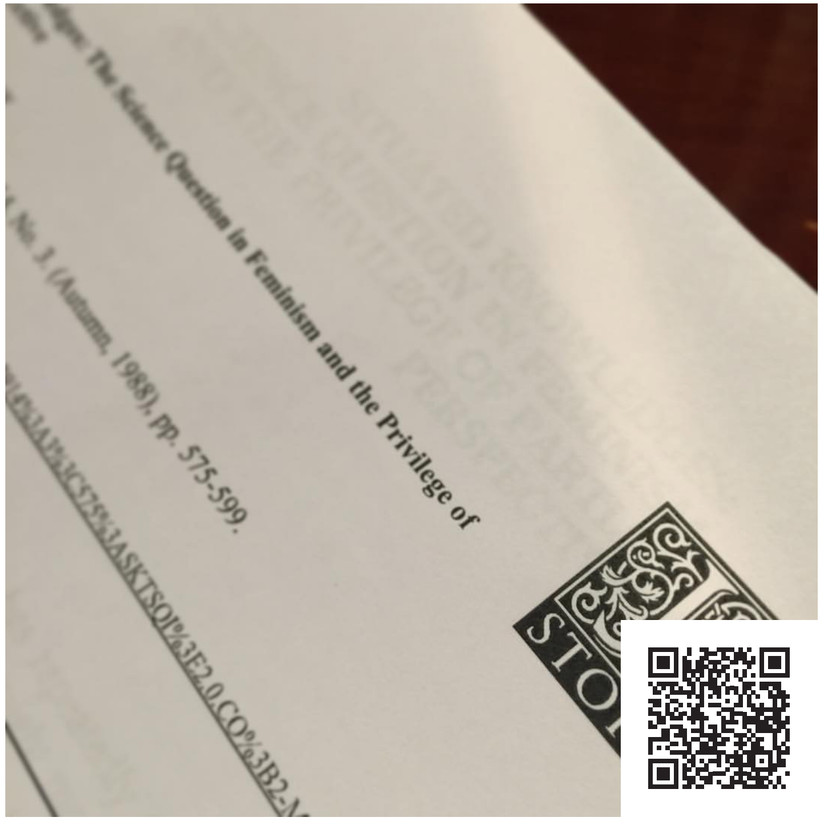
19/08/18

#TEDx talk on inter-species design and designing for non-human animals

The TEDx talk was released, with a follow up article on the TEDx blog. The blog wrote "Practice an act of radical empathy – try to put yourself in the hoofsteps, pawprints and undulations of other creatures and appreciate all the ways of being and doing that exist on this planet." The talk was really good at helping to start a dialogue with other Researchers. I'm not sure I agree with everything I committed to film that day, but it has offered interesting opportunities for collaboration and drew the attention of academics, filmmakers, and other artists.

28/09/18

JSTOR and Chill



After the feedback from Cork, and the TEDx talk, I was keen to showcase the work widely for feedback before I started to make the project more solid. I knew that it would be important to emphasise play in the work, and had worked through some of the limitations that I saw in some of the critical making. I submitted the work to the *Playful Encounters* conference in China. I had discussed the work, and gathered feedback from lots of different scholarly communities, but I wanted the opportunity to present to academics that specifically worked with play, to help develop out the ideas.

While in China I started to read a wider range of Haraway's work and started to track back some of the network of ideas. I had read Cyborg Manifesto as part of my Masters, and incorporated it into my Undergraduate teaching, but this night I sat in an odd sushi restaurant in China and read Haraway's work on Situated Knowledge.

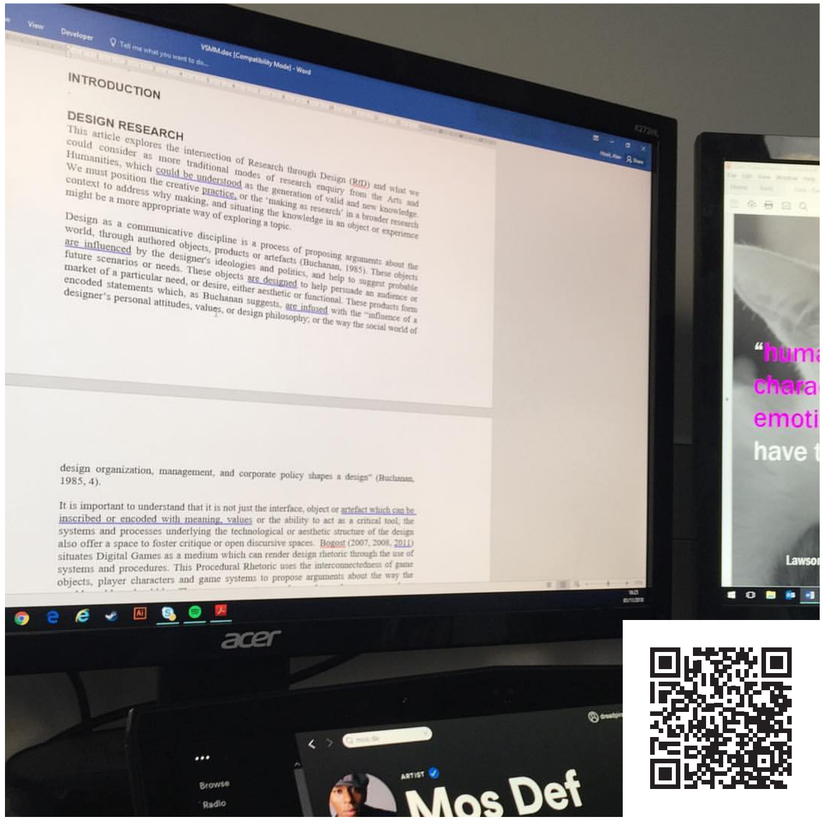
The work felt really rich with ideas, and helped to weave together some of my understanding for the project. This paper for me was a milestone in starting to think about the way that knowledge is crafted and shaped.

29/09/18

Today I demoed (a stripped down version of) my research project Equine Eyes that helps simulate horses vision using immersive tech in Ningbo, China.

I presented the Research and a demo at the conference. The work, however, caused issues again. The demo worked but because the prototype was built on the back of commercial hardware and systems, it really struggled in China. The system needed to connect to the network to run, and sections were blocked. It really limited the experience and meant that the work needed to be reconfigured before the demo (again).

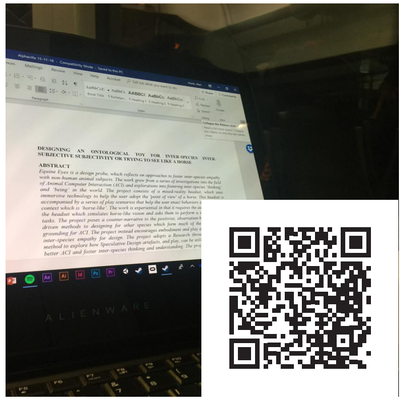
I hadn't realised until I was already presenting, but Hana Wirman, a very prominent Games and Play scholar, well-known and published in the ACI community, attended the talk and demo. It was really interesting to chat through the project with her and get feedback on the methods she used for working with other animals.



01/11/18

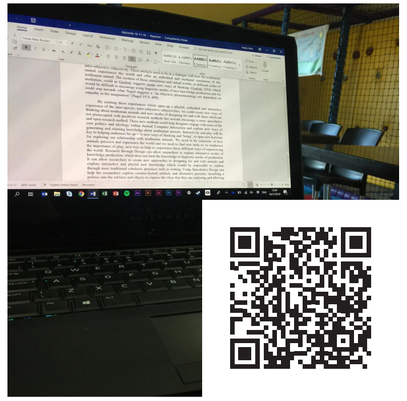
Today I wrote ~1000 words on Research through Design. Almost got an article finished that I've been trying to write for about 6 months.

I turned to writing again to piece together my ideas about critical making, craft, and the limitations of language. The submitted drafts of the paper were very different to the end publication because of the site of publication. It was moulded out of some of the previous work I presented, with Julian Stadon, at the VSMM conference, entitled *Oblique Strategies for Mixed Reality Art* (VSMM2017 International Society on Virtual Systems and MultiMedia).



15/11/18

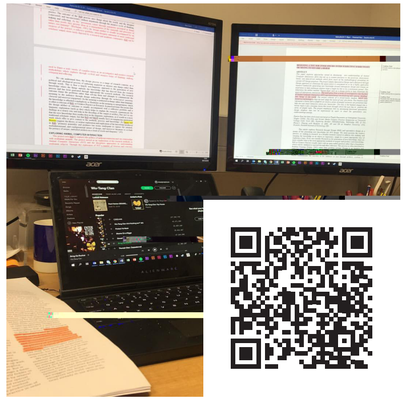
At the moment, I'm always writing.



18/11/18

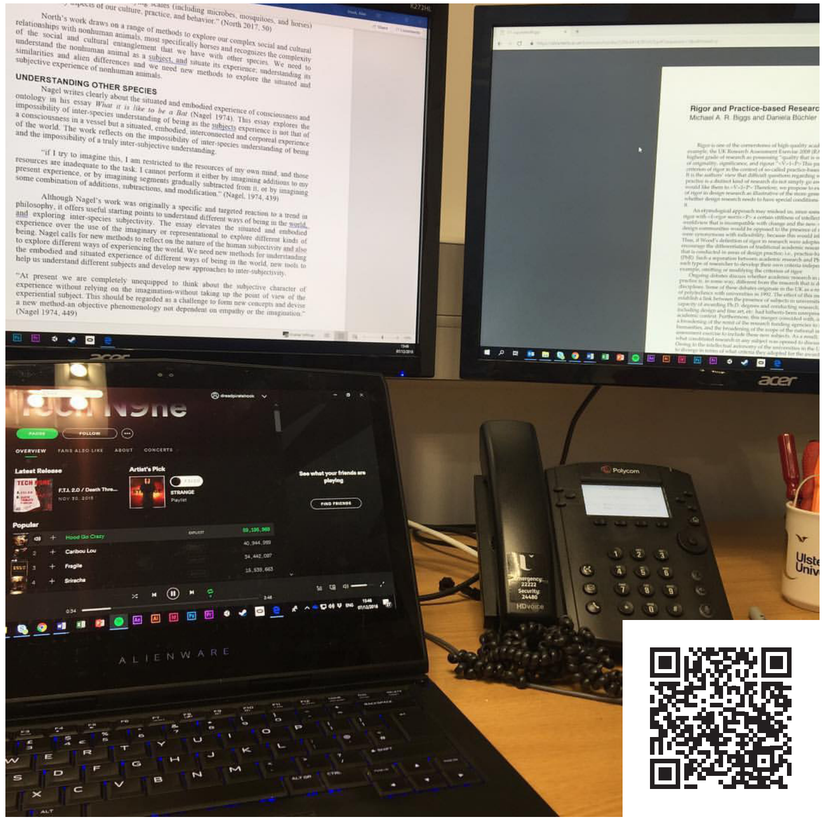
Sunday soft play writing. Getting close now.

For a while, I put down the cycles of making, and focused on writing as a way to knot and unknot my ideas for the work. Sometimes I wrote in my office, but sometime I wrote while my kids played in the soft play on a Sunday morning – drinking cups of coffee.



06/12/18

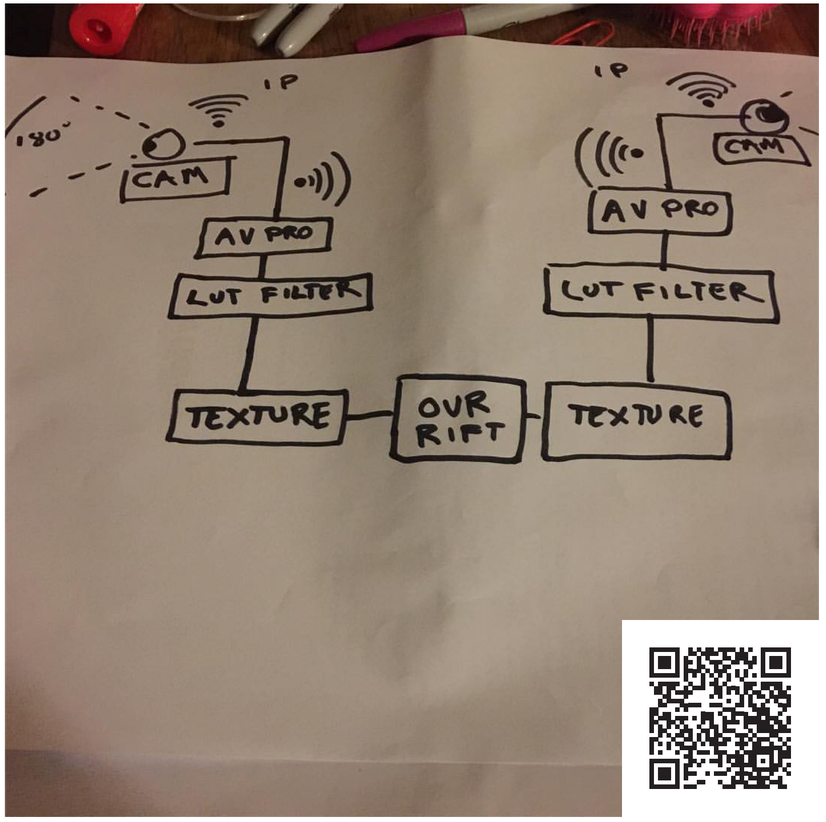
Bringing Da Ruckus in a substantial redraft of my latest writing



07/12/18

Redrafting, and trying to cut words, but more and more words are needed...

Working and reworking the writing has been really important to the thesis and the practice. I think that its essential to articulate the work academically – however resistant I am to the way that systems of power discipline knowledge – but it never been something I've found easy or enjoyable. It might be my dyslexia, it might be that I prefer making, it might be a resistance to the primacy of language to knowledge, it might be because I'm not great at it, but it's important to thinking and rhetoric.

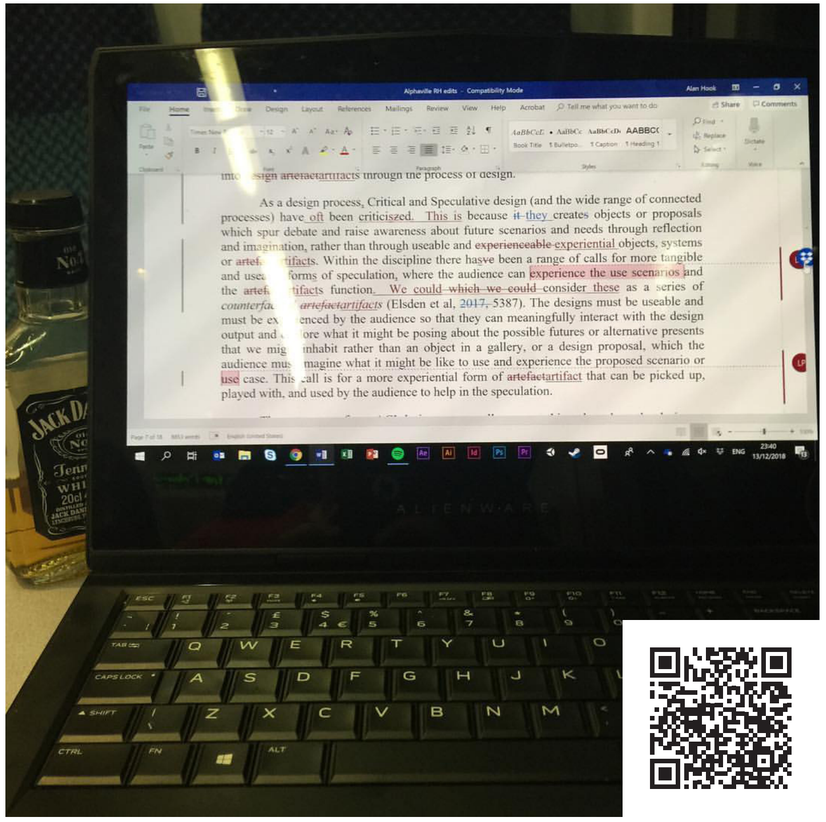


08/12/18

Drinking wine, figuring out a new project.

After writing and working the ideas, after chatting through and showcasing the project in China, I needed to find ways to restructure the work. This diagram was an attempt to map what a wireless version of the headset might be. The idea was to mount two IP cameras in a headset and send the images over the network to the textures in Unity, and then wirelessly back to the Rift using one of the prototype hacked wireless Rift headsets.

This was the start of thinking about how the headset could be redesigned to make it more playful and interactive. Less restrictive, where the audience could move about.



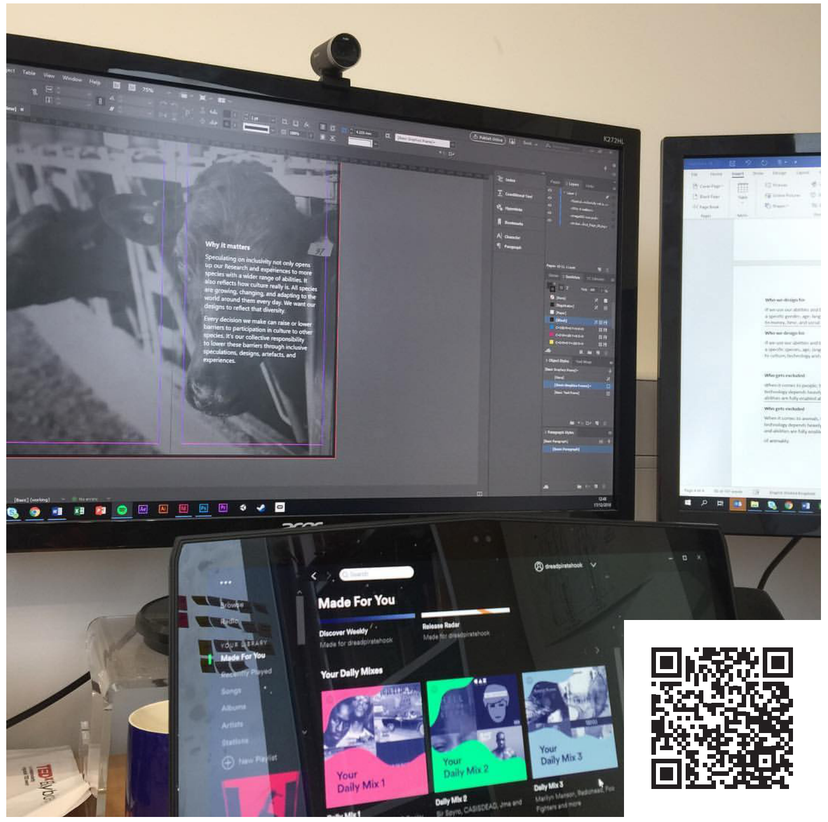
13/12/18

Drinking and Writing, and Writing and Drinking. Almost finished the final edits thanks to my fantastic wife and copy editor @rachyconks

This paper was the final draft of the article in *Alphaville*. The article needed so many rewrites because the editors wanted the writing to fit into the canon of Media and Cultural Studies – they were really keen to publish the research but wanted the writing to have a particular tone, style and language.

The writing was published as Hook, A. (2019). Exploring Speculative Methods: Building Artifacts To Explore 'Interspecies Intersubjective Subjectivity' . *Alphaville: Journal of Film and Screen Media*, 17, 146-164. https://doi.org/10.33178/alpha.17.09

Some of this writing finds its way into the thesis, redrafted, reworked and reconstituted.

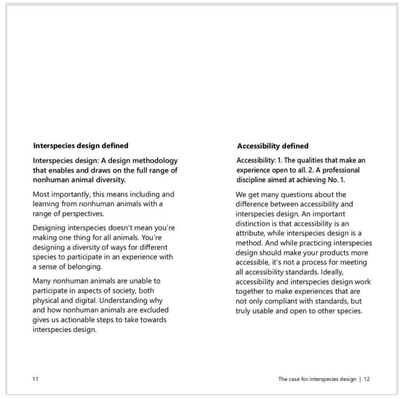


17/12/18

WTAF!!! More research!

I wanted to explore other types of making. The project as a whole had come under heavy criticism for being technology-led, and there had emerged an academic narrative that VR was an 'empathy machine'. I wanted to play around with other ways that we use reflection and action to structure and restructure our thinking. I started a mini-project which was a spoof of the Microsoft Inclusive Design toolkit. I used the bank of interspecies philosophy that I had built through the cataloguing journal articles to rework the design - adopting the original editorial design structures, but reworking the text and logic to explore all of the problematic ways we have philosophized human/animal relations.

The work was inspired by some quotes in the academic literature which tried to legitimise ACI as a field by linking it to working with different, lower levels of cognition. Some early work in ACI seemed to suggest that the usefulness of ACI could be in its work with 'otherness' and that it could offer useful outcomes for the Inclusive Design movements. For me, there was a really problematic politic in this, as it overlooked the long cultural history of marginalising people with a disability, and other marginalised communities, by comparing them with Animals. I understand the sentiment, but the approach seems tactless at best, and ableist at worse. I think, though, that there are areas in the Sciences, and HCI, where these narratives can grow when the Researchers focus on the solutions and usefulness of applying Research which they see as objective and not culturally entangled.



Interspecies design defined

Interspecies design: A design methodology that enables and draws on the full range of nonhuman animal diversity.

Most importantly, this means including and learning from nonhuman animals with a range of perspectives.

Designing interspecies doesn't mean you're making one thing for all animals. You're designing a diversity of ways for different species to participate in an experience with a sense of belonging.

Many nonhuman animals are unable to participate in aspects of society, both physical and digital. Understanding why and how nonhuman animals are excluded gives us actionable steps to take towards interspecies design.

Accessibility defined

Accessibility: 1. The qualities that make an experience open to all. 2. A professional discipline aimed at achieving No. 1.

We get many questions about the difference between accessibility and interspecies design. An important distinction is that accessibility is an attribute, while interspecies design is a method. And while practicing interspecies design should make your products more accessible, it's not a process for meeting all accessibility standards. Ideally, accessibility and interspecies design work together to make experiences that are not only compliant with standards, but truly usable and open to other species.

11 The case for interspecies design | 12

The principles of interspecies design

Recognize exclusion
Learn from other species
Work with one, speculate for many

The principles of interspecies design | 14

1

Recognize exclusion

Exclusion happens when we solve problems using our anthropocentric biases

Almost from the moment that Interactions first published Clara Manini's *Animal-Computer Interaction (ACI): a manifesto* (2011), we've evolved our understanding of designing for and with other species. Further work called for Speculative Design to reflect on the interactions between nonhuman animals and society. Today when we talk about designing for and with other species we draw on a range of research methods to design for other species and explore our anthropocentric biases. We explore mismatches between nonhuman animals and their technological environments, domestic situations, and culture as a whole.

Recognize exclusion | 16

17/12/18

Spent the day making a satire of the Microsoft Inclusive Design document for a new project on interspecies design, Speculative Design and the politics of inclusion

I still really like this work, and it became other things. There are sections which I'm not sure I would stand over now, but I think that there are interesting elements that I will revisit. Outside this project, I am often asked to develop a 'toolkit' as part of project outcomes. This mini project helped me reflect on what a toolkit does and the way it helps to structure knowledge through a set of 'frameworks for thinking'. The project also produced some other prototypes like a system for designing animal personas which I delivered remotely, during lockdown, to the Royal College of Art. All of the workshop participants were encouraged to bring an animal with which to work with. Some bought pets like cats, dog and jellyfish, others bought species that lived in their houses like spiders. It was a fascinating process, discussing how we can use imagination to become more attentive to other species.

During this project I posted the layout as I developed it, which means that there are a few posts in a very short period of time which are simular or repeat - this was a symptom of working really quickly pulling together the Research and laying it out in InDesign. The activity cards do not feature in the posts, but are available online alongside the full toolkit, booklet, and project outlines.

19/12/18

I've been busy on a new project which explores the political and rhetorical similarities and tensions between Inclusive Design and Interspecies Design. It is based on, and critiques, Microsoft's Inclusive Design guidebook and toolkit.

After I posted the project online, it was shared in the Exeter Anthrozoology as Symbiotic Ethics (EASE) Research group. They wrote "EASE's Dr Steve North is quoted by Alan Hook (a Researcher in New Media and Play at the University of Ulster) who is working on a new project "which explores the political and rhetorical similarities and tensions between Inclusive Design and Interspecies Design". It is based on, and critiques, Microsoft's Inclusive Design guidebook and toolkit: https://siddarth.design/inclusive-a-microsoft-design..."

Steve North then shared this on social media "Thanks to, Alan Hook for mentioning my work in your exciting new project, which critiques and extends existing guidelines on inclusive design, by introducing interspecies interactions to the mix". The toolkit didn't become a major part of the thesis, in order that I could focus the narrative and present a line of enquiry through the mess but I still think there was important work and thinking which happened while I crafted it.

05/01/19

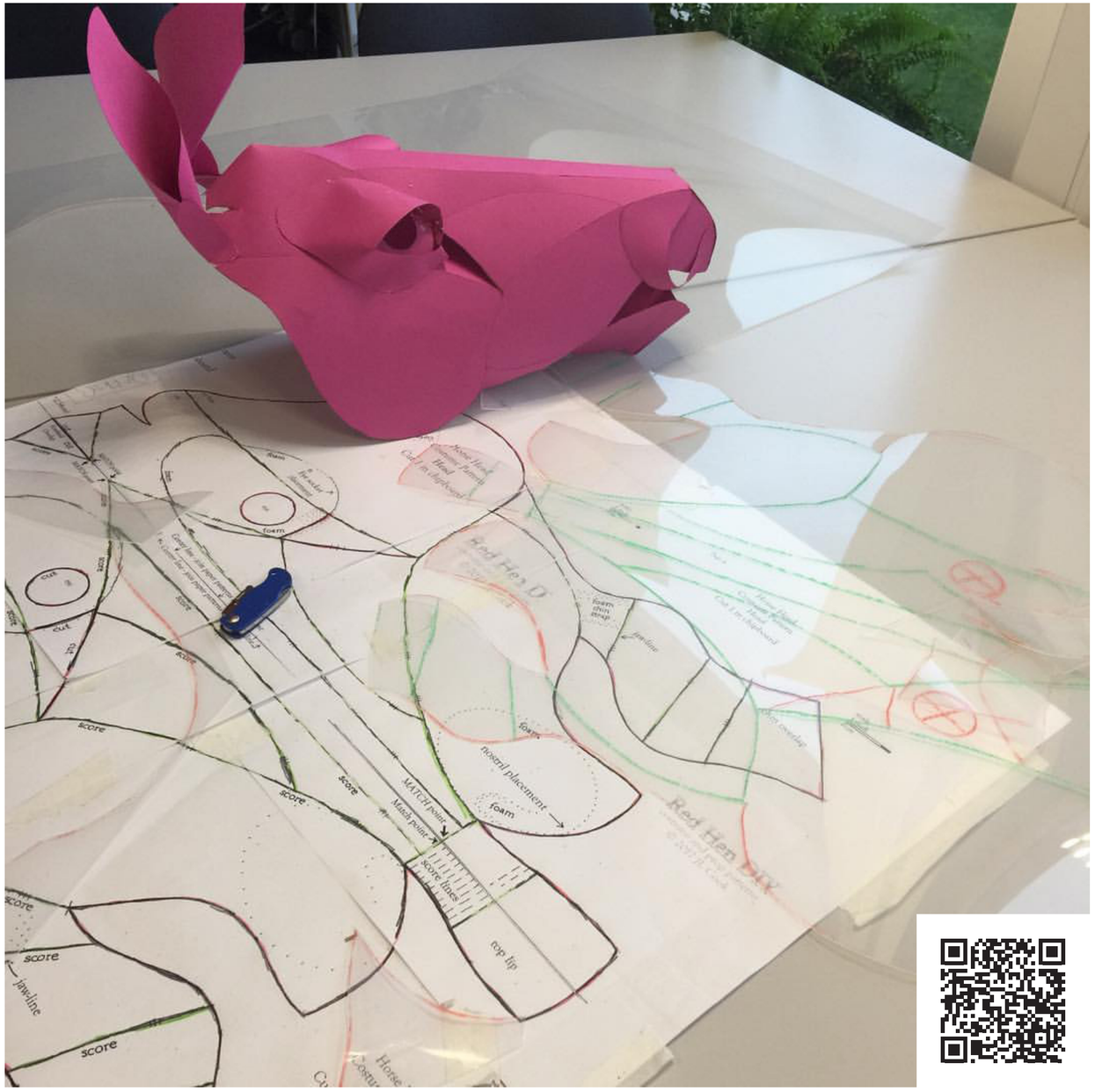
I'm a horse.

I tried and tested a series of solutions for the mask section of the headset, working with a range of materials. This was the first full build of a mask, purchased as a pdf net from a theature costume designer on Etsy. I needed to start to work towards the presentation of the work for the upgrade viva, so needed to make the work more presentable and lock down the art direction. It was really important to consider the shape, colour and form to help hone the rhetoric.

08/01/19

A horse of course.

I played with a number of different approaches, and experimented with different props, forms and outcomes. I was really interested in how humans had 'performed as horse'. This is a facial prosthetic developed for Furries, which I purchased on Etsy.



10/01/19

Producing failed prototypes today as I try and move from card to plastic prototypes.

To create the final prototype for the headset, I used a photocopier to enlarge the pattern so that the width between the two sides of the headset matched the width of the Oculus Rift headset. It took a little trial and error but it helped to scale and modify the Red Hen design so that it could be integrated into the existing structures.

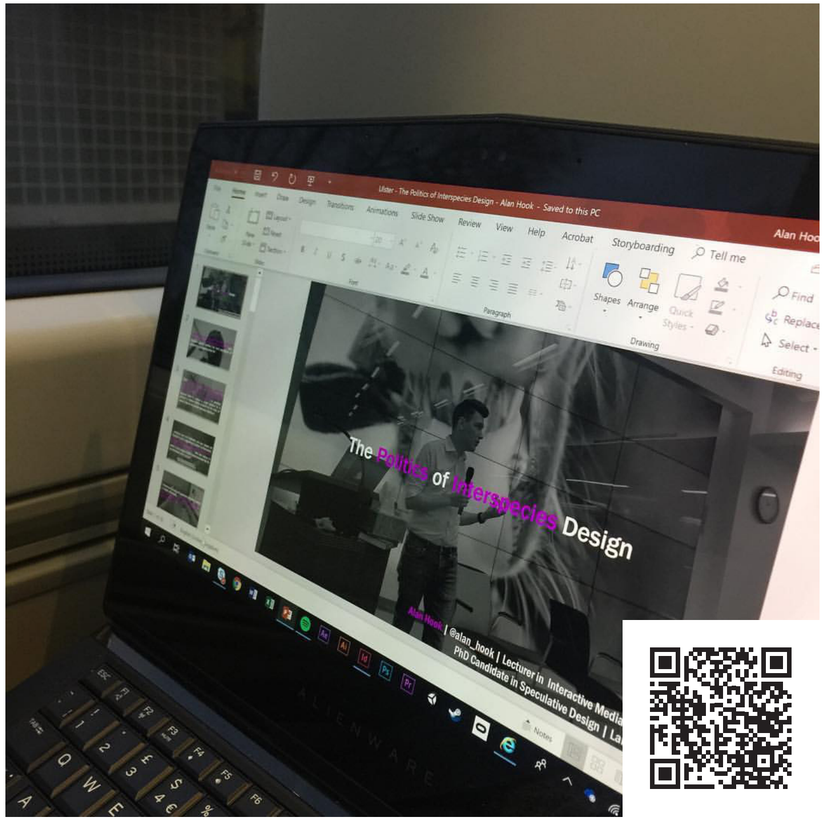
I tested a series of colours, thicknesses and materials with the design: foam, card, plastic to test what it felt like and how it presented the work. I was keen on a transparent headset where you could see the facial expressions of the human inside the work, but the plastic was too fragile compared to coloured versions and often cracked and shattered when it was bent and folded.

All of the prototypes where hand-cut and crafted using this template.

10/01/19

Digital prototyping going better than physical prototyping today

For the presentation of work at viva it was really important to make sure that the work was more stable than it had been in Cork or Ningbo. This meant delving into the underlying code again and starting to rebuild the experience from the ground up with less proprietary dependencies. It felt a little like wasted work sometimes because I knew what the outcome would be; I wasn't changing anything aesthetically, but rebuilding the underlying systems. Still, it was important to make sure that the work was well crafted and stable.

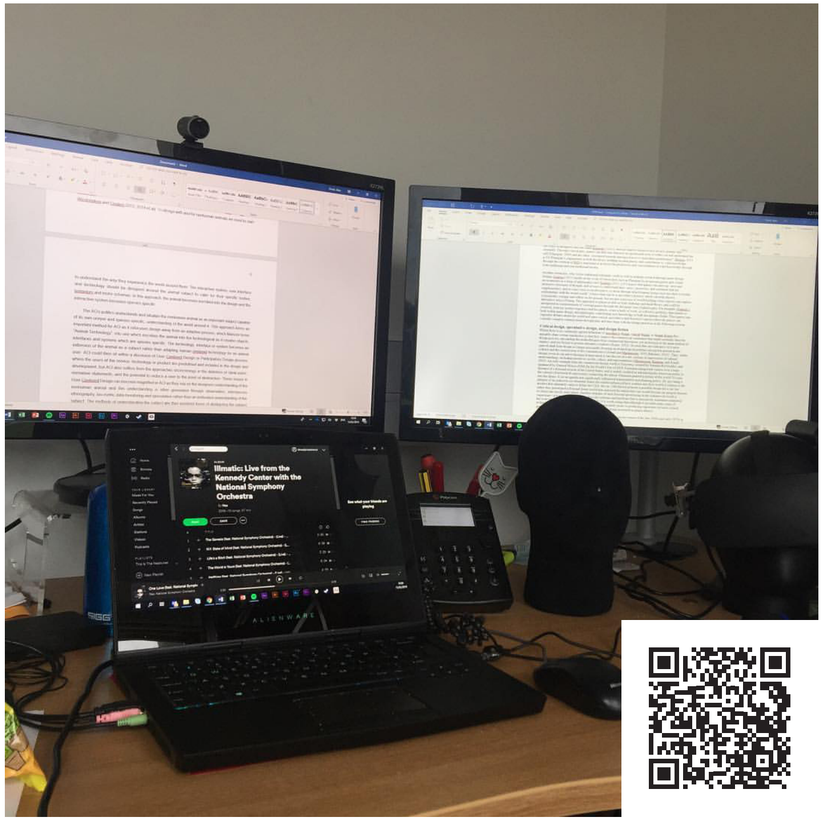


11/01/19

Writing a presentation for this afternoons workshop on the "Politics of Interspecies Design" for the Technology, Culture and Politics. Showcasing some work I finished yesterday.

I was invited to present some of the Research at a symposium on Technology, Politics and Culture at Ulster University. The political theorists who attended the small gathering were thinking about data and positivism in the formation of the city. The presentation to a very different academic audience drew out interesting questions of interspecies participation and informed consent. The questions poked at power dynamics, human exceptionalism, social responsibility, power and dominance - all important topics for ACI which have been explored by the community in different ways.

I think it's essential to present Research outside of your disciplinary constraints to find new angles and see your work through different lenses. It was probably one of the most challenging of instances, to a room of philosophy and cultural studies academics who asked probing and difficult questions about phenomenology, ontology, epistemology... but valuable in helping me test the more complicated arguments I wanted to make which I didn't have the language for in the *Alphaville* article.



15/02/19

I'm writing again! Watch out!!!

I needed to take all of the disparate pieces of writing and ideas and try and craft them into a coherent narrative for assessment at the viva. This required reworking some of the *Alphaville* article, conference talks to find a way of working between HCI and RtD Research.

understand how a nonhuman animal experiences the world and design for these animals, there lies the possibility to investigate a range of interconnected design practices such as Critical Design, Speculative Design, Design Fictions, and Design Probes. These alternative methods could be used to rethink the design process and focus on the design rhetoric in ACI. Through these methods, design can be used as a process of "engendering debates and changing perspectives about important social issues" (Bardzell Bardzell, & Stolterman 2014 1952). For example, we could use a Design Probe as a discursive method to explore the possibility (or impossibility), of an inter-species "inter-subjective subjectivity" (Reinerth, 2010/11)

SPECULATING ON OTHER SPECIES

Critical and Speculative Design use design methods and processes to create critical artifacts and objects, which are often outside of commercial practices and serve an inquisitive, evocative or provocative role (Malpass, 2010). The objects are usually counter to conventions or question usability, profit or taste (Mazé and Redström, 2007) and created as a process or product of critical reflection by the designer. Dunne and Raby suggest that the practice "rejects how things are now as being the only possibility", and that "it provides a critique of the prevailing situation through designs that embody alternative social, cultural, technical, or economic values" (2001, 58). This has been considered alongside Contemporary Art practices as a method which tries to open spaces for reflection, debate and critique and are often displayed in showrooms or galleries (Bradzell, Bardzell and Stolterman 2014). There are a broad range of connected design methods broadly considered as speculative design, critical design, or design fiction which arguably share certain similarities in that they:

remove the commercial constraints that might normally limit the design process, uncoupling the methodologies from commercial discourses; use prototypes as the main method of enquiry; and use fiction to present alternative realities outside of popular cultural attitudes and practices through complex and messy social, cultural and political issues (Auger, 2013). As s indicative of a more general shift from design no longer principally focusing on proble instead to the cultural and the construction of the communicative (Arnall and Martin Balsamo, 2011). Whilst design research can aid technological innovation it can also involv

15/02/19

Words.

I pulled apart my work, and pieced it back together again – removing many of the sections that I had to redraft into the article around Creative Practice. There was lots in the *Alphaville* first draft about RtD and the methods used, which I was required to take out to meet word count, but also in response to feedback from reviewers who wanted the piece to sit within one disciplinary discourse. I think that this really focused me on method and on the way that disciplines and methods shape what we do – which I believe is an important contribution of the thesis.

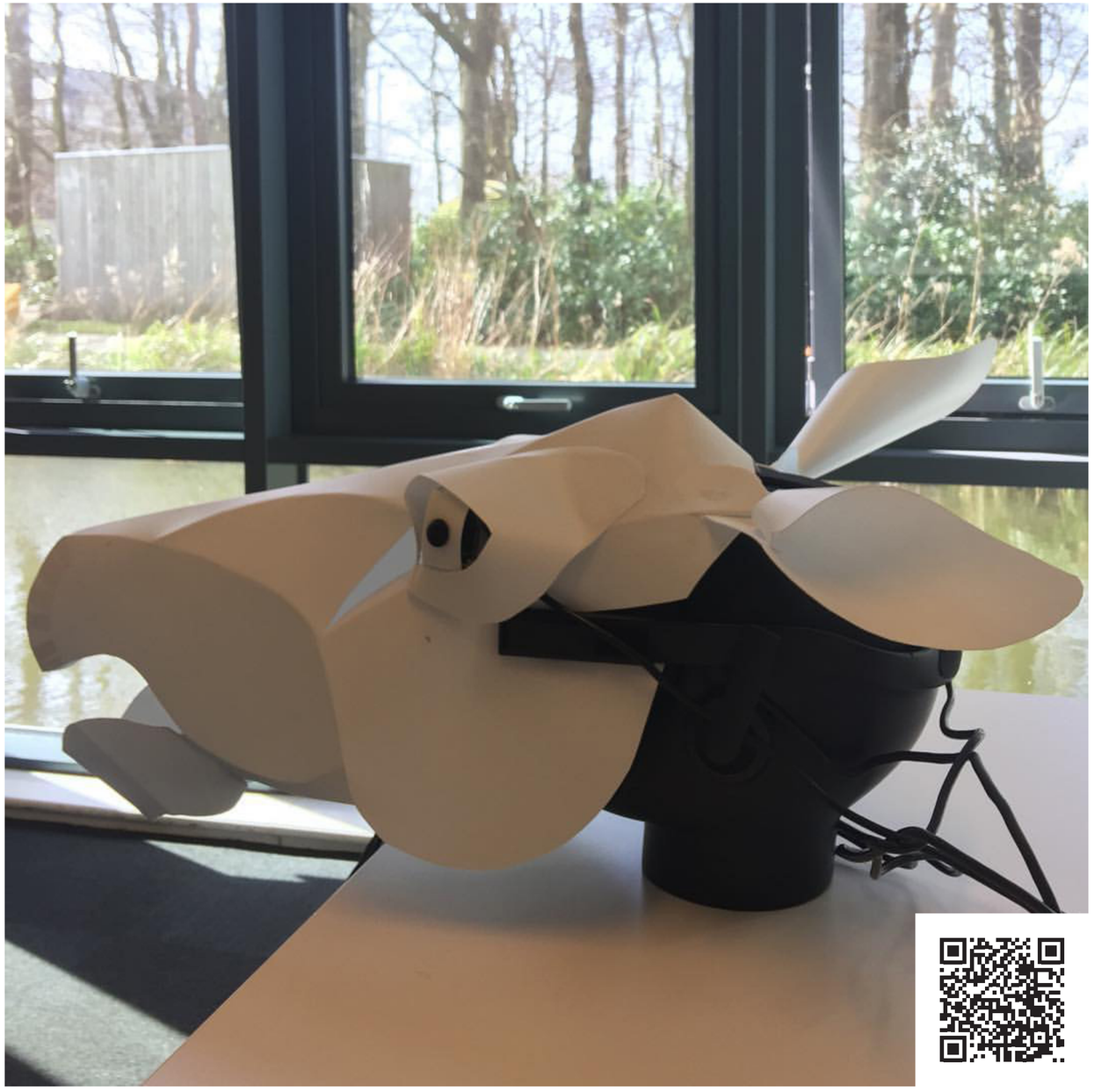
07/03/19

Equine Eyes is a Speculative Design project which explores methods for building Interspecies understanding and empathy. The headset simulates horse vision to propagate an Interspecies inter-subjectivity.

08/03/19

Final user testing today in Coleraine before demo and assessment on Monday

In the preparation for the viva, I did a photoshoot which produced one of the more recognised images of the work. At this stage of the thesis, I was still using terms such as 'inter-subjective' – which I think are problematic to posthumanist discourses and privilege the subjects as distinct. It does not dovetail with Object Orientated Ontology, and does not recognise the assemblages we make.



11/03/19

Equine Eyes PhD appraisal.

I took the work for the viva appraisal at Imagination Lancaster where we were able to test and play with the work. The project was well-received, but there were some challenging questions about how the work sits within Design Research.

One of the aims arising from the viva was to review how the work was playful, or how it could be more playful.

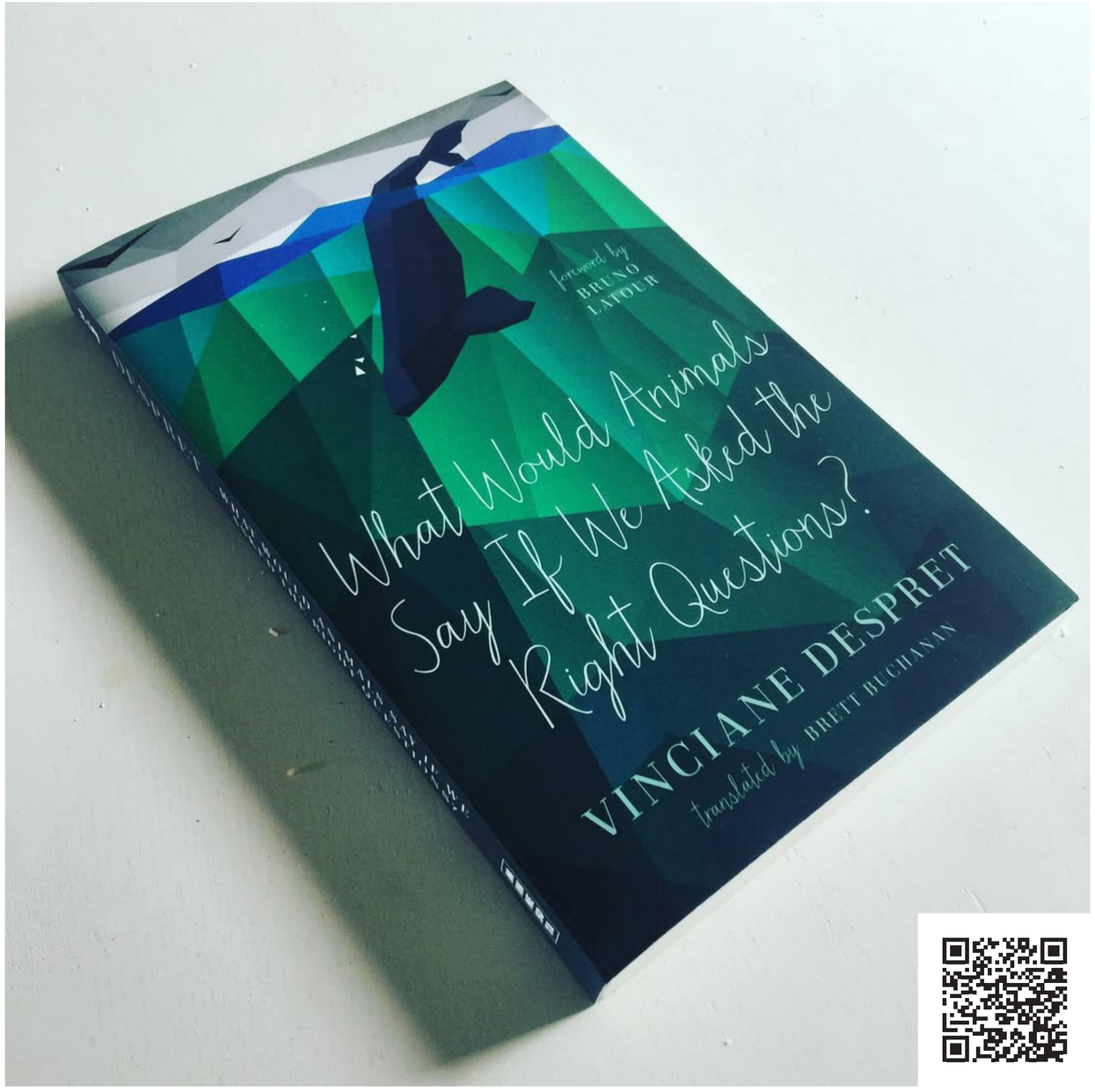
It was a real pleasure to present the work to Serena Pollastri and Professor Paul Rodgers for feedback and discussion.

25/03/19

Demoed some of my PhD work in "Speculative Methods for Interspecies Design" at the Imagine festival today at @UlsterUni #imaginebelfast

I was asked by Ulster University to contribute to a workshop in Virtual Reality and new Research for the Imagine Festival of Social Sciences. The audience was full of psychology Researchers and Social Scientists who were very interested in how the effectiveness was measured and spent the Q&A section planning out for me ways that I could measure the effects of the headset and collect data – the positivists had shown up and renarrativised the work – they wanted to put eye trackers in it, biometric sensors, dohickeys that monitored and surveyed the participants.

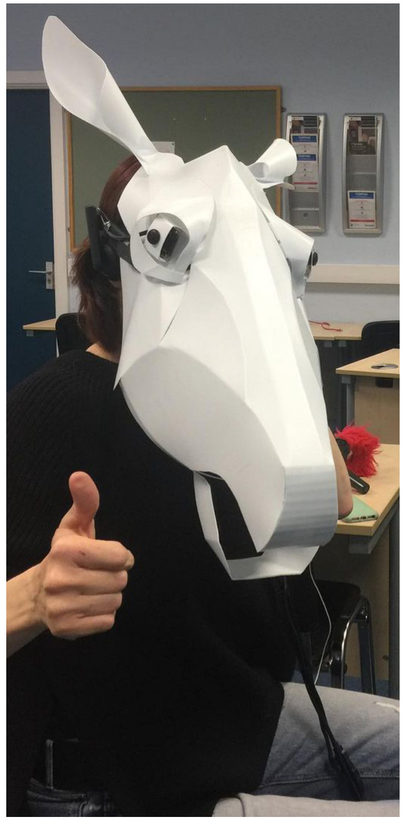
It was all interesting to listen to and discuss and really opened a dialogue between the Humanities and Social Science Researchers (two faculties that had recently merged at the institution) about what constituted valid knowledge.

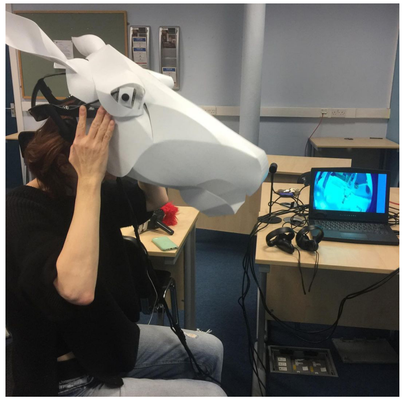


26/07/19

New annual leave book has arrived. Gearing up for a relaxing and brain expanding break.

This book really changed my thinking about human and nonhuman animal relationships. It is a book to which I always return; it explores the complexity of the world in a really thoughtful and probing way.





28/09/19

This afternoon I got to hang out with podcasting legends Collie Ennis and Colette Kinsella from The Critter Shed and chat about my research

I love podcasts, and one of my favourites was the *Critter Shed* from Dublin-based based producers Collie Ennis and Colette Kinsella, which is an educational podcast about insect life. In one episode, Collie said something about how he'd love to experience the world as a frog. I contacted the producers and offered to bring the headset.

I travelled with it to Ireland on the train, and tied the trip to another visit, a chat with a documentary filmmaker. I spent a lot of time prepping the work, laying it out and testing the systems the day before I travelled. When I arrived in Dublin, the project wouldn't boot to the headset. The two podcasters attempted to interview me while I tried to recode the system in a small meeting room in Trinity University. I couldn't get the device working. It was embarrassing and deflating, but the two are so kind, open and inquisitive that it was still a really enjoyable and worthwhile trip.

None of the interview or audio ever made it into the public domain, but it was largely just them asking me what it was like when it worked, while I hacked away at the code in a fluster. In the images, you can see the view which was supposed to export to the headset. This is us imagining what it might be like to experience a headset that helps you imagine...

I was contacted by Brazilian documentarian Flavia Moraes who was travelling to Europe and wanted to interview me about my work, having seen the TEDx talk. The interview is part of the film *Visions in the Dark* which explored nonviolent ways to train horses. The headset still didn't work, but that doesn't matter for the camera.

During the filming I met the lead trainer from the Academy set up by Monty Roberts (the famous horse whisperer). We discussed the headset and the importance of being with horses – that the headset could have practical uses in horse handler training. It was really interesting to chat to someone who spends so much time with horses and cares so much for them.

29/09/19

Today I've been working with the film maker Flavia Moraes from Brazil on a Documentary on Interspecies Empathy and our relationship with nonhuman animals.

21/11/19

Pretty excited about this, and my first work with Raspberry Pi

26/11/19

Trying to learn how to work in a YUV gamut colour space for a project.

After all the failed showcases of the work, I started a complete rebuild using Raspberry Pi as the core technology. I added to and changed the design spec for the project to prioritise being completely wireless, battery operated, and airlocked from the network.
Chatting to horse trainers, they suggested that it might be really important to be able to meet horses where they are, in fields, away from power supplies and networks.

The Stereo Pi is designed for building stereoscopic and immersive cameras for filming 3D footage or creating photospheres. It allows two distinct camera feeds, and I uncovered some tutorials that hackers had made to see yourself in third person which I used as a basis for a rebuild. The colour space in the Pi is different to the RGB which I have used in the past so I needed to complete a lot of desk-based research for design work to understand the YUV colour space.

chromaticity, D65 reference white, and linear RGB data (16 bits per color).

Instead of using a normalized range of 0–1, a range of –0.5 to +7.4999 is supported. Values below 0 and above 1 are what enable scRGB to have a larger gamut, compared to sRGB, even though it has the same primary colors. The correlation between the linear 16-bit scRGB values and normalized range are:

00000 = –0.5
04096 = 0.0 (black)
12288 = 1.0 (white)
16384 = 1.5
65535 = 7.4999

After gamma correction, the correlation between the nonlinear 16-bit scR′G′B′ values and normalized range are:

00000 = –0.7354
04096 = 0.0 (black)
12288 = 1.0 (white)
65535 = 2.3876

scRGB to sRGB Conversion

To convert linear 16-bit scRGB to gamma-corrected 8-bit sRGB (notated as $sR'G'B'_8$):

$sB'_8 = 0$

if $4096 \le (scR_{16}, scG_{16}, scB_{16}) \le 4243$

$sR'_8 = \text{round}[4.500 \times scR \times 255]$

$sG'_8 = \text{round}[4.500 \times scG \times 255]$

$sB'_8 = \text{round}[4.500 \times scB \times 255]$

if $4244 \le (scR_{16}, scG_{16}, scB_{16}) \le 12288$

$sR'_8 = \text{round}[(1.099 \times scR^{0.45} - 0.099) \times$

$sG'_8 = \text{round}[(1.099 \times scG^{0.45} - 0.099) \times$

$sB'_8 = \text{round}[(1.099 \times scB^{0.45} - 0.099) \times$

if $(scR_{16}, scG_{16}, scB_{16}) \ge 12289$

$sR'_8 = 255$

$sG'_8 = 255$

$sB'_8 = 255$

YUV Color Space

The YUV color space is used by the (Phase Alternation Line), NTSC (Na Television System Committee), and SE (Sequentiel Couleur Avec Mémoire or Se tial Color with Memory) composite color standards. The black-and-white system only luma (Y) information; color inforn (U and V) was added in such a way t black-and-white receiver w normal black-and-white pic ers decoded the additional c display a color picture.

29/11/19

Trying to learn me some Raspberry Pis for my project but it's tricky.

I managed to follow the tutorials and get two live camera feeds, with 200 FOV cameras, into the PI and back out into a HDMI 7" screen.

This was that start of the reworking process – post-viva – to redevelop the work. It had become critical to the outcomes of the project that the audience had more freedom of movement and flexibility, and that they were able to play.

02/12/19
Goggle Eyes

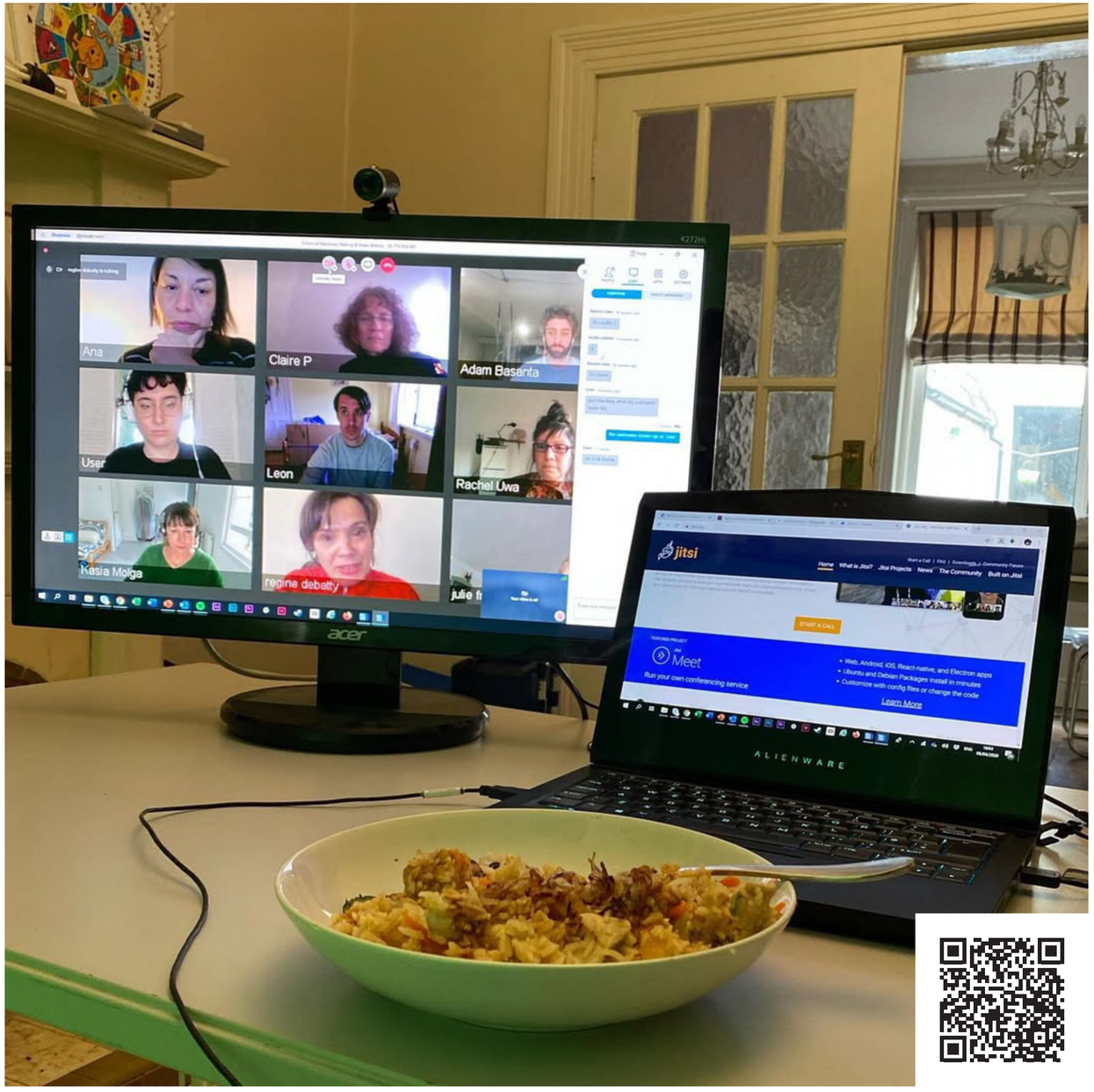
I purchased some headsets which were designed for mobile phones to house the work. This meant that I didn't need to design the strap structure around the head, or the lenses. The headsets need a little modification to run the wires, but offer a really quick solution to build a foundational framework.

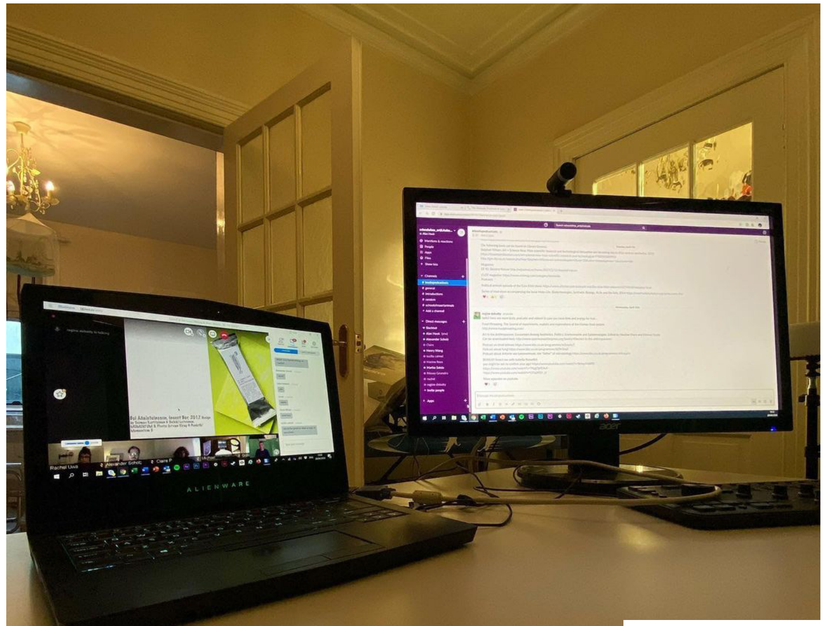
02/12/19

Testing again, I have stereoscopic HD view with 350 degree FoV, wireless and battery powered.

The colour space work was a little more tricky than expected. I worked with the hacker and maker communities online – linked in the thesis prototyping steps – but the code base was unfamiliar and difficult.

I managed to piece together all the sections for testing, and could take in two 220 FOV camera feeds, and then structure them side by side for the HDMI in a format that worked.





06/04/20

Today was the first day of my night school on Art and Animals, and the fantastic rachyconks cooked me a nice dinner to eat.

20/04/20

Doing some learning online.

During the lockdown, work, both in and outside the PhD, was hard. I had taken a management role in the school which meant that there wasn't a lot of time or space for the thesis work. The workload tripled, and I had to balance home schooling. To try and keep a regular appointment with my thinking, I enrolled in an online course run by one of my favourite bloggers, Regine Debatty, who runs WeMakeMoneyNotArt – which has been a big influence on my practice.

The online course met weekly, with lectures from Debatty on the intersections of arts practice and animality, and discussion groups on posthumanist thought. It was lovely, and I think important, to take some time and space in the mess of COVID to stay connected to my thinking, and with a community of makers with similar concerns. I met so many amazing artists and designers working with animals and discussed ethics, craft, feminism, and more gallery-based outcomes.

22/04/20

Instead of writing the paper for you to read, can you just imagine what it says by mushing all these already published books together?

Finding the headspace in the pandemic to write was impossible for me. I just wanted to mush together all of the things I'd read. When im working on a project, I like to visualise the outcomes by putting all the things I'm working between together in a pile. Usually this is a print out of 6-8 existing projects stuck on a wall which means that I can put Post-It notes between then to build a direction and sketch.

Doesn't really work with books though...

23/06/2020

I have been working though rushes from a shoot last year for days. Listening to myself waffle on. I've edited down an interview about my current research project (link in bio)

Moraes sent through a copy of all of the rushes from the interview I did in Dublin and they allowed me to cut from them what I wanted. I cut two stories, one academic and one personal, and shared them online.

Author's personal copy

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journal homepage: www.elsevier.com/locate/jrurstud

Re-capturing bovine life: Robot–cow relationships, freedom and control in dairy farming

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[c] Faculty of Social Sciences, University of Warwick, UK

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ABSTRACT

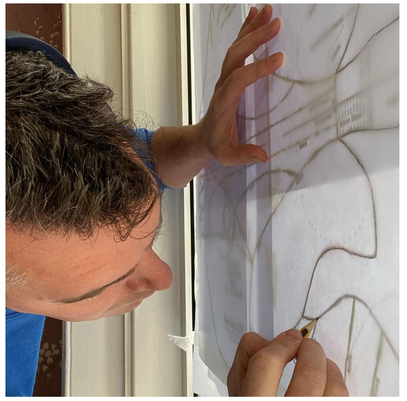
Robotic milking machines are novel technologies that take over the labour of
the need for human–animal interactions. Replacing 'conventional' twice-a-
people with a system that supposedly allows cows the freedom to be milke
they choose, it is claimed that robotic milking has health and welfare benefi
ductivity, and has lifestyle advantages for dairy farmers. Such claims are ce
installation of robotic milkers clearly establishes new forms of relationships be
and dairy farmers.
This paper draws on in-depth interviews with farmers and
relationships between representations of robotic milkers as a
autonomy, and practices and mechanisms which suggest that
important ways through the introduction of this technology.
changes in what it is to 'be bovine' in relation to milking robot
framing of cows' behaviour and 'nature' by dairy farmers an
interaction. Second, we examine how such changes in bov
tions of biopower which focus on knowledge
body and the herd. Such knowle
dairy are integral to
subjecti

08/07/21

"Everyday I'm hustlin"

The robotic milking machines are an often cited example of ACI for animal welfare that has been widely adopted by an industry, an example of scalability. I always found the idea interesting, but couldn't really orientate myself around why. This paper kept surfacing in searches, but because I wasn't working in an agricultural context, I hadn't really read it before. To this day, though, it is one of the most profound pieces of writing about ACI that I have read because it digs deep into the cultural power dynamics and how technology can shift cultural framings.

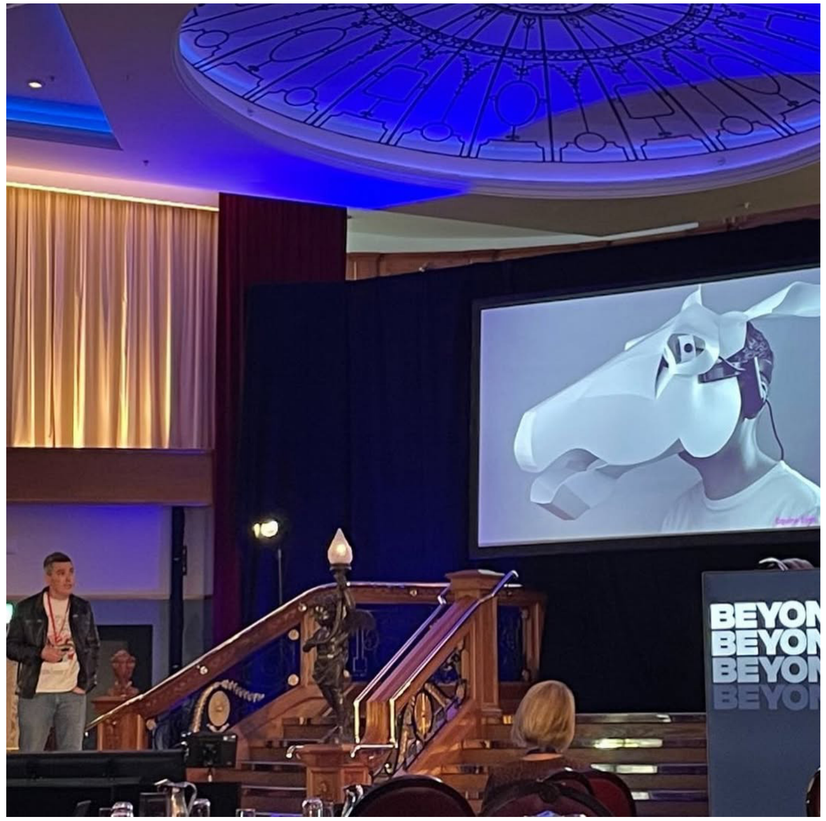
This is one of my favourite pieces of academic writing, and I love that it's in the *Journal of Rural Studies* – a space outside of the canon of ACI research, where it has closer connections with the communities, and inequalities it discusses.



Now that the technology worked, I started to build the housing for the prototype. The wireless prototype used the same pattern and housing as the Oculus version in the prototyping stages. I was happy with the shape and it had gathered media attention, so changing the look at this point wasn't necessary – and there were short production timelines before the conference and exhibition.

15/10/21

It's been great to block out time today to do some "making". New prototype coming next week.



I was invited to present some of the Research at a media and technology innovation conference called Beyond. It was only a 10-minute speaking slot, right at the end of the programme, but there was exhibition and showcase space to test the new wireless headset. COVID restrictions limited the exhibition context and interactions that the audience could have, but it was good to talk through the project with 'industry' and technological evangelists – neither of whom I enjoy discussing my practice with, but the challenge of arguing for wider applications of making, outside profit, is a challenge I do always enjoy – and I got to wear a 'Britney Mic'.

20/10/21

I'm Britney Bitch.

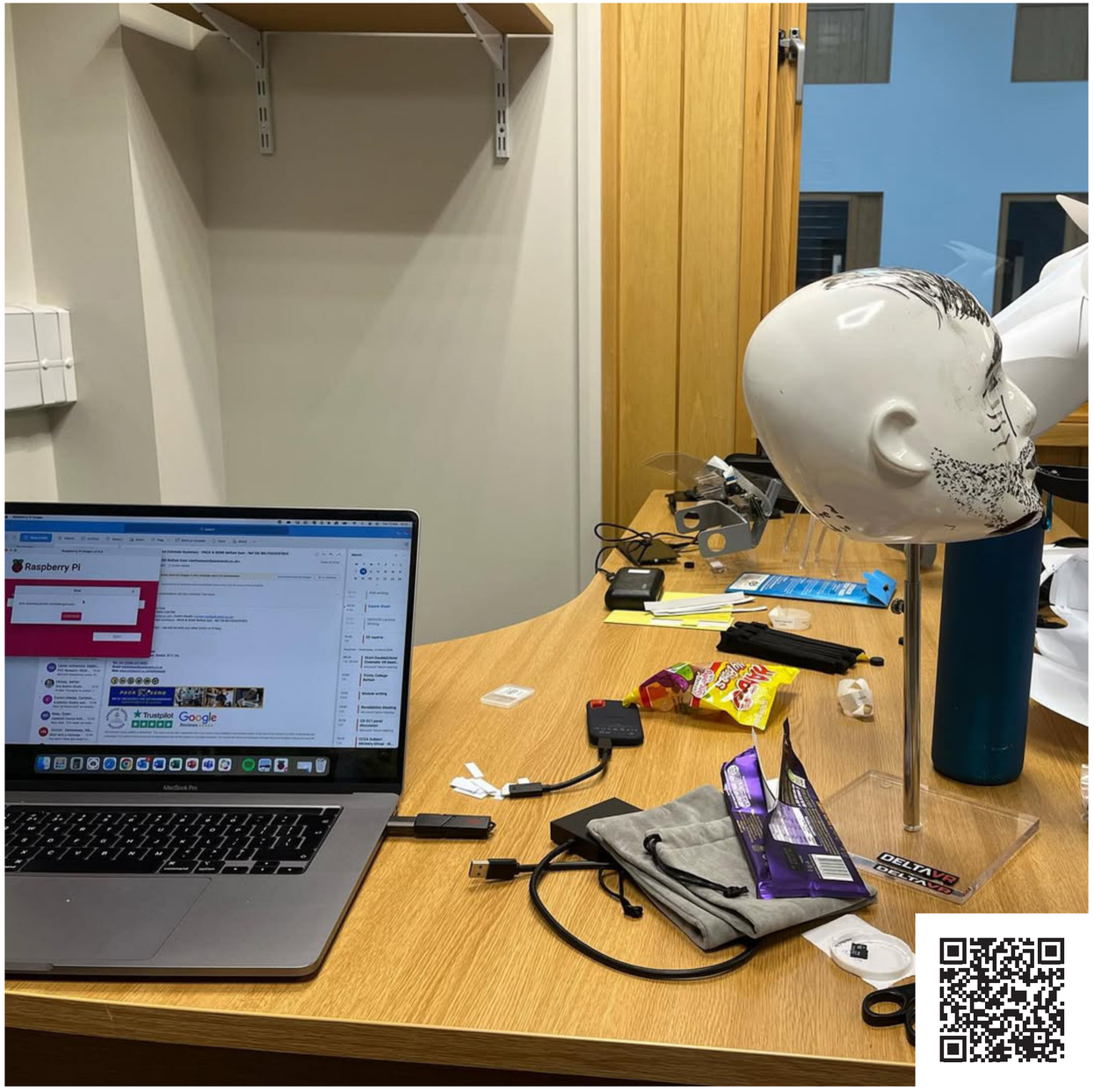
09/02/24

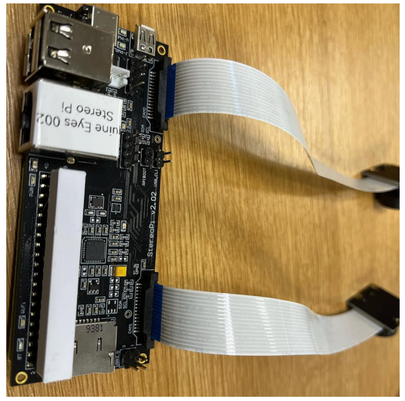
Great morning with @thepropmakerslimited at Poli productions working on fabrication plans for the final Equine Eyes iteration. Showing in the Superpower Design Exhibition In @cidgrandhornu supported by @ahrcpress IAA funding at @ulsteruni

Through the prototyping process I had built a working headset. It took in two live camera feeds from two 220 FOV cameras, into the Raspberry Pi, which stripped out the red in the YUV range, and put this live onto a HDMI screen. The technological reasoning of the design rhetoric had been honed and crafted. The character had shifted to a space I was more comfortable with, one that wasn't linked to proprietary technology, one which had a low carbon footprint, could be released as open source, and could be easily produced.

There was still feedback from users on the emotional engagement. The headset was too unstable, it took a long time and was complicated to boot, it was flimsy and they were worried it would get easily damaged. It was also hand-crafted, so each one had to be hand-cut. This meant that the headset was precious, and delicate, two attributes that don't really encourage play.

I worked with film prop designers Poli Productions on the fabrication of a new shell. They 3D scanned the inside of the prototypes and created a slotted skeletal framework to support the physical shell. They 3D sculpted more delicate sections, and helped in the redesign of the shape to address some of the user feedback.





13/03/24

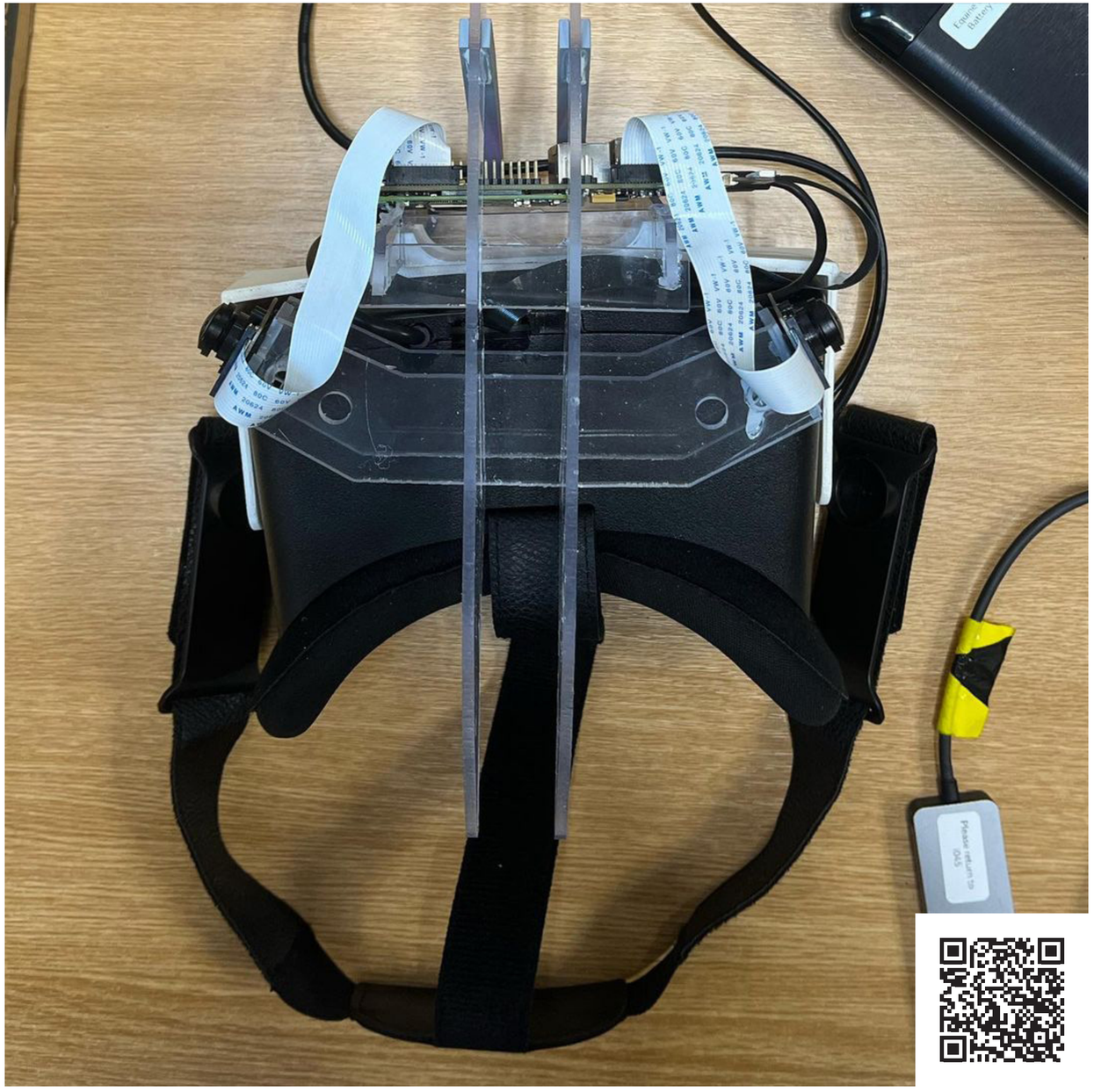
the final form is coming after 7 years of prototyping. I've been collaborating with @thepropmakerslimited and @tyndyll on a new piece. Developed for the Centre for Design Innovation in Belgium @cidgrandhornu. Showing as part of their Super Power Design exhibition (March-August) funded through @ulsteruni @ahrcpress Impact funding. I don't want to share what it finally looks like until the show opens, but I've been working with @vlatko_mitashev (assisted by @oneillscaptures) on some promo shots that I'll share soon.

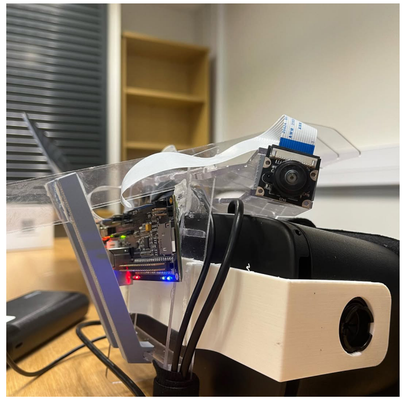
I was invited by Curator Benjamin Stoz to showcase the project in an exhibition of Speculative Design in the Centre for Innovation in Design, in Hornu, Belgium. This meant turning the final prototypes into an exhibitable piece for the Museum. The exhibition allowed me to work out the best display context and how the piece could be used by audiences.

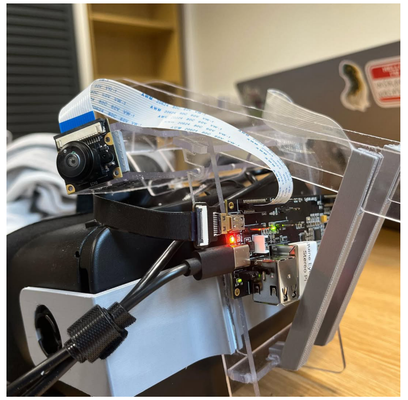
The final stages of design meant that the work needed to boot automatically so that there were no additional set up and install needs. I worked with Simon Hewitt, a software engineer and tinkerer, on the boot sequences and imagining. This meant that the code base for the headset could be openly released in code repositories.

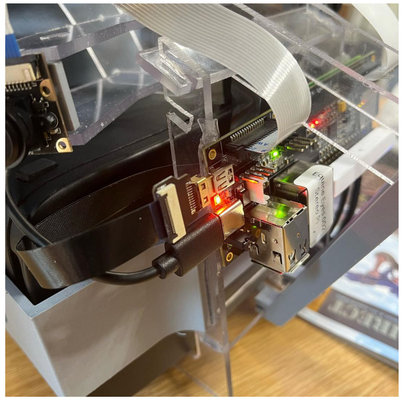
Simon is a huge dog lover, and whenever we work together, he always tries to get me to make a new Canine Eyes project with him. Maybe there's space for this, and it would make me connect differently with my dog Sonny, but I think that the project would lose something because part of the excitement and intrigue for users is the position of the eyes, and the code of stereoscopic vision that horses have.

We built three headsets for the show, so that audiences could wear them together (2) and there was also a spare if one was damaged in the rough and tumble of playing in the museum.









15/03/24

It's been a tough few months, a tougher few weeks, and this morning I thought I was shipping 3 heads that didn't work, but got it rebuilt, working, tested, packed and ready 51 minutes before the van showed up.

It's been 16 years since the paraflows exhibition when I last had to work like this, and it was a lot easier in my 20's. Got it done and shipped. Hope you enjoy the show Belgium see you in a couple of months.

There was a large number of issues with the final build, and deploying the image properly across three headsets. I have never worked quite so hard in my life to pull together the headsets for the show, and made myself sick with stress.

The project was finished and shipped.

I had booked a big family holiday for my wife's 40th birthday, where we went to Florida for two weeks. We flew out the same day as the show opened, so I didn't have an opportunity to do the installs and control the display of the work on the ground, but worked with the museum remotely to help design the display and exhibition context.

21/03/24

Equine Eyes (2024)

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The headset explores approaches to build Interspecies empathy through Speculative Design and play. The project probes how we might form new types of kinships with non-human animals.

I collaborated with @benjamin_stoz, @thepropmakerslimited and @tyndyll on a ground up rebuild so that it is completely wireless, mobile and robust enough for people to wear.

I've been prototyping this project on and off for about 7 years and the final piece will be shown this week in the Centre for Design Innovation in Belgium. The work will be on show (and wearable) as part of their SUPERPOWER DESIGN.

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Photography by @vlatko_mitashev, assisted by @oneillscaptures.

27/03/24

Equine Eyes (2024) on show at the @cidgrandhornu in Belgium - lovely to see visitors playing with the work.

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Photos by @jasnarok

While I took some much needed rest and family time in the sun, the show opened in Belgium. Other designers from the show messaged photos and video of the opening and audiences trying the work. It was really moving to watch and see public audiences experience the work in the way I intended.

I was very emotional when I saw the work being used.

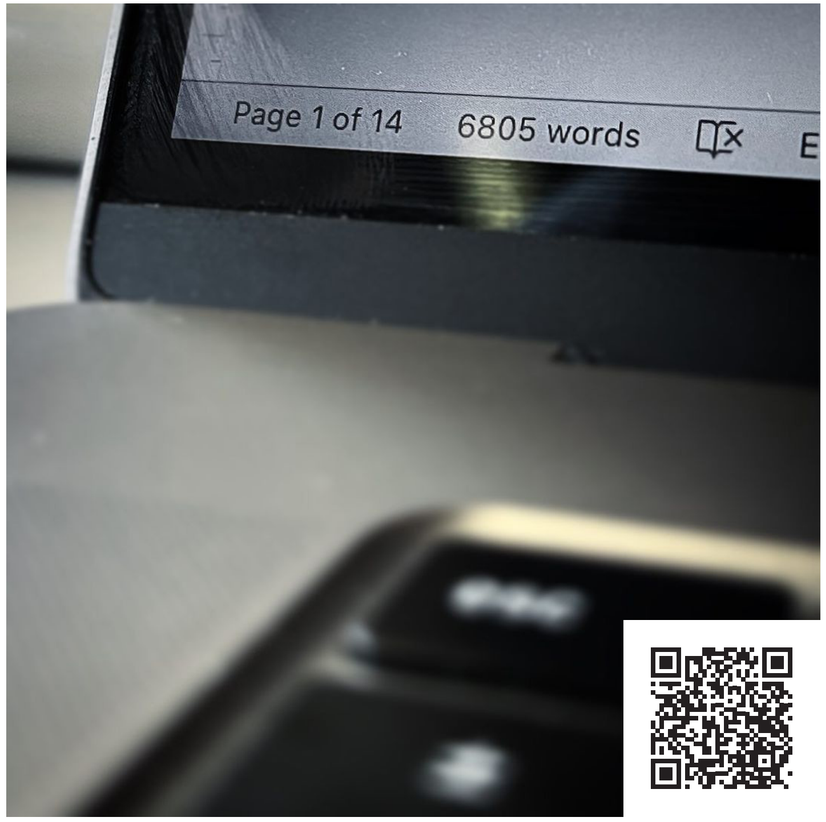
The Equine Eyes project was the last piece in the show, and visitors moved through a history of human body augmentation, looking at designs in cabinets and on plinths. At the end of the show were two rooms of Speculative Design artifacts, all presented on plinths with short explainer videos.

The last piece in the curatorial path was an open space, and the museum had hired a facilitator who helps audiences put on the headsets, chats to them about the project, and then facilitates a playful experience in the space for the audiences. They ask the users to walk around, navigate towards them, try and walk towards each other. The experience isn't time bound, and audiences can spend as little or as long as they like in the headset playing with the work, discussing it with staff and each other.

In June, I started the final sections of the PhD, writing up the final sections of the methodology. The thesis has undergone several complete overhauls and cycles of feedback since then, but all of the pieces were in place for the final write-up.

25/06/24

I've used the first two days of Annual Leave to try and get a good block of writing done on my PhD. It's not complicated writing, and there's no way I could manage 3,000 words in two days if it were, but making good progress! I'll swing back in mid-July to get this tidied up.



In July, I was invited out to the museum to discuss the work, capture the display contexts, and run some demos and a workshop for visitors. I travelled slowly from the north coast of Northern Ireland, down to Belfast, to Amsterdam, and then across Europe by train. This afforded me lots of writing time to catalogue the stages of prototyping and move work from the public research journal into a shape that could work for submission and assessment.

04/07/24

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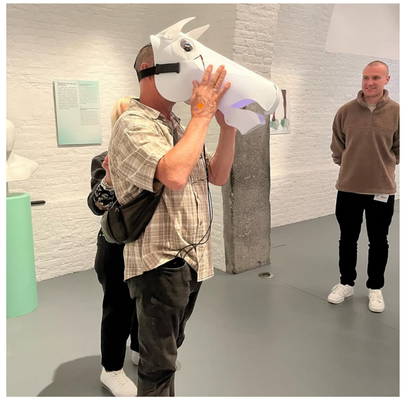
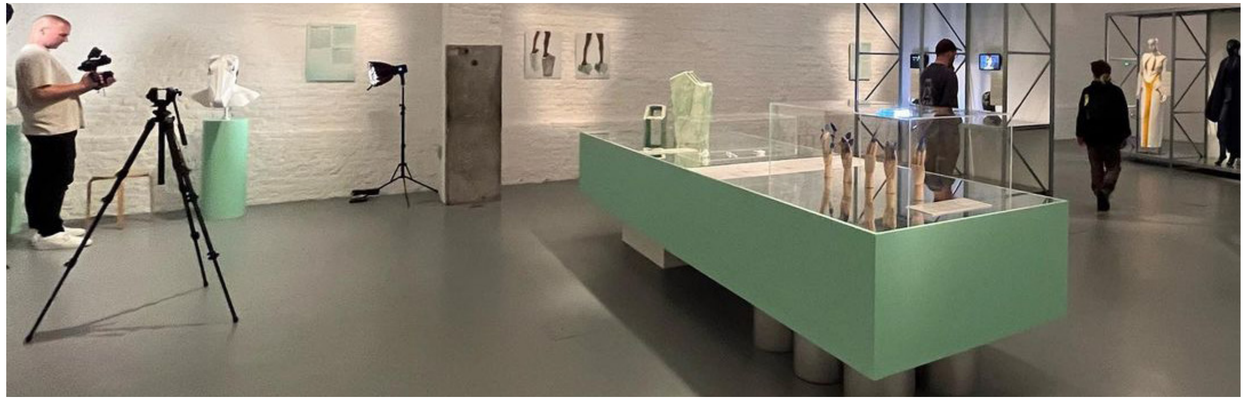
It's cheating, because they're "easy words" but I'll take 'em.





05/07/24

Very emotional, and feel privileged, to see the public be able to try the Equine Eyes project for the first time in the @cidgrandhornu in Hornu, Belgium.

Here with @motivepeak documenting the work and the show for @ulsteruni Impact Accelerator Account from the @ahrcpress.

07/07/24

Today I demoed work for the public at a classical concert in @cidgrandhornu to capture audience responses. I think we also caught a user proclaiming "ooh la la" when they put it on.

Imagining Otherwise.

A Pictorial presentation of the project *Equine Eyes*.

The headset is an ontological tool, or, to emphasise its playfulness, an ontological toy, for imagining with. It explores how Designing and making can promote new forms of kinship, and new types of knowledge. By better understanding the horse, we can reimagine it, and our relationship to it. As a piece of Academic Carpentry, it applies Design Rhetoric to craft an experience for helping audiences become more attentive to other species, specifically horses; but in so doing, they learn to become with other species – and the world – in new ways.

By applying philosophies from Object Orientated Ontology to the making process, to build experiences which nudge towards the flatness it strives for, the project tries to craft philosophy. The project as a whole employs Feminist methods to question the ways in which we discipline and situate knowledge; what ways we construct our knowledge(s) of other species and the world. The annotated portfolio platforms situated, subjective, positioned and crafted knowledge through Research through Design as a way to trouble discipline, the way we know the world, and our relationship with other species.

The project is Designed to explore different ways of thinking, doing and being with the world. It applies tactics from Feminist Design to build a playful, immersive, ontological experiment which promotes post-humanist discourses of thinking, and rethinking other species. The device uses the ambiguous spaces opened by play to experiment with different ways of thinking, knowing and being with horses, and the wider world. The work resists positivist rational ways of knowing other species, and champions plurality, positionality, provisionality, complexity, resistance, liberation, social justice, wellbeing, equality, entanglement, and inclusion to craft a Speculative Design that is open and greedy at the edges.

Two 220° field of view cameras are angled to create a 350° view for the wearer, with an overlap cone of stereoscopic sight at the front of the headset.

The live camera feeds are passed to a Raspberry Pi computer which removes the red chroma hue from the video image to create a feed which contains blue, green and yellow hues. The Raspberry Pi combines these to images into one video feed renderiong them side-by-side.

The processed video feed is displayed on a 16:9 LED display. The wearer views the live video feed through a set of domed lenses inside the headset to create an immersive experience.

The headset is uses a thin plastic, secured to an internal skeletal frame which balances durability and weight to allow the user to feel comfortable and free to move and play.

The headset is battery powered and fully portable, offering the wearer complete freedom of movement while wearing the headset.

Imagining Otherwise.

A video presentation of the project *Equine Eyes* [link]