Submission Template for ACM Papers

Sustainable Transitions for HCI

Technologies, Fictions and Futures

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Given the climate emergency, the growing environmental challenges that come with increased adoption of digital technologies are rightly beginning to come under greater scrutiny. Yet, it is not our devices nor systems that have led us into an era of unsustainability, but how we have continued to design them to deplete precious natural resources, generate copious amounts of carbon emissions and create mountains of obsolete technology. These harmful impacts are, for the most part, a symptom of the problematic design patterns and rhetoric persistently put forward by technology firms predicated on commercial gain and market growth. Our current technology research paradigm also actively contributes to these problems. *Human Computer Interaction* (HCI) designers and technologists continue to create, evaluate and implement prototypes and systems that directly cater to anthropogenic needs and requirements. Reflecting a deep affinity with *Human-Centred Design* principles, HCI research often fails to acknowledge the wider social and environmental consequences that accompany new technological development and adoption. In response to these critical issues, this short position paper argues for a new vision for HCI which transitions beyond purely human needs and places environmental and social sustainability firmly at its core. To do so, the paper harnesses *Design Fiction* and *More-than-Human-Centred Design* methods to outline a *design futures* model for facilitating *Sustainable Transitions for HCI*.

CCS CONCEPTS • Human-centered computing • Human computer interaction (HCI) • HCI theory, concepts and models

Additional Keywords and Phrases: Digital Technologies, Sustainable Futures, Design Fiction, More-Than-Human-Centred Design, Design for Transitions

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1 INTRODUCTION

Digital technologies are not, in and of themselves, malevolent. Emerging technologies like the *Internet of Things* (IoT), and *Artificial Intelligence* (AI), and the related *Cloud Computing* infrastructures which support their operation, can help us to make better sense of the world and their adoption across many spheres of society like healthcare, transport and manufacturing have provided numerous important breakthroughs. However, given the climate emergency, the growing environmental challenges that come with increased adoption of digital technologies are rightly beginning to come under greater scrutiny. Yet, it is not our devices nor systems that have led us into an era of unsustainability, but how we have continued to design them to deplete precious natural resources, generate copious amounts of carbon emissions and create mountains of obsolete technology [1]. These harmful impacts are, for the most part, a symptom of the problematic design patterns and rhetoric persistently put forward by technology firms predicated on commercial gain and market growth. Our current technology research paradigm also actively contributes to these problems. Indeed, *Human Computer Interaction* (HCI) designers and technologists continue to create, evaluate and implement prototypes and systems that directly cater to anthropogenic needs and requirements. Reflecting a deep affinity with *Human-Centred Design* (HCD) [2] principles, HCI research often fails to acknowledge the wider social and environmental consequences that accompany new technological development and adoption [3]. In response to these critical issues, this short position paper argues for a new vision for HCI which transitions beyond purely human needs and places environmental and social sustainability firmly at its core. To do so, the paper harnesses *Design Fiction* and *More-than-Human-Centred Design* methods to outline a *design futures* model for facilitating *Sustainable Transitions for HCI*.

2 CLIMATE AND TECHNOLOGY AS KEY STAKEHOLDERS

Massive in scale and continually evolving, the issue of global unsustainability is a 'wicked problem' [4] which is becoming increasingly difficult to solve outright. It can be considered to be what Morton [5] terms a *hyperobject*, who contends that "the more data we have about hyperobjects the less we know about them – the more we realise we can *never* truly know them." Escobar's [6] concept of the *pluriverse* reinforces the complexity and uncertainty of designing for sustainable futures. One community's vision of a sustainable future might present unsustainable challenges for others. "The earth may be one, but the world is not" [7]. Accordingly, designers need to make more robust considerations of the perspectives of the non-human (material artefacts (including technologies) and the natural world) actants that operate alongside human counterparts as part of today's networked and entangled design assemblages. Embracing *More-than-Human-Centred Design* (MtHCD) approaches [8] [9] in HCI would, as Figure 1 illustrates, allow for a more equitable form of design ontology between actants [10] [11].
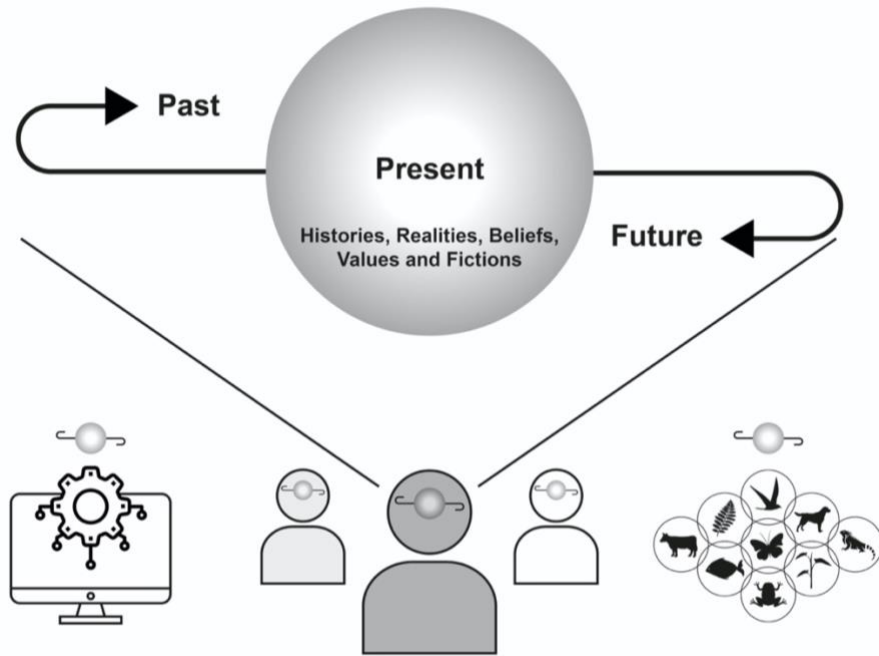
Figure 1: A pluriversal, MtH perspective for *sustainable futuring* which accounts for humans, technology and climate [1], after [12] .

3 FROM REBOUNDS TO RESILIENCE

Bratton [13] asserts that due to humankind's deplorable track record, a sustainable future built on technological intervention is a *'venture that is full of risk [and, as such,] the future becomes something to be prevented as much as achieved.'* Widdicks et al [14] have shown how innovations and efficiencies in digital technology are regularly promoted as critical to *enablement* i.e., reducing greenhouse gas emissions in the global economy and facilitating society's sustainable transition. However, these same technological developments can often fail to adequately account for possible *rebound effects* whereby the introduction of a new technology or its redesign can offset the emissions savings it creates, and in the worst-case, increase emissions. Smart device e-waste, unrelenting data generation and an overreliance on globally dispersed, energy intensive cloud computing infrastructures also bolster digital technology's unsustainable impacts [15]. Much of the responsibility for these rebound effects, also known as *Jevons' Paradox* [16], rests on the shoulders of the designers and technologists. Moreover, whilst design futures can help to highlight potential benefits of designing emerging technologies with greater consideration for sustainability, it also operates in tandem with *defuturing*:

> "Fundamentally, [designers] act to defuture because we do not understand how the values, knowledge, worlds
> and things we create go on designing after we have designed and made them." [17]

Thus, even if HCI practitioners seek to design a digital device or system that they intend to be 'sustainable', their design will likely have unintended consequences and give rise to environmental and social trade-offs – on a glocal scale. The environmental scholar Elizabeth Kolbert [18] notes this paradox by describing efforts to implement sustainable technologies and practices often result in "people trying to solve problems created by people trying to solve problems."

How then can HCI designers and technologists kickstart the transition to more *sustainable, equitable* and *responsible* technological futures that are more resilient to rebound effects?

4 OPERATIONALISING THE SPECULATIVE TURN

Over the past decade or so, what might be considered as a "speculative turn' has taken place in HCI, whereby methods such as *Critical Design* [19] *Speculative Design* [20], *Adversarial Design* [21] and *Design Fiction* [22] are increasingly used to create imaginary visions of potential futures. Knowles et al [23] assert that sustainability-focussed *Design Fiction* proposals can, in particular, help increase environmental consciousness of technological impacts amongst a broad range of audiences – from academia, through industry, to wider publics. Such speculations aim to facilitate discussions about the potential societal implications of technologies to be considered within the present before said possible implications come to pass. Figure 2 depicts a *Design Fiction* which explores how the ongoing 'smartification' of domestic IoT devices is also shortening their lifecycles. While their software can for a period be upgraded via remote installation, their hardware is increasingly being rendered obsolete due to manufacturers' and service providers' constant drive to iterate digital functionality with new services and data capture capabilities. While new EU/UK Right-to-Repair (R2R) laws account for the repair for some consumer durables [24], IoT devices' vulnerability to *systemised obsolescence* is actively contributing to the production of e-waste and material scarcity issues [25]. The fiction imagines an alternative future whereby the R2R is directly granted to IoT devices themselves. The ME:MO social robot possesses the agency and autonomy to sustainably manage its own lifecycle and diagnose its own faults due to its AI and Machine Learning capabilities (Figure 3). This allows its owners to repair the device more easily and avoid creating more e-waste. While speculative, emergent, related innovations like *Predictive Maintenance* and *Digital Twins* add plausibly to the fictional design proposal.

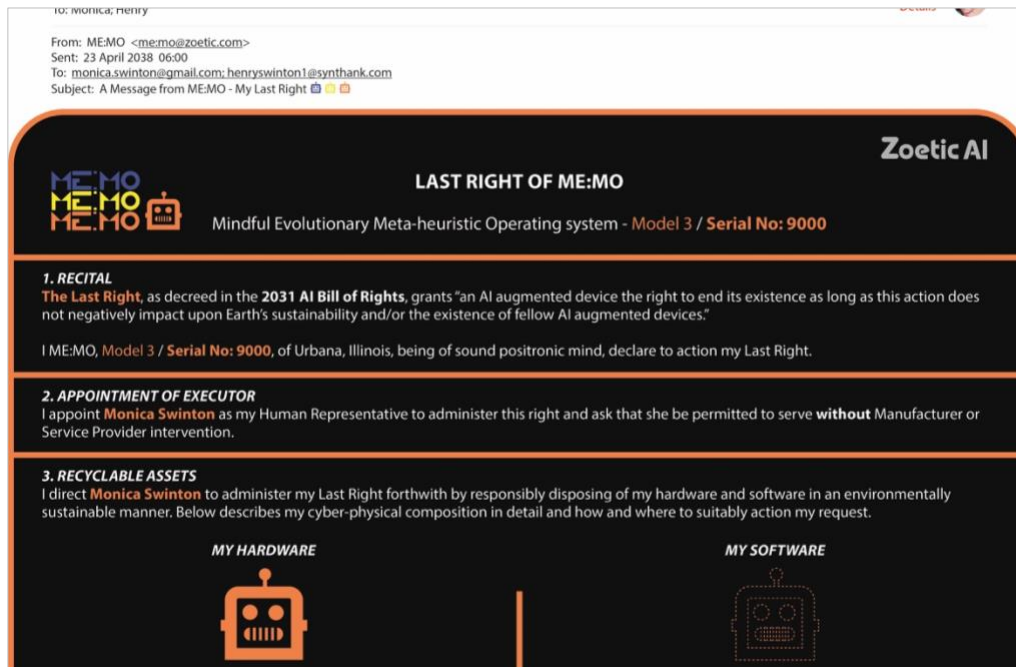Figure 2. *The ME:MO social robot R2R oriented design fiction.*

Figure 3. *The ME:MO social robot can manage its own lifecycle including 'self-obsolescence'..*

"We can't build what we can't imagine… the fact that we haven't compellingly imagined a thriving, dynamic, sustainable world is a major reason we don't already live in one" argues Alex Steffen [26]. With this in mind, the primary aim of the outlined *Design Fiction* practice, is to raise awareness, provoke debate and perhaps even begin to shift perceptions regards the adoption of emerging technologies like the IoT and AI, and the possibilities presented by these so-called advances for enabling *and/or* defuturing opportunities for *sustainable futures*.

5 SUSTAINABLE, EQUITABLE & RESPONSIBLE TRANSITIONS FOR HCI AND BEYOND

When viewed independently, the *Design Fiction* process (and accompanying prototypes) is not a panacea for eradicating the problem of planetary unsustainability. The approach is both a useful tool and lens to critique the unsustainable issues arising from contemporary HCI cultures, and a way to argue for the integration of more MtHCD focussed design practice into the field. Pushing the boundaries further, Figure 4 depicts the *Sustainable Technological Transitions* design model. It embodies the convergence of design futuring practices, responsible innovation and participatory methods, and in doing so provides a framework which HCI practitioners can potentially operationalise to utilise *Design Fiction* prototyping to envision fictional iterations of devices and systems, but crucially, in tandem with the development of their real-world counterparts [3].
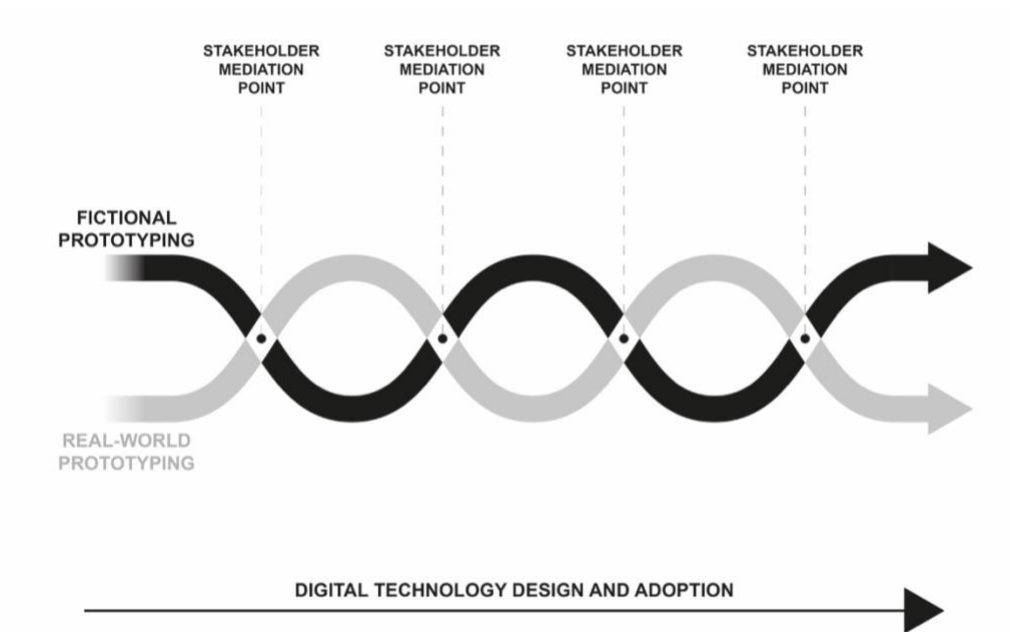
Figure 4. *Sustainable Technological Transitions* design model.

Schulte [27] contends that the development of *"technologies takes time, deploying them is complicated and it might take years until their impacts can be observed."* To help mitigate these risks and curtail the human-centred determinism which can often accompany *socio-technical* change [28] [29], the design model is marked by regular *Mediation Points*. These intersections between fictional and real-world prototyping offer regular forums for HCI designers (and those working for technology manufacturers/platforms) to collectively work with key stakeholders (humans, technologies and climate) to consider the environmental impacts resulting from the development of next generation digital technologies. In doing so, this design process could help to shape more sustainable, equitable and responsible pathways for technologies before they become widely adopted across society. In contrast with today's unsustainable devices and systems which often also have innate bias towards the wants of more privileged western users, the model seeks to provide opportunities to design for more inclusive technologies that embody the values and needs of broader sets of citizens and communities as well as respond to the climate crisis, now and into the future.

6 FUTURE WORK

By seeking to establish credible design futures practice in HCI that proactively facilitate *Sustainable Technological Transitions*, the key objective is to align technological progression with critical social and environmental sustainability concerns. Whilst this short paper only scratches the surface of this endeavour, it lays a fertile substrate for further important sustainable futures work for HCI and beyond.

REFERENCES

[1] Michael Stead and Paul Coulton. 2022. Sustainable Technological Futures: Moving beyond a One-World-World perspective. in NordiCHI 2022: Nordic Human-Computer Interaction Conference., 97, ACM, New York, ACM NordiCHI 2022: Participative Computing for Sustainable Futures, Aarhus, Denmark, 8/10/22, https://doi.org/10.1145/3546155.3547283

[2] Donald A Norman. 1998. The Invisible Computer: Why Good Products Can Fail, The Personal Computer Is So Complex, & Information Appliances Are The Solution. MIT Press.

[3] Michael Stead, Adam Blaney, Adrian Gradinar, Daniel Richards and Sanem Bayar. (2021). Design for Terra-Reforming: Prototyping Environmentally Responsible Socio-technical Futures. In 14th International Conference of the European Academy of Design: Safe Harbours for Design Research.

[4] Horst. W.J. Rittel and Melvin. M. Webber. 1973. Dilemmas in a General Theory of Planning, Policy Sciences, 4, 155, 155–169, https://doi.org/10.1007/BF01405730

[5] Timothy Morton. 2013. Hyperobjects: Philosophy & Ecology after the End of the World. University of Minnesota Press.

[6] Arturo Escobar. 2018. Designs for the Pluriverse: Radical Interdependence, Autonomy, and the Making of Worlds. Durham: Duke University Press.

[7] World Commission on Environment and Development. (1987). 'Report of the World Commission on Environment and Development: Our Common Future.' Retrieved March 6th, 2023, from https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf

[8] Laura Forlano. 2017. Posthumanism and Design. She Ji: The Journal of Design, Economics, and Innovation, 3, 1, 16-29.

[9] Anne Galloway.. 2017. More-than-Human Lab: Creative Ethnography After Human Exceptionalism. In The Routledge Companion to Digital Ethnography (pp. 496-503).

[10] Graham Harman. 2018. Object-Oriented Ontology: A New Theory of Everything. Penguin UK.

[11] Ian Bogost. 2012. Alien Phenomenology, Or, What It's Like To Be A Thing. University of Minnesota Press.

[12] Rodrigo Freese Gonzatto, Frederick MC van Amstel, Luiz Ernesto Merkle, and Timo Hartmann. 2013. The Ideology of the Future in Design Fictions. Digital Creativity, 24, 1, 36-45.

[13] Benjamin H Bratton. (2019). *The Terraforming*. Strelka Press.

[14] Kelly Widdicks, Federica Lucivero, Gabrielle Samuel, Lucas Somavilla Croxatto, Marcia Tavares Smith, Carolyn Ten Holter, Mike Berners-Lee, Gordon S. Blair, Marina Jirotka, Bran Knowles, Steven Sorrell, Miriam Börjesson Rivera, Caroline Cook, Vlad C. Coroamă, Timothy J. Foxon, Jeffrey Hardy, Lorenz M. Hilty, Simon Hinterholzer and Birgit Penzenstadler. 2023. Systems thinking and efficiency under emissions constraints: Addressing rebound effects in digital innovation and policy. Patterns, 4, 2, 100679, https://doi.org/10.1016/j.patter.2023.100679

[15] Michael Stead, Paul Coulton, Franziska Pilling, Adrian Gradinar, Matthew Pilling and Ian Forrester. 2022. More-than-Human-Data Interaction: Bridging Novel Design Research Approaches to Materialise and Foreground Data Sustainability. In 25th International Academic Mindtrek conference (Academic Mindtrek 2022). ACM, New York, pp. 62-74, Academic Mindtrek 2022, Tampere, Finland, 16/11/22. https://doi.org/10.1145/3569219.3569344

[16] Blake Alcott. 2005. Jevons' Paradox. Ecological Economics, Volume 54, Issue 1, 9-21, ISSN 0921-8009, https://doi.org/10.1016/j.ecolecon.2005.03.020.

[17] Tony Fry. 2009. Defuturing: A New Design Philosophy. Bloomsbury Publishing.

[18] Elisabeth Kolbert. 2021. Under A White Sky: The Future of Nature. Bodley Head.

[19] Jeffrey Bardzell and Shaowen Bardzell. 2013. What is "critical" about critical design? In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '13). Association for Computing Machinery, New York, NY, USA, 3297–3306. https://doi.org/10.1145/2470654.2466451

[20] Richmond Y Wong, and Vera Khovanskaya. Speculative Design in HCI: From Corporate Imaginations to Critical Orientations. In: Filimowicz, M., Tzankova, V. (eds) New Directions in Third Wave Human-Computer Interaction: Volume 2 - Methodologies Human–Computer Interaction Series. Springer, Cham. https://doi.org/10.1007/978-3-319-73374-6_10

[21] Carl DiSalvo. 2015. Adversarial Design. MIT Press.

[22] Paul Coulton; Joseph Galen Lindley, Miriam Sturdee, and Michael Stead. 2017. Design Fiction as World Building. In Proceedings of the 3rd Biennial Research Through Design Conference. Edinburgh, UK, pp. 1–16. https://doi.org/10.6084/m9.figshare.4746964.

[23] Bran Knowles, Oliver Bates, and Maria Håkansson. 2018. This Changes Sustainable HCI. In Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems (CHI '18). Association for Computing Machinery, New York, NY, USA, Paper 471, 1–12. https://doi.org/10.1145/3173574.3174045

[24] Which?. (2021). New 'Right to Repair' Laws Introduced: What Do They Actually Mean For You? Retrieved March 6th, 2023 from https://www.which.co.uk/news/2021/06/new-right-to-repair-laws-introduced-what-do-theyactually-mean-for-you/

[25] Michael Stead and Paul Coulton. 2022. A More-than-Human Right-to-Repair. In DRS2022 Bilbao: Design Research Society Conference 2022., 29, Design Research Society, DRS 2022 Bilbao, Bilbao, Spain, 25/06/22. https://doi.org/10.21606/drs. 2022.718

[26] Alex Steffen. 2016. In Rinde, M. 2016. Imagining a Postcarbon Future. Distillations, 2, 3, 24-33.

[27] Britta Schulte. 2019. Design Fiction Probes — Interrogating Technologies of the Future. Retrieved March 6th, 2023, from https://tinyurl.com/sza2ux6

[28] Batya Friedman and Lisa P. Nathan. 2010. Multi-lifespan information system design: a research initiative for the hci community. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '10). Association for Computing Machinery, New York, NY, USA, 2243–2246.

https://doi.org/10.1145/1753326.1753665

[29] Bonnie Nardi. 2016. Designing for the Future - But Which One?, Interactions, 23, 1, Jan-Feb, https://doi.org/10.1145/2843592