

# CODESIGNING WITH BLOCKCHAIN FOR SYNERGETIC LANDSCAPES

*The CoCreation of Blockchain Circular Economy through Systemic Design*

MARIE DAVIDOVA<sup>1</sup> and DERMOTT MCMEEL<sup>2</sup>

<sup>1</sup>*Welsh School of Architecture / Collaborative Collective*

<sup>1</sup>*davidovam@cardiff.ac.uk / md@collcoll.cc*

<sup>2</sup>*School of Architecture and Planning, Auckland University*

<sup>2</sup>*d.mcmeel@auckland.ac.nz*

**Abstract.** The paper is exploring methodology within the work in progress research by design through teaching project called ‘Synergetic Landscapes’. It discusses codesign and cocreation processes that are crossing the academia, NGOs and applied practice within so called ‘real life codesign laboratory’ (Davidová, Pánek, & Pánková, 2018). This laboratory performs in real time and real life environment. The work investigates synergised bio-digital (living, non-living, physical, analogue, digital and virtual) prototypical interventions in urban environment that are linked to circular economy and life cycles systems running on blockchain. It represents a holistic systemic interactive and performing approach to design processes that involve living, habitational and edible, social and reproductive, circular and token economic systems. Those together are to cogenerate synergetic landscapes.

**Keywords.** Codesign; blockchain; systemic design; prototyping; bio-digital design.

## 1. Introduction

‘The design of connections between places, communities, and nature is widespread, and accelerating (Thackara, 2015). These new undertakings may be diverse, but a green thread connects them: the understanding that caring for the health of a place and of the persons who inhabit it are parts of one story. With this care for place as their frame, communities are connecting the “what is” with the “what if?” across a range of activities, including regional food hubs, High Nature Value farming, fibershed and grain chains, biorefining, forest and watershed recovery, land-based learning, code clubs, and the maker movement.’ (Thackara, 2019)

This paper reports on current work in progress (WIP) on the Synergetic Landscapes Masters in Architectural Design postgraduate unit B research by design studio of the Welsh school of Architecture that takes part in Cardiff

University's Community Gateway project (Cardiff University, 2019). The focus here is on the context for the research on how blockchain offers a novel methodology for understanding and 'enacting' codesign through prototyping within cross-species coliving in urban environment (see Figure 1). Blockchain presents challenges to preconceptions of organisational and hierarchical structures. Since its inception blockchain has had negative associations with the crypto-currency Bitcoin being used on the dark web for anonymously buying drugs and other illicit trading. However, the idea behind blockchain, which we will unpack in section 2, is more altruistic. Blockchain is not inherently 'evil' as is often the presumption, rather it presents a novel way to rethink trust, power, oversight and control within systems. In our work we will deploy it in codesign settings to explore opportunities for new inter-species relations.



Figure 1. TreeHugger: The Ecosystemic Prototypical Urban Intervention with engraved QR code leading to site with its DIY recipe (Davidová, 2019; Davidová & Prokop, 2018; Davidová & Zimová, 2018).

The world today faces an Anthropocene Extinction, or 6th Mass Extinction (Dirzo et al., 2014). The reported declines are suspected to be caused mainly by human land use. I.e. locally, farming practices can affect arthropods directly by application of insecticides, mowing or soil disturbance, or indirectly via changes in plant communities through the application of herbicides or fertilizers. Forestry practices can also affect local arthropod communities via changes in tree species composition or forest structure. In addition, local arthropod populations can be affected by land use in the surrounding landscape; for example, through the drift and transport of pesticides and nitrogen by air or water, through the effects of habitat loss on meta-communities or by hampering dispersal (Seibold et al., 2019). Various environmental ecologists show that many species are adapting for life within the cities (Nemeth & Brumm, 2009). Therefore, the previously anthropocentrically-developed cities need to adapt for cross-species coliving conditions (Davidová & Raková, 2018) unless we are not to face full deadly biodiversity loss.

As humans have equal-neither privileged nor pejorative-roles within the overall ecosystem and biosphere (Boehnert, 2015), human world citizens must

pursue their active equal role within the cocreation of biosphere (Davidová & Zimová, 2018). The World Economic Forum has recognised that blockchain, crypto-currency and the ‘token economy’ provide a means for 21st century communities and distributed organisation to reclaim power and enact their values in a way not possible through 20th century centralised banking, industrial and commerce models (World Economic Forum, 2018). This research extends existing research (systemic approach to architectural performance and rethinking the blockchain) and explores how these methodologies, technologies and concepts might empower communities, reconfigure ecosystems of people/plants/animals/things to create sustainable ecosystems of commerce and exchange. These ecosystems of exchange are based around things people and others value (water quality, sustainability) rather than the (monetary) value of things.

## 2. Project Description

In this section we briefly contextualise the current work by discussing previous iterations, the current project and its specific aims. It goes on to contextualise blockchain and its role in helping to explore new inter-species relationships.

### 2.1. HISTORY

The project is relating two separate existing researches: a) Systemic Approach to Architectural Performance (SAAP); b) rethinking relational conventions through blockchain. To both fields, codesign and cocreation processes are central driving tools.

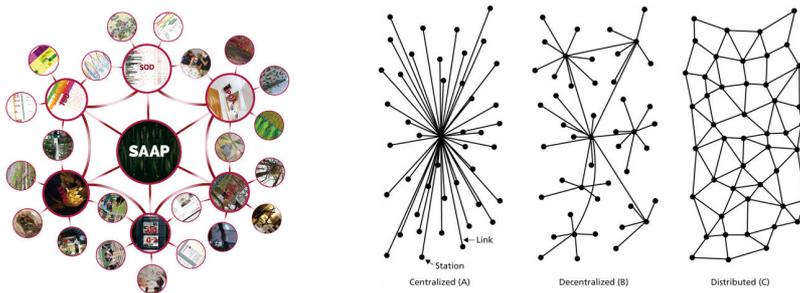


Figure 2. From left to right a) Synergised integrated process-based fields of SAAP (diagram: Davidová 2019) b) Centralized, decentralized and distributed networks. diagram (Baran, 1964).

SAAP is the fusion of process based fields formerly initiated by the integration of Systems Oriented Design and Performance Oriented Architecture (see Figure 2). SAAP involves Time Based EcoSystemic CoDesign and CoLiving, which is performed by both biotic and abiotic agents, including humans. It is ‘Time Based Design’ (Sevaldson, 2004, 2005), which merges and develops

methodological processes and the result's performance evolving in time. While doing that, it generates theory through experimental practice. It is based in (eco) systemic interventions that therefore co- and re-design the initial system by its copformance and coliving. These interventions are fusing the natural, edible, social and cultural environments of a variety of species, including humans, with abiotic agency (Davidová & Raková, 2018). For example, the TreeHugger wood responsive insect hotel (see Figure 1) interacts with larger ecosystemic network, being codesigned by the community, whilst being a product of material science research. It is offering diverse habitation as well as it is being feeder for bats and birds and advertising recipes for its iterations (Davidová, 2019; Davidová & Prokop, 2018). All those processes are codesigned in real time. In a novel approach we relate non-monetary system of values in blockchain to investigate cross-species and cross-matter circular economies that explore bottom up system that can mitigate variety of kinds of scarcity.

To understand the value of blockchain in this context is it best to return to its origins. It was a response to the 2008 financial crisis, caused by a combination of bank risk-taking and limited oversight. Under the pseudonym 'Satoshi Nakamoto' a group published a white paper proposing a new system for peer-to-peer transfer of funds that does not need a third party-a bank-to verify a ledger of transactions (Nakamoto, 2008). Bitcoin was the test currency and blockchain the technology on which it was built. Making the digital ledger of bitcoin transactions public enabled a level of oversight not previously possible. Simultaneously, it enabled computational checking that the ledger was not being tampered with. In removing the need for a banking or financial institute to 'check' it removes the power asymmetry between the bank its customers. It also removes structures and agents that enable and reward risk-taking; which becomes possible when a few individuals have insight, control and access to a substantial pool of resources aggregated from a large pool of individuals.

As our understanding of blockchain grows so too does our understanding of its implication. Artists Rethinking the blockchain provide a more speculative and theoretical perspective on DLT (Catlow, Garrett, Jones, & Skinner, 2017). A coffee machine is given a bitcoin 'wallet,' and instructions for buying coffee. It is also paying users of the machine who cleans it (Tallyn, Pschetz, Gianni, Speed, & Elsdén, 2018). It is no longer just people that have the capability to trade, and the rationale for decisions on the purchase of coffee beans are encoded into the coffee machines programming. The power of decision making is also taken from the hands of individuals. Elsewhere Distributed Autonomous Organisations (DAOs) are emerging. These organisations are using these traits of blockchain to eliminate organisations hierarchy and power structures, increase transparency and reduce bureaucracy (Norta, 2015, 2016). This technology is being touted as fundamentally transformative, and as such it compels an exploration of existing structures and how they may be rethought. In this case it provokes the question of what are the opportunities for new forms of relationships between human and non-human?

Much of the history of civilisation is based on organising in centralised and decentralised systems (Figure 2). A library, government or place of work all

organise people in one of these two ways. In 1964, with specific regards to communication, Baran hypothesised the problematic of these two systems and the opportunities that a distributed system might present (Baran, 1964). We now recognise this as the fundamental principle on which the internet is based, and how this system of communication can be powerfully transformative. Blockchain has presented us with the ability to ask what if other things, such as banking, could be structured differently to mitigate these problems. This project asks what if our relationship with other species could be reorganised to be more transparent, trusting and resilient.

## 2.2. PROJECT AMBITIONS

The WIP project discusses prototyping within the collaborative Synergetic Landscapes unit. This unit is to investigate the synergy of ‘non-anthropocentric architecture’ (Hensel, 2013), codesign across human and non-human communities and its linkage to emerging technologies. It is testing on how the emerging technologies (blockchain, reading and prototyping devices) and innovative approaches to life and business (circular economy, platform and token economies) help us rethink established forms of exchange and value with regards to sustainability and cultural landscape ecosystems. By doing that, the unit aims to investigate the possibilities of integration of decision-making on landscapes from the ‘bottom up’ on a community level within a recently deprived community of Grangetown, Cardiff, Wales, UK.

## 3. A Methodology

This core section explores the problematic of the designer (singular), as well as the opportunities presented by codesign and how blockchain presented a novel working method to advance current discourse on codesign.

The project presents an opportunity to challenge the trope of the individual creative designer. It extends the narrative to question the agency which humans have to ‘design’ for and control other species. This trope is one we teach and aspire to, and it is reinforced in the design media and in education. Design schools are replete with textbooks and lectures on Vitruvius, Mies van der Rohe and Hadid. Yet the modern age of design as a complex inter-disciplinary process is well recognised and documented in current (Apple) and historical (Bell Labs) cases (Gertner, 2012; Isaacson, 2011). Moreover, while codesign is currently in vogue in many circles, reconciling the ideology of the collective and the individual designer, it is not without challenges. A reasonably well documented example is Erskine’s Byker Wall, often celebrated as a successful codesigned project. It is most often referred to as Erskine’s Byker Wall; prefaced with the Architect’s name the project is evidence of our fascination and comfort with the myth of the ‘individual’ designer. In many ways the project was a failure. Firstly, Byker was a 17,000 strong community and only 46 households were picked to engage with the architect in what was then known as ‘public participation.’ In a thoughtful critique of the project by Anna Minton the power dynamics and asymmetries of both the design and political processes are brought to centre stage (Minton, 2015).

The problematics of power geometries has been well reviewed by Doreen Massey (Massey, 2013). Within digital systems this is also cause for concern, as the designers of the systems are the agents with real power, with users relinquishing it for gains in convenience and efficiency (Haraway, 1991). Returning to our project the opportunities presented by blockchain are to remove or redesign these power structures to reduce the asymmetry that Haraway and Massey posit as inherent in such systems of organisation. Such approaches are specifically needed in excluded communities like Grangetown in cities like Cardiff that largely suffer by productive generation unemployment and homelessness. In addition, other species have been by now excluded from participation in any capacity beyond optimisation for domestication or industrial farming.

### 3.1. DESIGN (AND VALUE)

‘If the Anthropocene proves more a fleeting geopolitical instant than a slow geological era - waves of apes maniacally excavating ancient carbon and drawing loops on maps - then whatever comes ‘next’ would be formed not by the same Anthropos but by something literally post-, un-, in-‘human’, for better or worse. So too the cities. ‘(Bratton, 2019).



Figure 3. Diagram showing the relationship between the collective and the individual and between the mapping and the prototyping (diagram: Davidová 2019).

The holistic team-built WIP project is exploring possibilities of cities' transition towards Post-Anthropocene for cross-species bio-digital coliving. This is approached through codesign and full-scale prototyping in the complexity of real life and real time in so called 'real life codesign laboratory' (Davidová et al., 2018). It is investigating prototyping of materialised ecosystemic interventions for cross-species habitable and edible cultural landscape ecotop. The project will test its linking through QR codes to their online recipes for DIY. This is to investigate if such action can support local- and visiting- makers' communities (empowering people by skills, tools sharing and open access designs). Therefore also, if it can grow a number of its own iterations. Subsequently, such prototypes and recipes will investigate how they can be networked to a blockchain system of values investigating its use for socially and environmentally sustainable circular economy. Or generally, it will investigate on how to develop new structures for social/economic exchange 21st century models.

The methodology is grounded in Research by Design (Morrison & Sevaldson,

2010; Sevaldson, 2010). This means that the unit generates theory through experimental practice of designing and its outputs implementation into-, observation of- and reflection on- the real-life codesign laboratory. The designing is approached through combining codesign (Sanders & Stappers, 2008) with individual design in Systems Oriented Design (SOD) (Sevaldson, 2013) and full-scale prototyping (Hensel & Menges, 2006). Such combination is a driving methodology in Systemic Approach to Architectural Performance (SAAP) (Davidová, 2017, 2018). The students are developing collaborative teamworking skills while holding their specific roles within the team. This is approached through collaborative visual complexity mapping tool of SOD, so called gigamapping (Sevaldson, 2018). The students' roles are based on their research interest within the unit's team project. Therefore, each individual student is deeply developing her/his research interest into an expertise and learn how to relate such to other team members' expertise within a framework of one complex collaborative holistic project. After the initial collective project of several interventions that will be prototyped in real life, each individual student will develop her/his expertise and its relations to others into a design thesis. This will be informed by real life observations and improvements (see Figure 3).

### 3.2. CODESIGN THROUGH GIGAMAPPING AND PROTOTYPES WITH BLOCKCHAIN

This project is exploring several layers of codesign. The processes also involve the cocreative planning for the initial generative interventions as well as codesigning them in real life through interaction and DIY. They address the urgent questions in Systems Oriented Design on needs of representing the participants that wouldn't be heard otherwise (Sevaldson, 2018). The first stage mainly involves people, the people that represent certain human or nonhuman social groups involved. The second stage involves the overall environment. What are the implications for a bird or a tree having a 'wallet' and trading power? What behaviour would manifest where human and non-human interactions and exchanges were recorded in an immutable DLT? Can Mamuna get the code and the material to reiterate the ecosystemic prototype she likes in her front garden, because she has been volunteering on community gardening that coproduces food for homeless people? Can the pollinators get paid for doing their job for coproducing the food for the community garden? And what about the plants? Etc...

This all has started with the codesign gigamapping workshops (see Figure 4), where the local community with its youngest, various stakeholders and specifically, local NGOs play critical role. One layer already incorporated in that is interaction with concepts provoked by blockchain next to the future DIY generated from the first-generation intervened prototypes. The background rich community has been updating the integration of Muslim religion into blockchain concept which is offering many solutions to that social group. I.e. in Muslim religion, there is no possibility of interest payment. Therefore, one needs to gather community together to buy a house or open a café. They all provide a service to each other and must operate without the bank. With blockchain, there is no bank and it can well accommodate such system. One needs no money for buying coffee

in Ali's shop. You can earn your tokens for taking care of Grange Garden. By doing that, you have raised Ali's café income. Therefore, he is glad to award you with the best and ethical coffee (see Figure 4). Also, many other social groups can get integrated through blockchain though they might not well fit into the 20th century economic model and by it ruled society.



Figure 4. From left to right: a) Gigamapping codesign workshop with the community; b) A cafe owner draws a concept of the possibility of serving coffee to those that cannot afford it. (photos: Davidová 2019).

The second fully focused on blockchain workshop will also cover format targeted at non-technical people. The format will build on work started by the Design Informatics Research Centre at the University of Edinburgh and developed upon by the 'Chip of the New Block(Chain) research project at the University of Auckland. The workshops are comprised of three distinct parts, a presentation, a trading game and an ideation session. First, in a short presentation we introduce in very general terms blockchain. Second, participants build a blockchain. Using Lego to represent bitcoin they buy and sell trading cards and build the blocks onto a Lego blockchain. This creates a permanent record of the transactions that everyone can see, helping to create a tangible point of reference. Third, an ideation session is facilitated by the organisers. Here the participants are encouraged to consider what opportunities this technology might present. The session ends with a design exercise to propose a new concept in how blockchain might reorganise an existing situation and what benefits might be gained.

The third stage of codesign will already stimulate the cocreation through real life prototypical interventions of token systems within the 'real life codesign laboratory', both the analogue and its cross-related virtual ones. Such observations will be generically cocreated by its communal environment as well as updated by the initial authors for their master dissertations.

#### 4. Conclusion

This work in progress discusses some of the factors being explored by the authors about design in the 21st century in search for balance and equity across diverse species and social groups in Post-Anthropocene. What the Post-Anthropocene could mean? What if beehives have a crypto-currency wallet and money where you had to pay the hive to harvest its honey? What if the hive paid locals who maintained flowerbeds? As bee's reside within a certain radius of the hive,

what if their 'money' could only be spent within certain proximity of the hive? These concepts all become plausible with programmable crypto-currency. We are designing within and with inter-species and inter-communities' architecture with the concept of circular economy. Can we assign 'value' to other species and their presence in the build environment? Can we design systems that encourage and support interspecies existence? The work seeks for tools for participation of those who typically can't rise their voice to codesign social, environmental and economic systems from the 'bottom up'. How can the power asymmetry between human and non-human species be reduced? How would we as a species feel about a redesign and reduction of our power, control and oversight of our environment? The paper documents a Systems Oriented Design methodology, informed by- and informing- blockchain, that is typically seen as evil, for a possible collaborative design approach. This work contributes to the body of knowledge by providing an approach that allows researchers to explore a novel collaborative design methodologies as well as speculate on design in a Post-Anthropocene world.

## References

- "Community Gateway - Cardiff University": 2019. Available from <<https://www.cardiff.ac.uk/community-gateway>> (accessed 2019-06-19).
- Baran, P. 1964, On Distributed Communications, in P. Baran (ed.), *RAND-Memorandum RM-3420-PR*, RAND Corporation, Santa Monica.
- Boehnert, J.: 2015, Ecological Literacy in Design Education - A Theoretical Introduction., *FormAkademisk - Research Journal of Design and Design Education*, **8**(1), 1–11.
- Bratton, B.: 2019, Further Trace Effects of the Post-Anthropocene, *Architectural Design*, **89**(1), 14–21.
- R. Catlow, M. Garrett, N. Jones and S. Skinner (eds.): 2017, *Artists Re: thinking the Blockchain*, Torque Editions & Furtherfield.
- Davidová, M.: 2017, Systemic Approach to Architectural Performance: The Media Mix in the Creative Design Process, *FormAkademisk - Research Journal of Design and Design Education*, **10**(1), 1–25.
- Davidová, M.: 2018, Roles, Agency and Relations of GIGA-Maps in Systemic Approach to Architectural Performance: The Special Prototypes of Post-Anthropocene, *Critical Practice in an Age of Complexity*, Tucson, 114–132.
- Davidová, M.: 2019, Intelligent Informed Landscapes: The Eco-Systemic Prototypical Interventions' Generative and Iterative Co-Designing Co-Performances, Agencies and Processes, *Intelligent & Informed - Proceedings of the 24th CAADRIA Conference*, Wellington, 151–160.
- Davidová, M. and Prokop, Š: 2018, TreeHugger: The Eco-Systemic Prototypical Urban Intervention, *6th eCAADe RIS 2018 Proceedings*, Nicosia, 75–85.
- Davidová, M., Pánek, K. and Pánková, M.: 2018, Spiralling Slope as a Real Life Co-Design Laboratory, *AMPS Proceedings Series 12. Critical Practice in an Age of Complexity*, Tucson, 133–142.
- Davidová, M. and Raková, D.: 2018, Biodiversity and Climate Change Adaptation through Non-Discrete Architectural Spaces and Architectures: Systemic Approach to Traditions for Sustainable Futures, *FormAkademisk - Research Journal of Design and Design Education*, **11**(4), 1–31.
- Davidová, M. and Zimová, K.: 2018, COLridor: Co-Design and Co-Living Urban Adaptation, *FormAkademisk - Research Journal of Design and Design Education*, **11**(4), 1–30.
- Dirzo, R., Young, H.S., Galetti, M., Ceballos, G., Isaac, N.J.B. and Collen, B.: 2014, Defaunation in the Anthropocene, *Science*, **345**(6195), 401–406.

- World Economic Forum, -: 2018, *Fourth Industrial Revolution for the Earth Series Building block(chain)s for a better planet About PwC*, World Economic Forum, Fourth Industrial Revolution for the Earth Series.
- Gertner, J.: 2012, *The idea factory: Bell Labs and the great age of American innovation*, Penguin, New York.
- Haraway, D. 1991, A Cyborg Manifesto: Science, Technology and Social-Feminism, in D. Haraway (ed.), *Simians, Cyborgs and Women: The Reinvention of Nature*, Routledge, New York, 149–181.
- Hensel, M.: 2013, *Performance-Oriented Architecture: Rethinking Architectural Design and the Built Environment*, John Wiley & Sons Ltd, West Sussex.
- M. Hensel and A. Menges (eds.): 2006, *Morpho-Ecologies*, AA Publications, London.
- Isaacson, W.: 2011, *Steve Jobs*, Little, Brown, London.
- Massey, D.: 2013, *Space, place and gender*, John Wiley & Sons.
- Minton, A.: 2015, “Byker Wall: Newcastle’s noble failure of an estate – a history of cities in 50 buildings, day 41” . Available from <Retrievedfrom<https://www.theguardian.com/cities/2015/may/21/byker-wall-newcastles-noble-failure-of-an-estate-a-history-of-cities-in-50-buildings-day-41>> (accessed 2019-12-04).
- Morrison, A. and Sevaldson, B.: 2010, Getting Going Research by Design, *FormAkademisk - Research Journal of Design and Design Education*, **3**(1), 1-7.
- Nakamoto, S.: 2008, “Bitcoin: A peer-to-peer electronic cash system” . Available from <<https://bitcoin.org/bitcoin.pdf>> (accessed 2019-06-19).
- Nemeth, E. and Brumm, H.: 2009, Blackbirds sing higher-pitched songs in cities: adaptation to habitat acoustics or side-effect of urbanization?, *Animal Behaviour*, **78**(3), 637–641.
- Norta, A. 2015, Creation of smart-contracting collaborations for decentralized autonomous organizations, in R. Matulevičius and M. Dumas (eds.), *International Conference on Business Informatics Research*, Springer, Tartu, 3–17.
- Norta, A. 2016, Designing a smart-contract application layer for transacting decentralized autonomous organizations, in A. Sharma, T. Ören and W. Grosky (eds.), *International Conference on Advances in Computing and Data Sciences*, Springer, Singapore, 595–604.
- Sanders, E. and Stappers, P.J.: 2008, Co-creation and the new landscapes of design, *CoDesign*, **4**(1), 5–18.
- Seibold, S., Gossner, M.M., Simons, N.K., Blüthgen, N., Müller, J., Ambarlı, D., Ammer, C., Bauhus, J., Fischer, M., Habel, J.C., Linsenmair, K.E., Nauss, T., Penone, C., Prati, D., Schall, P., Schulze, E.D., Vogt, J., Wöllauer, S. and Weisser, W.W.: 2019, Arthropod decline in grasslands and forests is associated with landscape-level drivers, *Nature*, **574**(7780), 671–674.
- Sevaldson, B.: 2010, Discussions & Movements in Design Research A systems approach to practice research in design, *FormAkademisk - Research Journal of Design and Design Education*, **3**(1), 8–35.
- Sevaldson, B.: 2013, Systems Oriented Design: The emergence and development of a designerly approach to address complexity, *DRS // CUMULUS 2013*, 14–17.
- Sevaldson, B.: 2018, Beyond User Centric Design, *Relating Systems Thinking and Design 2018 Symposium Proceedings: Challenging complexity by Systemic Design towards Sustainability*, Torino, 516-525.
- Sevaldson, B. 2018, Visualizing Complex Design: The Evolution of Gigamaps. In P. Jones & K. (Kyoichi) Kijima (Eds.), (pp. 243–269), in P. Jones and K. Kijima (eds.), *Systemic Design*, Springer Japan, Tokio, 243-269.
- Tallyn, E., Pschetz, L., Gianni, R., Speed, C. and Elsdon, C.: 2018, Exploring Machine Autonomy and Provenance Data in Coffee Consumption: A Field Study of Bitbarista. , 170., *Proceedings of the ACM on Human-Computer Interaction*, **2**(CSCW), 170.
- Thackara, J.: 2015, *How to thrive in the next economy: designing tomorrow’s world today*, Thames and Hudson, London.
- Thackara, J.: 2019, Bioregioning: Pathways to Urban-Rural Reconnection, *She Ji*, **5**(1), 15–28.