Editorial: Designing for Transitions

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> *"Transition Design acknowledges that we are living in 'transitional times'. It takes as its central premise the need for societal transitions to more sustainable futures and argues that design has a key role to play in these transitions. It applies an understanding of the interconnectedness of social, economic, political and natural systems to address problems at all levels of spatiotemporal scale in ways that improve quality of life. Transition Design advocates the reconception of entire lifestyles, with the aim of making them more place-based, convivial and participatory and harmonizing them with the natural environment" (Irwin et al 2015).*

The *Designing for Transitions* track at DRS 2018 encompasses emerging approaches to design research at the intersection of sustainable design and sociotechnical systems theory. Exemplary are the growing international research communities explicitly centred around Transition Design (e.g. Irwin *et al* 2015) and Systemic Design (e.g. Sevaldson 2017), aiming to strengthen the role of design in the context of societal challenges. Whether considered in terms of everyday social practices, at a community scale or at the level of global challenges, a framing around designing for transitions brings together considerations of temporality, futures, different types of literacies, participation, social innovation, human needs, and interconnectedness; designing for transitions involves designing how transitions are conceived, enacted, governed and managed.

Our aim at DRS is for the track to build bridges between scholars and designers who work on transition in design, whether their work is explicitly framed in terms of transitions, or whether they encompass expertise and framings which take a broader view of design for social sustainability. The selection of ten full papers on designing for transitions from the 33 submissions to the track provide a window onto a range of diverse current work from researchers with different disciplinary specialities, from social innovation to futures to energy use practices—but all also strongly congruent with the wider theme of DRS 2018, 'Catalyst'.

The first session clusters five papers that explore 'Future Visioning and Worldviews in Transition' – recognising the importance of exploring narratives, mindsets, and visions of different possibilities and alternatives in considering designing for transitions. In the first paper (Hesselgren et al 2018), authors Mia Hesselgren, Elina Eriksson, Josefin Wangel and Loove Broms look at future images of energy transitions with newly designed tools to initiate dialogues and reflections for the future. The second paper is a theoretical reflection on the myths of modernity by Renata M. Leitão. The paper

(Leitão 2018) considers myths that are hindering the transformation of our ways of thinking and conditions that will enable new epistemologies to emerge. The third paper (Srivastava and Culén 2018) investigates pathways for decreased consumption amongst millennials. Authors Swati Srivastava and Alma Leora Culén describe Zygo, a future service based on the second-hand marketplace. The fourth paper entitled 'A Vocabulary for Visions in Designing for Transitions' by Dan Lockton and Stuart Candy considers a set of concepts relating particularly to vision in designing for transitions by building on perspectives and projects from other fields (Lockton and Candy 2018). The final paper in this first session is by Jonas Fritsch, 'Affective Interaction Design at the End of the World'. This paper (Fritsch 2018) proposes a rethinking of affect in HCI and interaction design based on recent theoretical advances in cultural and critical theory, especially affective attachments on a macro-level.

Our second session stresses 'The Practice of Transition Design', through both papers reporting on practical cases, and more theoretical contributions to the analysis of practice in transition contexts. Terry Irwin kicks off, outlining an emerging Transition Design approach for addressing 'wicked' problems (such as climate change, loss of biodiversity, crime, poverty, and pollution) and catalysing societal transitions toward more sustainable and desirable futures, including describing how Transition Design is being tested on a community-based project (Irwin 2018). Next, Stacie Rohrbach and Molly Wright Steenson examine teaching and learning in Transition Design, creating a theoretical basis that informs the practice of transition design, outlines methods and tools and proposes opportunities for development (Rohrbach and Steenson 2018). İdil Gaziulusoy and Elif Erdoğan Öztekin's paper 'Design as a Catalyst for Sustainability Transitions' contributes a literature review on theories of sustainability transitions and design, also linking very clearly to DRS 2018's overall theme of examining design as a catalyst for change (Gaziulusoy and Erdoğan Öztekin 2018). The fourth paper, entitled 'Catalysing pathway creation for transition governance' by Sampsa Hyysalo, Sofi Perikangas, Tatu Marttila, and Karoliina Auvinen, reviews transition management for catalysing vision building, experimentation and pathway construction for sustainability transitions in a Finnish energy context (Hyysalo et al 2018). Our final presenters, Niti Bhan and Rinku Gajera, examine users in an informal trade ecosystems and the creation of a 'value web' or the value creator's entire value web, as a basis for systemic design interventions (Bhan and Gajera 2018).

While the authors presented visions and practices that demonstrate the critical role of design in the context of societal challenges, they generally stayed on the safe and perhaps 'conventional' side. There is not much explicitly *political* in these papers. What do we *not* see represented here? From our perspective as track chairs—drawing on our own research areas as well as others'— we stress the need for an increasing focus on power, politics and the political economy of design for transitions. Transition Design must engage with politicised issues such as migration, decoloniality, the politics of climate change mitigation (not just adaptation) and other complex and controversial problems. Perhaps the de-politicised nature of these papers (and typically DRS papers in general) reflects the political economy of design research – and those voices who are able to participate in the Design Research Society community? We note the Decolonising Design group's DRS2016 statement: "We strongly believe that design, as a field of study, has systematically failed to address the questions of power that have shaped its own practice" (Ansari et al, 2016). One might argue that design research is insufficiently engaged with the debates in adjacent disciplines and that designers will find it hard create the change to which Transition Design aspires without better theory and practice around the politics of Transition Design. This expanded focus on of attention at the intersection of design, the environment and politics has been developed in some depth in recent work of one of the track chairs (Boehnert 2018) and in Arturo Escobar's recent publications (2015, 2018). Ultimately, Transition Design must engage with the system structures that determine whose interests are served by design.

Transition Design's focus on systemic approaches must be developed in greater depth. With this collection we see little work which really employs systems thinking or cybernetic ideas beyond fairly

basic notions of complexity or simple feedback loops; it seems as though there is a great opportunity here for a deeper systems investigation of transitions in different contexts, including via participatory methods (e.g. Birney et al 2017; Aguirre Ulloa and Paulsen 2017). As the field matures, we will also—hopefully—see more applied case studies of how a Transition Design approach works in practice, complementing the examples we have in this track at present. This might include more attention to the experience of transitions in everyday life—the ways in which the futures of everyday practices might evolve and change, and how design which centres on lived experience can address that (e.g. Scott et al 2011), how changes in agency (mediated by technological change) may trigger changes in social practices (e.g. Kuijer and Giaccardi 2018) and how that might relate to concepts such as commons and commoning (e.g. Onafuwa 2018 ; Morelli et al., 2017) or even situated 'experiments in transition' such as living labs (e.g. Keyson et al 2016) or living 'in prototypes' (e.g. Desjardins and Wakkary 2016).

In keeping with Mulder and Loorbach (2016) a multi-level perspective approach as well as a transition in the design regime itself are needed to bring both the emerging debate and the corresponding practices around 'transition design' forward. Hence, transitions are long-term, complex, and non-linear processes of systemic change, which usually only become visible at societal level over decades. The high level of ambiguity, unstructuredness, and uncertainty, makes it hard to plan and design transitions. The role of design is, however, visible in the various niches, experiments and design interventions indicating their proneness to address societal challenges. Key is how these niches together can shape the contours of the changing design regime. See for example, De Koning and colleagues (2017) who studied emerging city makers to understand how their design capabilities can enable systemic change through a focus on participatory design. These new types of city makers generally bring value to the cities, however, their value could be enriched through more participatory networks that stimulate crossovers and accelerate the transition towards sustainable futures. Track chair Ingrid Mulder's work on participatory city making, working with communities and co-design of transitions is relevant here (Mulder & Loorbach 2016). Transition Design is practice linked to Transition Town movements and community activism. Here again power imbalances need to be theorised, and are all too often poorly articulated in design theory.

In this DRS track, we have brought together various niches in design research, which we hope not only contribute to the corresponding debate more widely at DRS 2018, in our track and in the foreseen keynote "Whose Design?" by Sadie Red Wing and Arturo Escobar, but also will enable a better framing of design for transitions, and mature our design repertoire and actions for transitions.

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Affective Interaction Design at the End of the World

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We are living in a time of ecological and humanitarian crisis that requires imminent action from the joint fields of HCI and interaction design today. This paper presents Affective Interaction Design as an emerging research agenda directly targeting end-of-world challenges. To arrive at this, the paper proposes a re-thinking of affect in HCI and interaction design based on recent theoretical advances in cultural and critical theory, in particular emphasizing how a broadened understanding of affect is necessary to better address affectively charged and uncertain situations such as those connected to the end of the world. The paper sketches out how Affective Interaction Design combines conceptual guidelines, design methods, a situational ethics and new ways of assessing the value of affective interactions over time. Finally, the paper outlines three end-of-world frames for engaging with concrete affective design experiments – the end of nature, the end of culture and the end of the human – where digital and interactive technologies can being used on a micro-level to catalyze changes in affective attachments on a macro-level.

affective interaction design; affect theory; transition design; design theory.

1   Introduction

In the last years it has become increasingly clear that the world is reaching a number of far- from-equilibrium tipping points related to recent developments in major environmental and societal crises facing us. In a very palpable way, we seem to be moving towards the "end of the world". This image might be most clearly associated with the climate crisis, but is also present in such affectively tensed areas as the ongoing civil wars in Syriah and Yemen, the current refugee and immigration crisis, the post-Brexit EU, the right-wing populism sweeping through politics in Europe and the US, a constantly looming terror and, lately, nuclear threat and the pervasive effects of the financial crash in 2008. According to the Belgian philosopher Isabelle Stengers, we are indeed living in 'catastrophic times' facing the imminent end of natural resources and a disequilibrium of the ecological and cultural systems with which we are familiar today (2013). In his book from 2010, *Living in the End Times,* Slovenian philosopher Slavoj Žižek identifies four so-called 'riders of the apocalypse', namely:

"(...) the ecological crisis, the consequences of the biogenetic revolution, imbalances with the system itself (problems with intellectual property; forthcoming struggles over raw materials, food and water) and the explosive growth of social divisions and exclusions." (2010, p. x)

Living at the end of the world means living in times where "choices in the present become highly charged affectively with fear for the uncertain future" (Massumi 2015, p. 4). For many this means coping with a growing urge to change this condition, accompanied by a feeling that it is impossible to find ways to act in the light of the overwhelming complexity presented by these interconnected global, ecological and humanitarian problems (Klein 2014). This is partly due to the difficulty of rationally comprehending the globally interconnected effects of a range of societal and environmental challenges that seem to be overlapping and spilling into each other (Tsing 2015).

Within HCI and design research, a response to this situation might be located in the emergence of Transition Design as an encompassing design-led agenda for engaging with a range of interconnected social, economic, political and natural systems to form more sustainable ways of living (Irwin 2015). Light et al. have also forcefully put forth a call for action under the heading of design for existential crisis in the anthropocene age (2017). The authors argue that technology designers and design researchers have a stake in the production of futures, and are hence implicated in the waves of change and uncertainty in a world characterized by ecological crisis, populism, mass migration, rising refugee numbers, automation and the like. Light et al. frame their project in relation to design as an existential challenge with a range of ethical concerns and the need for new design values to be explored in order to potentially "save humanity". Within this frame, the authors point towards concrete suggestions for attuning designers' towards meaning, purpose and fulfilment in difficult, unstable and rapidly changing times. Specifically, they argue that designers should focus on being "attentive, different, critical and in it together" (ibid., p. 6).

This paper extends the general call for action presented above while at the same time situating it in a tangential conceptual and genealogical trajectory presenting an emerging research agenda on Affective Interaction Design for end-of-world challenges. Essentially, the argument presented in this paper is that Affective Interaction Design can offer a research agenda that facilitates a sustained engagement with uncertain and affectively charged design situations at the end of the world. In cultural and critical theory, a large body of work within the so-called 'Affective Turn' has been instrumental in theorizing and analyzing situations characterized by uncertainty and trauma in more than a decade (Clough 2007, Gregg & Seigworth 2010). Starting from a basic Spinozan definition of affect as an "ability to affect and be affected" (Spinoza 1678), the paper introduces this affect theoretical genealogy into HCI and interaction design. Affect here is understood as a pre-personal intensity, that influences our bodily, vital forces directly (Massumi 2002). According to Spinoza, positive affects are those that make us feel alive and act in the world. Negative affects have the opposite effect, reducing our possible activity in the world and making this reduction felt. In this conceptual framing, end-of-world contexts would be characterized by negative affect, making it difficult to act or be acted upon. Living at the end of the world – or perceiving to be living at the end of the world – both has an impact on our ability to affect (what can we do?) and our ability to be affected (what matters?).

Based on three concrete affectively charged end-of-world design situations, this paper will show how it might be possible to design affective interactions on a micro-level for positive changes in affective attachments (Bennet 2001) and new possibilities for action on a macro-level. Importantly, though, this is not a trivial process, and often requires painful transitions tied to personal development and negative affects when effectuating this change (Massumi 2015). This means that Affective Interaction Design is not to be understood as an "easy-fix" for making people 'feel good' in difficult situations, or as overly relying on the supposed power to design your "way out of trouble". Instead, this paper provides a call for action for a sustained engagement with affectively charged design situations at the end of the world.

To arrive at a working notion of Affective Interaction Design, the first section will present a new affect theoretical foundation for understanding affective concerns in HCI and interaction design based on recent findings from cultural and critical theory. It will be shown how this conceptual reframing better allows for a designerly engagement with affectively charged situations such as end-of-world contexts. Based on this, a more detailed description of how Affective Interaction Design can be developed as a research agenda comprising conceptual guidelines, methods, situational ethics and longitudinal assessments of affective design experiments leveraging the potential for affective mobilization in existing digital and interactive technologies. Finally, the article frames three concrete design experiments relating to three different "ends of the world"; the end of nature, end of culture and end of the human. This feeds into a general discussion of the Affective Interaction Design research agenda and points in the direction of future work to be pursued under this heading.

2   Rethinking Affect in HCI and Interaction Design at the End of the World

In the past two decades, affect has played a central role in broadening the scope of both the theoretical foundations and practical design implications of interaction design and HCI. Intensive work has been carried out under the heading of Affective Computing in an attempt to make computers better at displaying and recognizing human emotions as a central part of improving the interaction with interactive systems (Picard 1997). Emotional Design (Norman 2004) argues for understanding affective and visceral attachments to product design as a central aspect of a product's success or failure, much in line with e.g. Jordan's work on pleasurable object design (2002). However, within HCI and interaction design, Affective Computing and Emotional Design have been criticized for attempting to overly structuralize, formalize, and represent emotions and affect as 'informational' (see, e.g., Sengers et al. 2002, Aboulafia and Bannon 2004). A range of researchers have advocated rethinking the 'informational' or 'cognitive' understanding of affect, arguing that emotions and affect are in the affective interaction between a user and a system, and not to be found in the code or hardware (Boehner et al. 2005, Höök 2008). Recently, Lottridge et al. have defined an *'affective interaction'* as any interaction that is coloured by an emotional experience (2011, p. 201). These 'interactional' approaches all emphasize the centrality of affect and emotion to understanding the richness and complexity of human experience and consequently the need to explore this in the design of interactive systems. In this body of work, the aim is less to contain affect than it is to unfold a range of different affective relations to be experimented with in the crafting of interactive system for design values such as self-reflection or ambiguity. Höök has further argued that in addition to the 'informational' and 'interactional' approaches to affect a third approach exists, where affect more generally falls within an experience-oriented (McCarthy & Wright 2004) approach to HCI and interaction design (2012).

Notable examples within an Affective Computing approach to design include projects on affective learning in how to train autistic children to express and recognize affective states (Blocher & Picard, 2002) and a range of projects aimed at measuring and reducing stress in computer tasks, combining facial readings and physiological data (e.g. McDuff et al., 2016). Recent work includes studies of how emotion tracking through various forms of data logging can promote successful behaviour change through affective forecasting (Hollis et al., 2015) and the design of a context-sensitive smartphone app to naturally embed inspiration to express gratitude in everyday life (Ghandeharioun et al. 2016). Concerning design projects within the 'interactional' approach, a prototypical example is the *Influencing Machine* (Sengers et al. 2002), an enigmatic installation where users influence the emotions of an (invisible) artificial agent expressing its emotions through visuals and sound. In line with this, *Affector* is an experiment in the co-interpretation of affect, where a video window between the offices of two friends communicates their moods by systematically distorting the video feed according to sensor readings (Sengers et al. 2008). A more recent example is *AffectAuru*, an emotional prosthetic that allows users to reflect on their emotional states over time, combining a multimodal sensor setup for continuous logging of audio, visual, physiological and contextual data and an interface for user reflection while using the system (McDuff et al., 2012).

Whereas the 'informational' approach to affect has rightly been criticized for sometimes reducing the complexity of emotional and affective concerns in HCI and interaction design to make them fit within a computing perspective, the 'interactional' approach often leads to designs that attempt to make people reflect on the richness of their own emotional situation, it might be argued that this also reduces affect to an individual's immediate feeling, and lacks in ambition and scope for unfolding the potential of affective interactions when considering affect as constitutive force for both human experience and larger societal formations. Indeed, the end-of-world challenges that we are facing today point to the necessity to engage with the long-term evolutions of affective relations and attachments while extending the focus of inquiry from the immediate feeling of the interaction towards larger relational issues.

To mobilize a theoretical starting point for Affective Interaction Design that deals directly with these issues, this paper combines the advances in affect theoretical studies in philosophy, aesthetics, cultural and critical theory with interaction design research targeted at crafting interactive and digital technologies. Indeed, the interest in addressing affective guidelines in HCI and interaction design as seen in e.g. Affective Computing and Emotional Design should be seen relative to a general acknowledgement over the last decades of articulating and conceptualizing affective and emotional forces as basically constitutive for understanding human experience and development in a number of disciplinary fields (Stern 1985, Damasio 1994, LeDoux 1996, Kahneman 2011, Dolan 2012). In critical and cultural theory, there has been an 'Affective Turn' towards research into the impact on a non-cognitive and bio-social level of new media and technologies on our possibilities of experience in a globalized world (Massumi 2002, Sedgwick 2003, Clough 2007, Gregg & Seigworth 2010, Blackmann 2012, Karatzogianni & Kunstman 2012, Hillis et. al. 2015). Importantly, this research has emphasized how affect must be understood not only as relating to an individual's self-relation or assessment of emotions ("how do I feel"), but also as a constitutive force in a range of larger societal formations such as economic markets and stock trade (Massumi 2015), networked and social media (Hillis et al. 2015) and activist politics and Culture Wars (Reestorf 2016). Affective Interaction Design draws on this work and cultivates established philosophical theories of affect (e.g. Spinoza 1678, James 1912, Whitehead 1929, Bergson 1907, Deleuze 1970) that will be applied in order to clarify how these conceptual starting points can lead to new affective concerns in interaction design.

In Affective Interaction Design, affect is conceptualized as a pre-personal intensity that influences our bodily, vital forces directly. This is to be understood as a capacity to act and be acted upon through increase or decrease of e.g. joy, sorrow or desire (Spinoza 1678, Massumi 2002). Affect is neither purely natural/physiological, nor solely cultural. This also means that affect can neither be contained as the properties of a person, nor the properties of a system. Affective experience lies 'in-between' and thus brings together the natural and cultural in affective-felt tendencies that modulate the potential for action in a given situation (Massumi 2009). In earlier work, I have explored how this can be used in HCI and interaction design as a way to challenge basic notions of interaction and interactivity in material, processual and experiential terms (Fritsch 2009, Fritsch 2011). Here, the argument presented has been that starting from affective experience entails looking into the very formation of experience; that which *makes us* experience and the forces that modulate this. Importantly, affect differs from emotion, which is understood as recognized affect; affect is pre-personal and non-conscious whereas emotion has individuated to a conscious form. An example is feeling angry; you are already feeling something, before you recognize this feeling as anger. Munezero et al. have presented a framework based on the work of Massumi to better differentiate between affect, feeling, emotion, sentiment and opinion in relation to text detection, arguing that affect is non-conscious and a predecessor to feelings and emotions (2014, p. 104). Further, Massumi has argued that affect works on a microperceptual level with macropolitical consequences (2009).

Starting from an affect theoretical foundation means starting with affect as an in-between dimension of experience that modulates how we experience and the relations and attachments we form. Within the frame of Affective Interaction Design, this allows us to tentatively define affective

interactions as interactions with concrete digital and interactive technologies (on a micro-level) that catalyze new affective attachments and mobilize affect towards end-of- world problems (on a macro-level). End-of-world contexts are characterized by negative affect, making it difficult to act – and inter-act. Affective Interaction Design thus attempts to effectuate changes by altering affective attachments through affective interactions towards positive affects that offer new possibilities for action. Importantly, though, this is not a trivial process, and often requires negative affects as part of the process of change (Massumi 2015).

In addition to the explicitly affect-oriented approaches to design, Affective Interaction Design also draws on a range of findings from a number of design research approaches. The need to engage in critically challenging real-world issues, politics and policymaking through explorations of technology design adheres to longstanding perspective from Participatory Design (Greenbaum & Kyng 1991), Critical Design (Dunne 1999), Adversarial Design (Di Salvo 2012), Design Activism (Markussen 2013) and Transition Design (Irwin 2015). In relation to the proposed design experiments concerned with the climate and cultural crises, Sustainable Interaction Design (SID) serves as a foundational inspiration for exploring "(...) how interactive technologies can be used to promote more sustainable behaviors (Blevis 2007, p. 503). Affective Interaction Design adds to these design explorations an agenda for addressing affect conceptual guidelines, when intervening into design situations at the end of the world. The next section further develops how such an agenda might be comprised.

3   Sketching a Research Agenda for Affective Interaction Design

The societal imperative to find new ways of tackling the transversal nature and complex issues related to end-of-world challenges is coupled with the need presented in this paper to radically broaden the notion of affect in interaction design and develop Affective Interaction Design as a new design research agenda. In the following, the paper sketches out the different aspects of an affective research agenda in HCI and interaction design that fully acknowledges affect as a constitutive force of human experience and larger social and societal formations, such as those presented by end-of-world challenges.

3.1 Conceptual design guidelines and values

The majority of the research on affective design guidelines in HCI and interaction design has been aimed at establishing affect as a concept, which should be considered in the design and evaluation of computers to help people better perform specific tasks (Picard 1997, Norman 2004). Lottridge et al. present a range of guidelines for putting emotion research into practice, such as 'to enhance performance through emotional input and regulation', 'to visualize emotion for decision support' and 'to foster the appropriate emotion for different learning goals' (2012, p. 228f). However, what Affective Interaction Design aims to provide are specific conceptual guidelines for addressing behavioural change by altering affective attachments in relation to emotionally saturated issues such as end-of-world problems, through affective interactions. Developing appropriate affect conceptual guidelines and values to orient the design work in the proposed design experiments is a key activity in this respect. As opposed to design principles, which might be considered clear rules of thumb (Blair-Early & Zender 2008), the main task of these guidelines is to offer to interaction design researcher concepts, directions and themes of engagement that can guide the practical design work without in any way predetermining it. These guidelines will be formulated based on the presented theoretical foundation in the light of end-of-world challenges and refined through practical experiments.

3.2 Developing affective design methods and a situational ethics

It requires great considerations and care to intervene into affectively charged design situations at the end of the world, characterized by uncertainty and vulnerability. There is a substantial amount of literature in HCI and design addressing e.g. designing for vulnerable user groups but no established methods for addressing affective issues in the design process. Among others, Munteanu et al. describe this situation and call for a need to establish a 'situational ethics' (2015) for intervening into

such problematic design settings. The authors argue that a situational ethics is necessary to meet the ethical challenges in field work or design experiments involving at-risk or vulnerable user groups, both in the planning and execution stages of the research (2015). Since Affective Interaction Design deals with concrete affective tensions in cultural, natural and physiological situations of crisis, it will be imperative to consider the ethical challenges for both users and researchers. According to Munteanu et al., a strategy to build a situational ethics requires looking for 'ethical triggers', continuously assessing risks and adjusting protocols accordingly and ensuring a multidisciplinary design team (ibid. p. 113). A situational ethics will also outline viable ways of entering, leaving and sustaining the design initiatives. It will also affect the design methods and techniques occurring at all stages of the design process. Some of these methods will be appropriated in the light of the affective design agenda. In addition, new methods and techniques must be developed to cater specifically for affective data and concerns. Developing an extensive repertoire of affective design methods and a situational ethics is therefore key to guiding the practical design processes related to end-of-world problems.

3.1 Assessing the value of affective interaction design over time

Measurements of affect have a long history of influencing the development of HCI, where extensive research has been carried out to explore methods of assessing affective and emotional features in the evaluation of interactive systems (Lottridge et al. 2011, Pollak et al. 2011). However, this research is primarily concerned with establishing an accurate account of an individual's experience of a given interaction with a computer system and this system's capability to influence affective states and does not engage with the end- of-world issues presented above. There is a need to develop non-reductionist ways of assessing the value of Affective Interaction Design that go beyond the individual's immediate feeling, when interacting with the system, and accentuate long-term affective mobilizations and changes in affective states and relations towards specific societal issues. Therefore, it will be necessary to develop a model for studying affective attachments over time combining longitudinal digital ethnographic studies (Markham 2015) and continuous logging of physiological measurements (Lottridge et al. 2011) for observations on relational changes (macro). This will be combined with qualitative micro-analytical interviews (Stern 2004) and video- cued recall methods (Suchman & Trigg 1991) unfolding the micro observations of the affective qualities of the interactions with the different technologies. The aim is to combine the micro-analytics of the affective interaction with the long-term relational impact on affective attachments to cultivate new design values in an affective perspective.

3.2 New technologies and affective design exemplars

Affective Interaction Design must be established as a form of research-through design (Frayling 1993), where the theoretical mobilization should continuously be informed through a practice-based engagement with building affective design prototypes. It will be necessary to develop a range of affective design exemplars (Binder & Redström 2006), i.e. designs that specifically embody the Affective Interaction Design research agenda. As shown above, prior design experiments engaging with affect include work on the display and measurements of affective states in computer systems for learning and motivation and artistic interventions aimed at making people reflect on their emotions. The existing affective design prototypes within HCI and interaction design present a multifaceted interpretation of affect; from physiological measurements, facial recognition and computers aiming to express emotions to systems that foster affective and emotional reflections. However, there are no prototypes concerning the explicit use of an affective approach to meeting end-of-world challenges. Hence, Affective Interaction Design will develop affective design prototypes that can serve as guidance for future explorations. These prototypes will explore particular technologies believed to hold a potential for changing affective attachments, which will be further explored in the next section.

4   Framing Affective Design Experiments for End-of-world Challenges

This section presents three potential 'ends of the world' that can be used to suggest three overall frames for directing affective design experiments within the overall agenda of Affective Interaction Design. Some of the experiments draw on existing explorations, others remain on a more conceptual level, but they are all in-the-making. All three frames attempt to give an indication of how specific technologies can be developed and tested in the design of real-world applicable affective design prototypes proposing to change affective attachments and relations through micro-interactions targeting three end-of-world design situations: the end of nature, the end of culture and the end of the human.

4.1   *End of Nature*

The end of nature relates to the challenges we face with the current climate crisis. Data from the UN's *World Meteorological Organization* (WMO) indicate that 2016 was the world's hottest year ever on record, with devastating consequences for the melting of the Arctic Sea and a growing number of natural disasters worldwide[1]. Within the overarching frame of Affective Interaction Design, a starting point for engaging with design experiments related to the end of nature might explore the design of affective interactions for changing habits related to the climate crisis deploying advanced and distributed sensor and actuator technologies. The goal would be to technologically stage affective attachments to issues related to the climate crisis, such as food or product consumption, CO2 emission, carbon footprints, deforestation and other environmental issues. The hypothesis would be that creating a stronger affective link between people and the environment can lead to changes in behaviour and habits. This might be achieved through sensorial augmentation, which refers to an augmentation of the senses, using technological enhancement to detect something that the body cannot normally perceive (Linden et al. 2011). In an earlier project, we have developed Feltradio (Grönvall et al. 2016), which is a portable technology for sensing WiFi through sensorial augmentation and Electric Muscle Stimulation (EMS). In relation to the end of nature, we are currently exploring how to use the same infrastructure to affectively relate to e.g. the level of CO2 emission, so people can actually experience that which they cannot normally sense. This might foster a critical awareness of the relations between people and the natural resources being used and lead to changes in behavior and action. The experiment thus utilizes micro-perceptual triggers (the sensor and actuator technologies) to create a sustained engagement with macro-issues (environmental challenges) through augmentation of big data streams into our affective and embodied experience of the world. This would potentially lead to a better sense of how one's actions might be connected ecologically to the greater environment, thus creating the foundation for making different choices and facilitating new forms of positive action.

4.2   *End of Culture*

The end of culture relates to the ongoing Culture Wars (Reestorf 2016), not least in the wake of the current migration and refugee crisis (especially from a European perspective), but also from a result of the geopolitical challenges caused by climate change. The *UN Refugee Agency (UNHCR)* reports that we are witnessing the highest level of displacement of people on record with an unprecedented 65.3 million (21.3 million refugees) people being forced from their homes[2]. In addition to this very concrete end of culture, the increase in right-wing populism in a range of European countries is very much based on the perceived cultural threat posed by the flows of refugees and immigration which to many warrants an end to the culture they are familiar with. From an Affective Interaction Design perspective, one way of engaging with theses issues might explore affective design experiments that use location-based and interactive platforms for affectively engaging storytelling to provide spaces for lasting cultural dialogue around issues of integration. The hypothesis is that it is necessary to

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[1] http://public.wmo.int/en/media/press-release/global-climate-breaks-new-records-january-june-2016
[2] http://www.unhcr.org/figures-at-a-glance.html

initiate an actual dialogue between people to actually create changes in affective attachments towards refugees and migrants, but also to different fractions within native groups in increasingly culturally divided societies. Here, we would follow Guattari's call for individuals to "(…) become both more united and increasingly different (2000/1989, p. 69). Creating conditions for cultural dialogue and differential attunement might be explored through the use of mobile technologies, as a way of collecting and curating people's personal stories and sound in real-time from a range of distributed locations. These might include refugee camps, asylum centers or different residential areas in cities and villages. In the context of this paper, this would be a European country, but the scope is not limited to Europe. Around these sound recordings, spaces will be facilitated where people can listen to and engage with the stories and people behind those stories. These experiments extend an ongoing project with the use of interactive audio design in the creation of an affectively engaging interface for attuning to the differential qualities of people's voices (Fritsch & Jacobsen, 2017). In the overall project frame this experiment stages different encounters between people, stories and voices creating changes in affective attachments towards more positive forms of cultural dialogue.

4.3   End of the human

The end of the human relates to recent advances in technological implants and the rise of automation and robots replacing human skilled labor. The latter is closely connected to advances in AI and machine learning – e.g. in stock trading – once again challenging notions of intelligence and agency. Important existential questions have re-merged with new intensity due to a number of advances increasingly challenging and blurring boundaries between humans and technology. The prospective of 'human enhancement', which aims to increase human capacities above normal levels through the use of different kinds of technology (Savulescu and Bostrom 2011), is inextricably tied to discussions of loss of humanity and economic inequality on a global scale. Affective Interaction Design experiments targeting this framing might explore different interfacial engagements and uncertainties connected very concretely with implantable technologies, for instance the Implantable Cardioverter Defibrilator (ICD) pacemaker. In short, an ICD is a device implantable inside the body (the heart) and able to perform cardioversion, defibrillation and pacing of the heart. In addition, the ICD collects and sends data about the patient's heart to the hospital via a router that comes with the device. People get the device implanted through an operation due to severe heart problems, potentially following a heart attack or stroke. This is in itself a life-changing situations characterized by anxiety, affective saturation and uncertainty, often involving a near-death experience. Following this, patients' need to both cope with getting used to living with a life-threatening disease and an implantable technology in their heart. This presents a range of challenges, as explored by e.g. Andersen et al. (2017) who have developed an app that makes the data from the ICD accessible for the patients. An Affective Interaction Design approach would seek to design concrete affective interactions through technologies that might change people's relations to their bodily vulnerability towards more positive affective attachments.

The three frames for affective design experiments presented in this section all concern design situations characterized by affective uncertainty and crisis, where the affective tensions are far more palpable and form part of larger, collective eco-systems of power, politics, technology and resources. They are far-from equilibrium design situations saturated with fear since they very clearly present affective encounters with "difference as alterity – as otherness" as noted by Susan Ruddick (2010). This is most obviously the case for the end of culture and the current refugee and migration crises in Europe, where the feeling of cultural identity and values for many is being questioned in the encounters with refugees and immigrants defined as 'others'. Difference as alterity, however, is also central to understanding design challenges at the end of nature and the human. Concerning the end of nature and the climate crisis, 'the other' can both be used as a way to frame the clash of alternative positions in the climate debate, but also in our lack of establishing a real relation or affective attachment to nature understood as an 'other'. Here, cultivating affective attachments through sensorial augmentation becomes a way of bridging between culture and nature. Concerning

the end of the human, an implantable technology might be immediately understood as an 'other' – but the same might be said about the relation to the whole body, which has been altered into something completely different from what you were used to. In direct continuation of this, Massumi reminds us that "(a)ffective politics, understood as aesthetic politics, is dissensual, in the sense that it holds contrasting alternatives together without immediately demanding that one alternative eventuates and the others evaporate. It makes thought-felt different capacities for existence, different life potentials, different forms of life, without immediately imposing a choice between them." (2009, p. 12). This calls for design experiments that explore "actual differentiation" and conditions of emergence, and do not attempt to impose solutions in advance. This is very much in line with the ideas presented in a Transition Design approach to engaging with "wicked problems" on an ecological, social and societal scale, and in a non-reductionist way (Irwin 2015).

In all of the proposed frames above, affective interactions would attempt to catalyze experiential changes creating more positive affective attachments during the long-term use of the design, leading to new abilities to act. The suggested experiments both highlight how it is possible to define design challenges from an end-of-world perspective, and how it might be possible to engage with these challenges through design from an affective point of view. While this move into concrete contexts and technologies comes with a risk of reducing the overall design agenda, they are necessary to connect the conceptual guidelines with an interventionist design agenda. Importantly, though, it must be stressed that the presented experiments are in no way the only experiments that could be carried out within the presented ends of the world.

5 Discussion

Affective Interaction Design is an emerging research that arguably poses a range of questions and strikes many themes that must be critically discussed both in relation to the framing of end-of-world challenges as well as the overall affective framework. First, it should be noted that the argument put forth in this paper is not that the world is about to end any time soon – statistically speaking it has never been more peaceful, prosperous or connected as it is today (e.g. Pinker 2011) – or that digital technologies can save us or provide sustainable solutions to the multifaceted problems we are facing today. Rather, the argument is for interaction design to develop a serious commitment and engage explicitly with affectively saturated design situations at the end of the world to be able to change the current course towards more sustainable transitions. As has been shown, the 'ends' also hold a generative potential, and point to a need for rethinking our existing affective attachments and habits and thus stimulate positive shifts in attitudes and policies that will help us better act in the face of the challenges we are facing.

As emphasized above, this attitude should not be mistaken for a naïve optimism based on a too strong belief in the role of design in making these transitions. There are a number of seemingly insurmountable dilemmas and challenges that characterize an engagement with design situations at the end of the world. And there is a fair chance that processes and proposed designs will fail. This should not, however, prevent the joint fields of HCI and interaction design from engaging with these issues. Affective Interaction Design tries to pose a nuanced approach to thinking interaction design's role in changing our current conditions for living in the light of the challenges presented at the end of the world. The presented research agenda embodies a commitment for making a difference through a sustained engagement. To achieve this, the agenda must be conceptually founded, bound up with concrete methods and ethics and develop strategies for making sense of the potential impact and value of the different designs in a non-reductionist perspective over time. In addition, it would also be necessary to cultivate Affective Interaction Design into an engagement with broader issues of large-scale policymaking to ensure a continued impact.

Affective Interaction Design does not attempt to 'annex' existing design approaches such as Adversarial Design, Transition Design or Sustainable Interaction Design under an affective heading. These are existing approaches that all deal with pertinent aspects when it comes to developing a

critical, reflective and interventionist approach to interaction design in order to engage with some of the most important societal problems we are facing today. Indeed, some of the main values and motives going onto Affective Interaction Design draw on and relates to a range of different design approaches that are not directly affectively motivated. However, the argument presented is that HCI and interaction design can greatly benefit from developing a long-lasting design agenda that explicitly aims to engage with the affective complexity characterizing design situations at the end of the world. As has been shown, in order to do this, it will be necessary to revise the existing definition of affect as it is currently presented in Affective Computing and Emotional Design. Again, it is important to stress that an affect theoretical foundation opens a way of thinking affect as a constitutive force in an experiential, societal and socio-cultural perspective, which goes beyond reflecting on one's own emotions or trying to teach computers to register and express human emotion to smooth out interaction.

A valid point of critique concerning both the overall framework and the presented design experiments would be whether it might not be possible to engage in activities that would contribute even better to a more sustainable future than the examples in this paper. A derived question might be, whether a range of the things you could do would in fact not work better and more sustainably without technology. Here it is important to remember that the outset for the Affective Interaction Design research agenda is to develop a different approach to developing digital and interactive technologies in the light of the challenges presented at the end of the world. This does not mean, however, that a non-technological solution might work better in a concreted design case, e.g. for creating spaces of cultural dialogue and lasting integration. A continuous awareness of the possibilities and limitations of the design agenda should be integral to the situational ethics developed.

6   Conclusion

This paper presents Affective Interaction Design as a new research agenda for engaging with end-of-world contexts and challenges in HCI and interaction design. The agenda introduces an affect theoretical foundation for understanding design contexts characterized by crisis and uncertainty, and comprises conceptual guidelines, methods, a situational ethics, measures for assessing the longitudinal value of affective interactions and novel affective design exemplars. Three frames for design experiments have been proposed targeting affectively charged end-of-world challenges through concrete interactions with different technologies (micro-triggers) that might lead to positive changes in relations and attachments, potentially triggering behavioral changes or changes in habits (macro changes).

In the future, it will be necessary to further cultivate this research agenda to develop be fundamental new insights into design processes concerned with affectively saturated design situations, and strategies for leveraging the affective potential of existing and new digital and interactive technologies. The sheer complexity of the presented affectively saturated design situations at the end of the world and the pervasive and transgressive nature of the challenges they embody, provide a complicated starting point for a necessary engagement with a range of issues. There are no signs that end-of-world challenges will disappear in the coming years, rather on the contrary. In this light, Affective Interaction Design functions as general call for action for HCI and interaction design to rethink existing and explore new ways of thinking and doing design.

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