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The Future Is Metahistory: Using Spime-based Design Fiction As A Research Lens For Designing Sustainable Internet of Things Devices

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A spime describes a device that could generate data about itself throughout its entire life-cycle and this 'metahistory' would be saved and remain searchable and mineable. Given growing Internet of Things (IoT) device e-waste and material scarcity issues, the concept of spimes provides a useful approach to addressing the current lack of consideration of sustainability in the IoT. Using Design Fiction, we generated a series of near future artefacts that help concretise a world in which the UK Government sanctions the use of blockchain technologies to sustainably manage spime metahistories. The Government's so called 'Open Traceability Protocol' enables citizens to securely trade data-rich spime objects, use recycling apps to search for replacement spime components, and to access spime devices' provenance information. The paper outlines the design of the artefacts that ask whether increased data transparency would place greater accountably upon designers and producers in relation to the resources they deplete to manufacture connected products, while at the same time making such issues explicit to users of IoT devices. We also discuss how reflecting upon our design process enabled us to develop a theoretical lens – *IoT Design Ethics and IoT Data Ownership* – through which aspects of IoT unsustainability can be more thoroughly considered. Finally, we argue that viewing this lens alongside two previously developed spime research lenses allows the formation of an overarching *multidimensional lens for spimes*, which we contend researchers and practitioners can harness in order to begin reframing IoT design culture as a more sustainable paradigm for design practice.

Keywords: spimes; metahistory; sustainability; digital technology; data; design fiction

1 Introduction

With the Internet of Things (IoT) rapidly expanding, people are accumulating increasing numbers of physical-digital assets and artefacts, that is, everyday objects whose material elements are augmented by internet connectivity which allows them to be readable, recognisable, locatable, addressable, and/or controllable by computers. Thus, everyday devices like fridges, kettles and locks, not only perform their traditional function but they also collect and exchange data (Rowland et al, 2015). Whilst societies have long established value cultures in regards to 'purely' physical items, we argue that the different types of value

propositions Internet-connected artefacts facilitate are less understood. The manner in which technology providers such as Google, Amazon and Apple surreptitiously harvest and monetise the personal data that people generate when using their connected product-services, is perhaps the most prominent example of how the IoT is changing our relationships with objects and artefacts. As Authors (2018a) have shown, the often simple and user-friendly nature of IoT devices' interfaces is in reality a frontage for extremely complex *constellations* of virtual processes and interactions. The *visible* elements of the IoT – the physical products – work in conjunction with the *invisible* aspects – creating expansive digital infrastructures which share peoples' personal data through a plethora of algorithms, 3rd party platforms, data concentrators and server networks.

The 'invisibility' of these processes and infrastructures is a source of growing concern (Sadowski, 2016). Recent controversies like Cambridge Analytica's alleged misuse of 87 million peoples' Facebook data to influence voting patterns during the 2016 US presidential election (Solon, 2018), highlights the privacy and security risks, and indeed ethical issues, which stem from internet platforms capturing, selling and manipulating users' personal data. Debate has thus begun regards the regulation of access to IoT product-service data and how such information may be put to purpose (Brass, Carr & Blackstock, 2017). In light of such discourse, we developed upon Sterling's concept of *spimes* (2005) as a way to explore alternate value propositions arising from the acquisition and sharing of people's personal connected product-service data.

2 Spime-based Design Fictions

When viewed simply, spimes are a class of near future, internet-connected objects, but unlike the disposable IoT products that permeate our society today, these devices would be designed so that they can be managed sustainably throughout their entire lifecycle, from their initial production to having their components recycled and reused at the end of their life. Spimes, in essence, would aim to make the implicit consequences of product obsolescence and unsustainable disposal explicit to potential users (Author, 2017). Figure 1 and 2 depict two previous spime-based design fictions – the *Toaster For Life* and *HealthBand* Do-It-Yourself (DIY) wearable health device. Both are examples of using the emergent method *Design Fiction* (Bleecker, 2009, Authors, 2018a) to concretise near future worlds in which spime product-services *plausibly* exist, as well as to consider the different types of sustainable people-product relationships such devices and their associated technological features may possibly facilitate (Author, 2016; Authors, 2018b). Whilst these fictions examine different aspects of the spime concept, both extrapolate from present day emergent technologies and design practices. This approach is significant as the origins of spimes are *in the present* as they are a *rebuttal* to today's unsustainable product design culture. The earliest, near future spime objects would therefore likely share some technological attributes with present day IoT devices (Author, 2016).

Figure 1. The Toaster For Life (2016). This fictitious sustainable mass produced connected toaster affords effective repair, upgrade, customisation, recycling, and its parts and components are all inherently trackable. Source: Authors.

The *Toaster For Life* explores three *key classifying design criteria for a spime objects* (Author, 2017), namely *sustainability*, *technology* and *temporality*. The basis for the fiction are disparities identified between contemporary sustainable design theory and unsustainable *centralised* product manufacturing processes. This incongruity is represented through the extrapolation of emerging present day technologies including RFID, GPS and 3D printing which are married with fictitious sustainable characteristics, and then incorporated as features into the spime toaster's design. Consequently, within the design fiction, the 'mass produced' toaster affords effective repair, upgrade, customisation, recycling, and its parts and components are all inherently trackable. The fiction demonstrates how manufacturers might begin to embrace new cyclical product-service relationships with customers, akin to circular economy thinking (Webster, 2015). In doing so, it proposes provocative alternatives to *planned obsolescence* being an integral part of IoT products' lifecycles, which ultimately creates copious amounts of e-waste.

Figure 2. The HealthBand Do-It-Yourself medical wearable (2018) is a fictional crowdfunded, open source device which explores the sustainable potential of social innovation and localised production channels. Source: Authors.

The *HealthBand* fiction was a means to further unpack the spime design criteria *synchronicity* and *wrangling*. In recent years, practices and technologies like open source hardware, crowdfunding and the maker movement have increasingly been cited as a more environmentally friendly alternative to the mass manufacture and distribution of products (Smith & Light, 2017; Kohtala & Hyysalo, 2015). To embody these ideas, *HealthBand* explores the relationship between *decentralised* and *democratised innovation* design activities (von Hippel, 2005) and the IoT. In accordance with a Design Fiction as World Building (DFasWB) approach (Authors, 2017a), a range of related artefacts were generated to provide various 'points of entry' for audiences to engage with the fiction's near future world where DIY health devices are commonplace. The fiction also aims to emphasise the broader social, ethical and sustainable implications of decentralised design practices and technologies – particularly in relation to future product manufacturing policy and legislation.

3 Metahistory: A Spime Design Criteria

Our third spime-based Design Fiction explores how *metahistory* could become a central design criteria. In doing so, *The Future Is Metahistory* fiction examines the possible sustainable implications of the data driven 'digital instantiation' of a spime. To begin defining metahistory as a criteria, we studied Csikzentmihalyi and Rochberg-Halton's (1981) work on the psychology of material culture. They have concluded that people have substantial personal histories with each and every material thing that they own. On the whole, such histories are only recorded on the objects themselves as patina – signs of age and use – and as thoughts and memories to which, by and large, only the user(s) of the artefacts are

aware of. As Author (2017) notes, a spime device, conversely, would generate important data about itself and its interactions with its user(s) throughout its entire life-cycle and this rich and complex metahistory would be saved and remain searchable, trackable and mineable at any time. Sterling (2005) argues that moving to a spime-based paradigm would deepen the relationships people have with their material products as this future would see silos of metahistories becoming 'informational resources [which are] manipulable in real time'.

At this juncture, it would not be unreasonable to argue that through its expanding array of networked artefacts, sensors and AI capabilities, the IoT is beginning to bring forth eventualities which are similar to those which spimes might potentially yield. Indeed, the enormous growth in the use of data sensing physical IoT devices such as smart phones, voice activated speakers, connected televisions and fitness wearables has led to a thriving information economy. Like would-be spime objects, the digital histories generated by people as they use their IoT products are being captured, stored and mined. However, whereas the likes of Google and Facebook interrogate this 'big data' for commercial gain, the principal value of the 'informational resources' spimes would create would manifest through means to support *environmental sustainability* (Author, 2017). Sterling (2005) believes that mining spime metahistories would help inform sustainable decision-making, particularly in relation to the lifecycle of material goods. He envisages that, once recorded, a spime object's metahistory data would remain 'available online for historical analysis by [its user] and any other interested parties'. Author (2017) contends, that, rather than the profits of big data, Sterling was likely inspired by the altruistic value inherent to 'open data'. Such datasets are often shared and mined to help inform decision-making with regards to public policy or legislation.

As a concept, spimes shares similarities with Iishi & Ullmer's (1997) notion of 'tangible bits', in that, by imbuing material artefacts with virtual properties, the boundary between our physical, man-made environment (atoms) and cyberspace (bits) will become more *seamless* and *symbiotic*. Importantly however, a near future spime object's design would seamlessly intersect physical and digital parameters along with that of *sustainability* (natural environment) – all three attributes being of equal importance within the spime design process (Figure 3). Further, we contend that the confluence of the three parameters results in what we call the *Spime-based Design Fiction practice space*.

In the next section, we will go into more detail with regards to how we used Design Fiction to concretise a plausible world in which the transparency of spime data is every day and mundane. In our design fiction, it is *sustainable accountability*, with a view to countering connected product e-waste and material scarcity, as opposed to monetary value, that is the principal resource obtained from data sharing practices. As such, *The Future Is Metahistory* seeks to ask whether increased data transparency, alongside the adoption of particular emergent technologies and practices, would influence people to embrace new, more sustainable modes of product ownership? Likewise, would transparent lifecycles place greater accountably upon designers and producers in relation to the resources they deplete to design and manufacture connected devices?

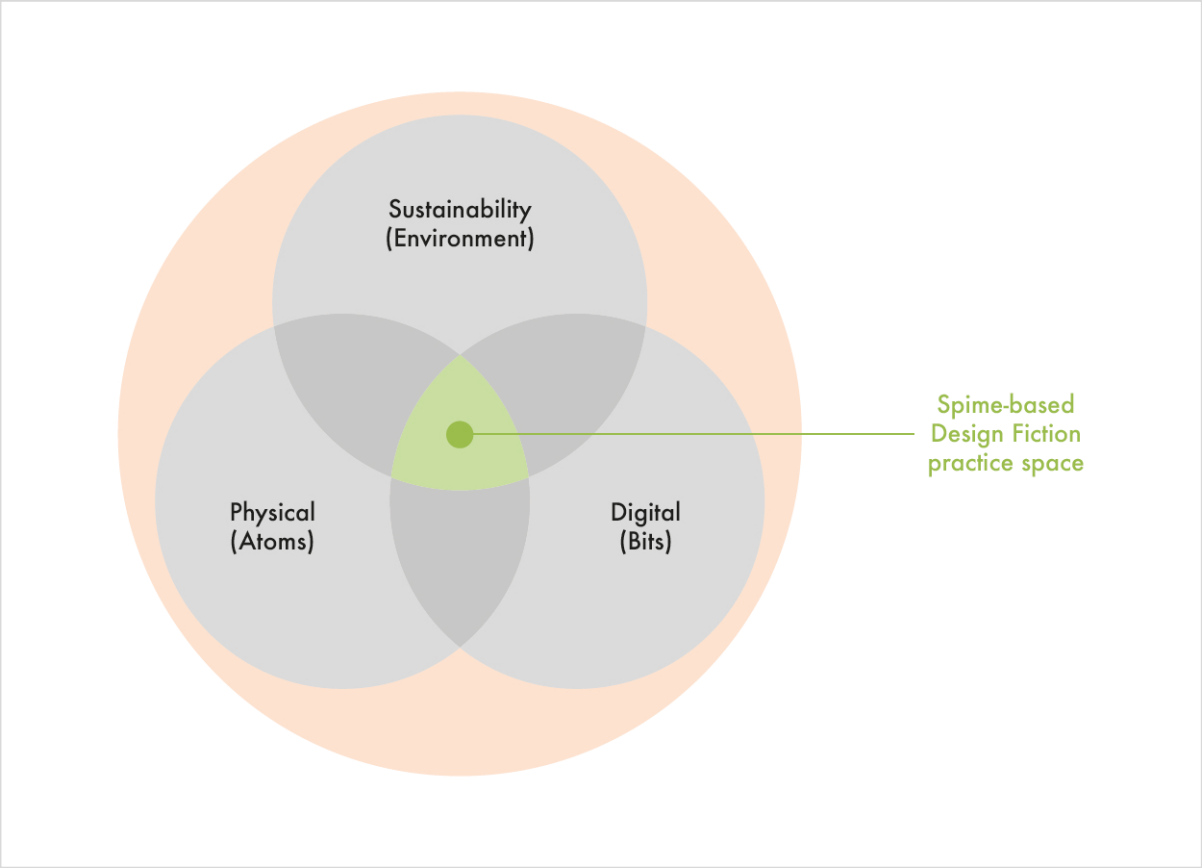

Figure 3. A Venn diagram illustrating the seamless intersection between three design attributes for near future spime objects. The confluence of the 3 attributes results in the Spime-based Design Fiction practice space. Source: Authors.

4 Concretising Metahistory

Design Fiction is different to normative design practice, in that, rather than trying to solve existing problems or to produce something for sale or consumption, we use the method to create fictional prototypes which aim to encourage people to think critically about the issues that the prototypes embody. Applying Design Fiction can help us to gain a better understanding about the meanings and values that emerging technologies and products might bring into play should they be adopted by society in the future. Like Speculative Design and Critical Design, early iterations of Design Fiction focussed on the creation of a singular, particular prototype or artefact. DFasWB on the other hand, uses multiple artefacts to critique present day issues while probing potential futures. When brought together, these artefacts can be used to start to define multiple entry points to an artificially created world. Each entry point describes that world at a different scale. The effect is a reciprocal prototyping relationship, where the world is prototyping the artefacts and the artefacts are prototyping the world.

Figure 4 depicts our first artefact - an advertisement for a spime-like Internet-connected clothes iron called the Bosch Meta-Glide 3000. This prototype is designed to emphasise the types of routine ‘metahistorical product data’ that users’ would potentially be privy to in a spime-centric near future world. Unlike today, where consumers’ know very little about the origins and history of their IoT products, in this future where spimes are commonplace, people would have the capability to know much more about the physical-digital objects that

they buy. The *Meta-Glide 3000* advertisement is an example of how metahistory data would create transparency in regards to the device's provenance and allow users to discover the 'untold story' of the product, for example, by providing information such as the materials the device is manufactured from, the supply chains it has travelled through to market, and its past and current data usage.

Figure 4. Everyday spime-like devices such this steam iron would generate metahistory data which when made accessible to users could facilitate sustainable behaviour. Source: Authors.

We noted earlier that if spimes were to come into existence in the near future, it is probable that their early 'instantiations' would share some technological and design attributes with present day IoT devices. Thus, like the *Toaster For Life* and *HealthBand*, within the fiction we also chose to extrapolate a notable emergent technology – *blockchain*. A *blockchain* is a publicly distributed digital ledger whose immutable nature makes it a highly secure method for managing data transactions between different parties. It is the technology that underpins the much-publicised cryptocurrency *Bitcoin*. Blockchains are broadcast across global peer-to-peer networks which typically consist of thousands of computers and servers. Transactions are verified by *consensus*, that is, participants on the network confirm any changes between one another. This *decentralised* process eliminates the need for a *centralised* certifying authority, such as an established bank or financial broker. Once verified, a transaction is combined with others to create a new data block for the ledger, which is then added to the existing blockchain. In doing so, *cryptography* ensures the enclosed data becomes permanent and unalterable. Proponents argue, that as well as removing bureaucracy, reducing costs and increasing the speed of transactions, blockchain also makes data processes *transparent* and *traceable*. Many envision a plethora of future applications for the technology in addition to cryptocurrency. These include medical records

management, the control of governmental voting activities, utility tokens granting access to resources like energy and water, and the trading of commodities and investments (Stallings, 2017; Morrison & Sinha, 2018).

Whilst acknowledging the current issues of Blockchain in relation to the consumption of resources and energy (Authors, 2019b), we felt it was still a useful way of approaching the potential of *The Future Is Metahistory* as it helps us concretise both the transparency of would-be spime product metahistories, and the inherent traceability of such devices throughout their entire lifecycle. Although a relatively young sector, several IoT manufacturers and platforms have already gone out of business and as has been seen with defunct firms such as *Jawbone* and *Berg*, all of the data and support services associated with these companies and their products, is consequently no longer available to their customers (Graham, 2017; Fairs, 2014). Having data stored on a blockchain would ensure that it is independent from manufacturers and service providers, and, as is an essential attribute of spime objects, this data would remain accessible to users should a connected product firm cease trading.

Despite the hyperbole currently surrounding blockchain, we argue that the technology has yet to enter the mainstream consciousness. Our second artefact is therefore a fictional Which? help guide entitled *Buying and selling your devices securely: Blockchain and Smart Contracts made easy* (Figure 5). Similar to the technology advice guides that are available today (Which?, 2019), it serves as a means to introduce broader audiences to the technology and explain its complexities and advantages in terms that can be easily understood. 'Published' in 2029, the guide gives examples of near future applications for blockchain including crypto-transfers, speed voting, energy resource betting and, most significant for the purposes of our fiction, *the trading of physical-digital goods*. Within the fiction, the document has been produced together with present day technological bodies, the UK Government's *Digital Service* and the *Citizens Advice Bureau*, alongside the fictional *Alliance for Sustainable Blockchain Stewardship* (AfSBS).

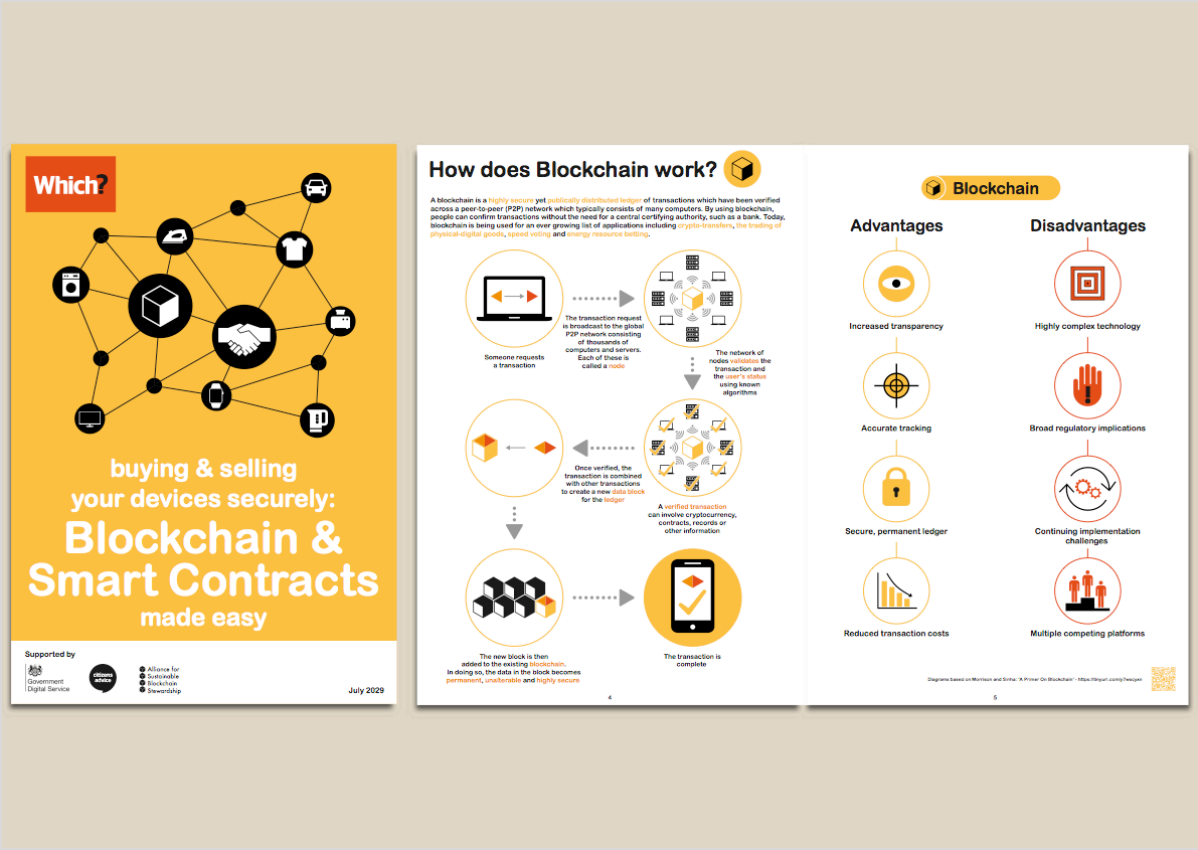

Figure 5. A near future Which? help guide for buying and selling physical-digital devices securely using blockchain and smart contract technologies. Source: Authors.

While distant visions of the future can be worthwhile, we contend that plausible proximate futures are more useful for exploring the meanings and implications of emergent technologies and practices (Authors, 2017b). With this in mind, we referenced the first two organisations, and indeed *Which?*, to 'root' the guide within an 'everyday' and mundane future. We argue that this sense of plausibility lessens the potential for the spime and metahistory concepts to appear fantastical, unreal or 'too futured'. In turn, we believe that building from familiar formats (Authors, 2016) enables the speculation to more meaningfully contribute to broader social, ethical and sustainability debates that are relevant to the implications of adopting spimes. We followed this approach when conceiving all of our artefacts. For example, to establish verisimilitude, we chose to brand the fictional steam iron as a *Bosch* appliance as opposed to fabricating a manufacturing firm. However, in other instances, our fictional motifs are as equally as important as details appropriated from the present, such as the creation of the *AsFBS* which subtly relates the guide to our other artefacts and, thus, also helps to bolster plausibility and explicate a fuller, more rounded world.

Similarly, our third artefact (Figure 6) is a press release written by fictional UK Government Chief Scientific Adviser, Dr Clement Benway, on behalf of the *Council for Science and Technology* and the imagined body *Better IoT Global*. Echoing the rhetoric that often besets new technologies, in our fictional world, metahistory data, in conjunction with blockchain, is considered to hold 'transformative possibilities for environmental sustainability'. Accordingly, the press release outlines how the sustainable benefits of these technologies will be 'optimised' by the UK Government. After a successful trial period, blockchain, with its

transparency and traceability competencies, is deemed to be a secure and robust method for storing and transferring peoples' product metahistory data. The Government therefore seeks to implement its so called 'Open Traceability Protocol' which will allow retailers and platforms to trade in new or used physical-digital devices while ensuring secure and sustainable transfer of said devices' metahistories. To manage this initiative, the Government has sanctioned the formation of an accrediting body – the *AsFBS* – which retains the power to issue the *Secure Metahistory Certification Mark* (SMC Mark) to regulate any retailers or platforms intending to enter the sector.

COUNCIL FOR SCIENCE AND TECHNOLOGY

better IoT global

Alliance for Sustainable Blockchain Stewardship

The Council and BIG announce the formation of the *Alliance for Sustainable Blockchain Stewardship* and the creation of the *Secure Metahistory Certification Mark*

For Immediate Release: 23/02/2026

The Council for Science and Technology and Better IoT Global are pleased to announce the formation of the *Alliance for Sustainable Blockchain Stewardship* and the creation of the *Secure Metahistory Certification Mark*. The announcement comes after implementation strategies for both initiatives were approved by Government following a year of research and consultation:

- The Department for Science and Technology's white paper *The Future is Metahistory: Blockchain, Ecology and the Economy* was published 18/01/25 and outlined potential benefits and possible issues with regard to corporate and public adoption and acceptability of Blockchain and the optimisation of consumers' metahistories.

- Technology and consumer trials held across summer 2025 were successful and provided valuable insights for efficient and secure implementation.

- *Open Traceability Protocol* and knowledge exchange - the increased transparency granted by metahistory data regards physical and digital materials is deemed to hold transformative possibilities for environmental sustainability.

- Optimisation will also create new markets and generate opportunities for platform development and data mining jobs which in turn will boost the overall economy.

- Blockchain's inherent decentralisation is a proven secure and robust alternative to traditional centralised transaction systems. There has been growing mistrust amongst the wider public for conventional banking culture since the UK was again plunged into a recession by banking malpractice in spring 2023.

The alliance will work closely with product manufacturers, data platforms and sustainable bodies on advancing open traceability for sustainable benefit.

The certification mark will be used by stores, platforms and applications to denote a secure and sustainable transfer of consumer's personal metahistories using blockchain and smart contracting processes.

Dr Clement Benway,
Government Chief Scientific Adviser (GCSA),
c.benway@gov.uk

Figure 6. In our fictional world, the transparency of product meta-histories underpinned by blockchain technologies have been identified as having considerable sustainable benefits. This has led the UK Government to implement the 'Open Traceability Protocol'. Source: Authors.

In the document the UK Government envisages that an optimisation of metahistories will create new markets, generate opportunities for platform development and increase employment in the data mining sector, all of which is expected to boost the UK's economy. Figure 7 depicts a user experience tableaux for a near future mobile app called *Lazarus* which has been developed under the auspices of the 'Open Traceability Protocol'. Built on blockchain technologies, *Lazarus* enables people to grant access to the metahistories of transferred products. Consequently, users will be able to view gifted devices' provenance data and 'use-stories' – details of how previous users have interacted with such products during their period of ownership. Inspired by popular 'gifting' websites like *Freecycle* and *TrashNothing*, as well as 'buy and sell' platforms like *Gumtree* and *Craigslist*, we wanted this artefact to provoke questions regarding how spime objects might be designed to negotiate the complexities of being traded through second-hand markets. *Lazarus* would facilitate greater 'asset transparency' by tracking the origins and histories of physical-digital products,

verifying their provenance through blockchain and keeping the 'digital instantiation' of the product 'secured' to the 'physical instantiation' of the same product throughout its entire lifecycle. As Sterling (2005) asserts, spimes are 'always associated with a story. [They] have identities, they are protagonists of a documented process'. An app like *Lazarus* might help to empower sustainable behaviour by affording people the opportunity to easily and *securely* recycle, reuse and repurpose data-rich spime objects when they are no longer wanted or considered to be at the end of their useful life. This process sits contrary to the disposable nature of the IoT, where the underlying sustainable value of physical-digital assets are not maximised. An IoT product's data is often simply erased before its material elements are lost to landfill.

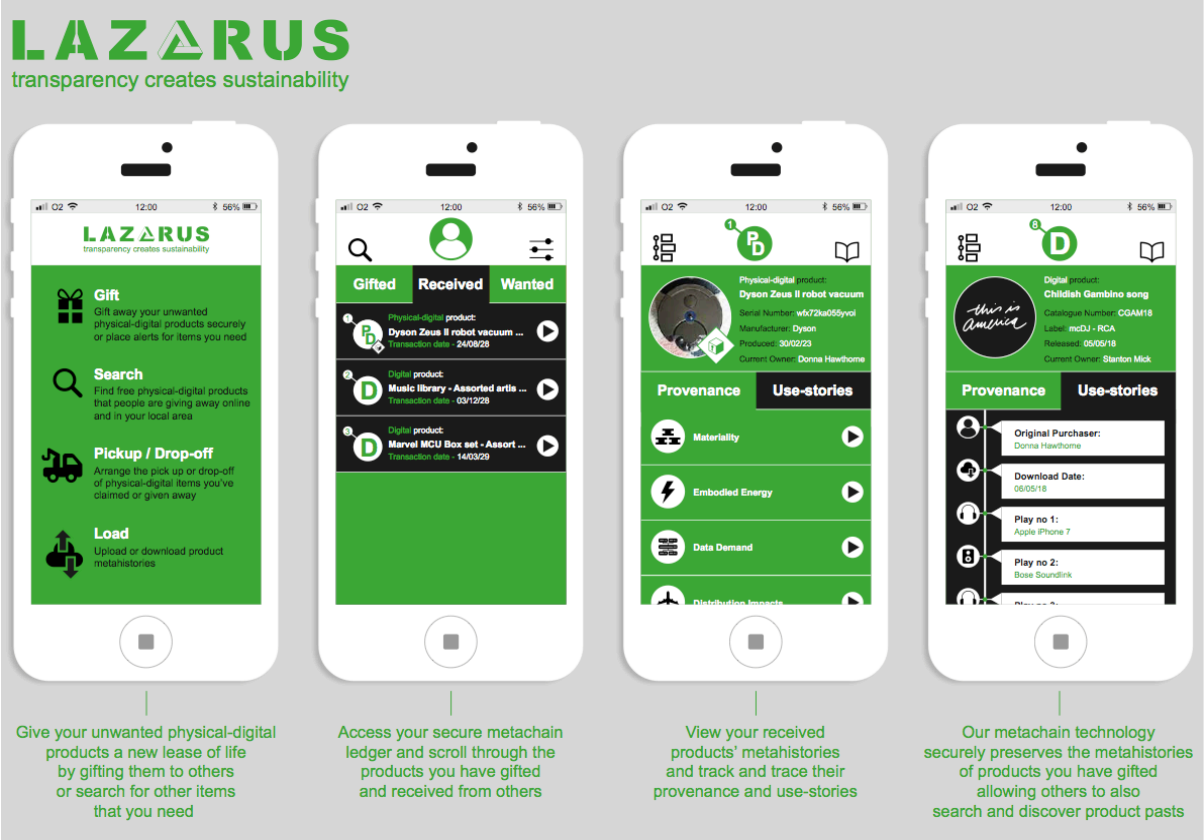

Figure 7. A user experience tableaux for Lazarus, a blockchain/metahistory based platform which promotes sustainable consumer behaviour. Lazarus enables people to securely gift away data rich physical-digital objects, search for recycled items and access product metahistories which include important provenance data. Source: Authors.

As per Sterling's outline, access to spime metahistories could aid people to make more sustainably informed decisions. People should understand that they, as individuals, are also *accountable* for the unsustainability of the connected products they purchase, through how they use them and, perhaps most importantly, through how they dispose of these devices. Likewise, could embracing metahistory also empower retailers and platforms to become a driving force for reducing e-waste and material scarcity? Figure 8 features a fictional customer email receipt from eBay detailing the purchase of a second-hand Internet-connected toaster. We can see that eBay has complied with the Government's protocol and included the *SMC Mark* on the receipt to denote that the transaction involves blockchain processes in the transfer of the toaster's metahistory from its previous to new owner.

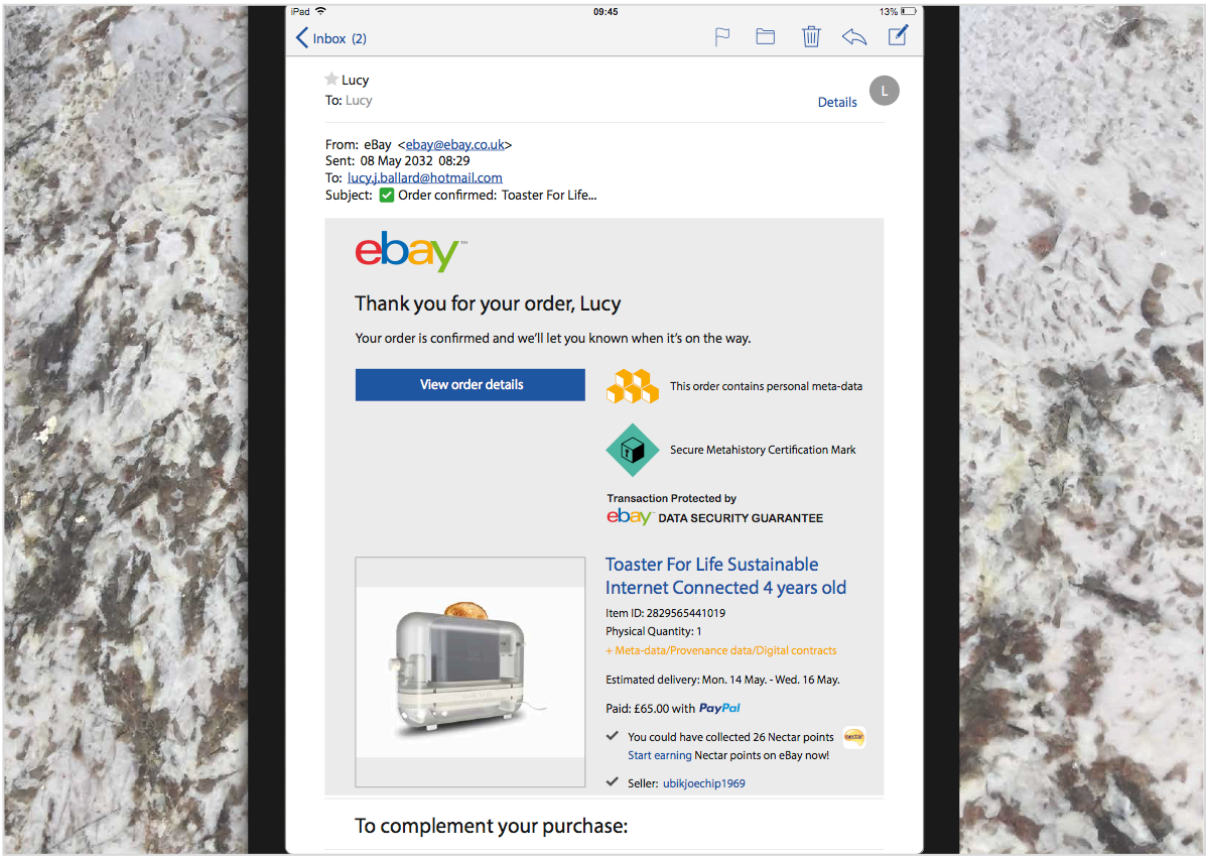

Figure 8. An eBay customer receipt for the purchase of a second-hand spime toaster.. As per the Governments 'Open Traceability Protocol', eBay has included the Secure Meta-History Certification Mark as this transaction involves blockchain processes and the transfer of the toaster's seller's personal meta-history data. Source: Authors.

Despite such compliance, some companies might seek to gain from mining the vast silos of metahistory data generated by billions of spime products. Figure 9 is a web interface for a cloud data mining platform operated by the internet giant *Amazon*. So-called 'excavators' can sign up to mine the spime silos for crypto-rewards with Amazon accumulating fees and percentages from their members who successfully mine metahistory blockchains. Through building our world, we have sought to frame metahistory as a counterpoint to the increasing anxieties presently being felt towards how Internet platforms acquire, share, and mine IoT data for profit. The transparency of metahistory data has therefore been presented in a positive light through the majority of our artefacts. The Amazon platform and Figure 10's *Change.org* petition however, begin to raise questions about the manner in which we have concretised metahistory, particularly concerning our extrapolation of blockchain technologies and data-mining activities. In the next section, we will discuss these issues further and argue that our framing of metahistory facilitates the building of a *plausible* world, as opposed to one which is *preferable*, and why making this distinction is critical when using the spimes concept as a means to envision sustainable connected product futures.

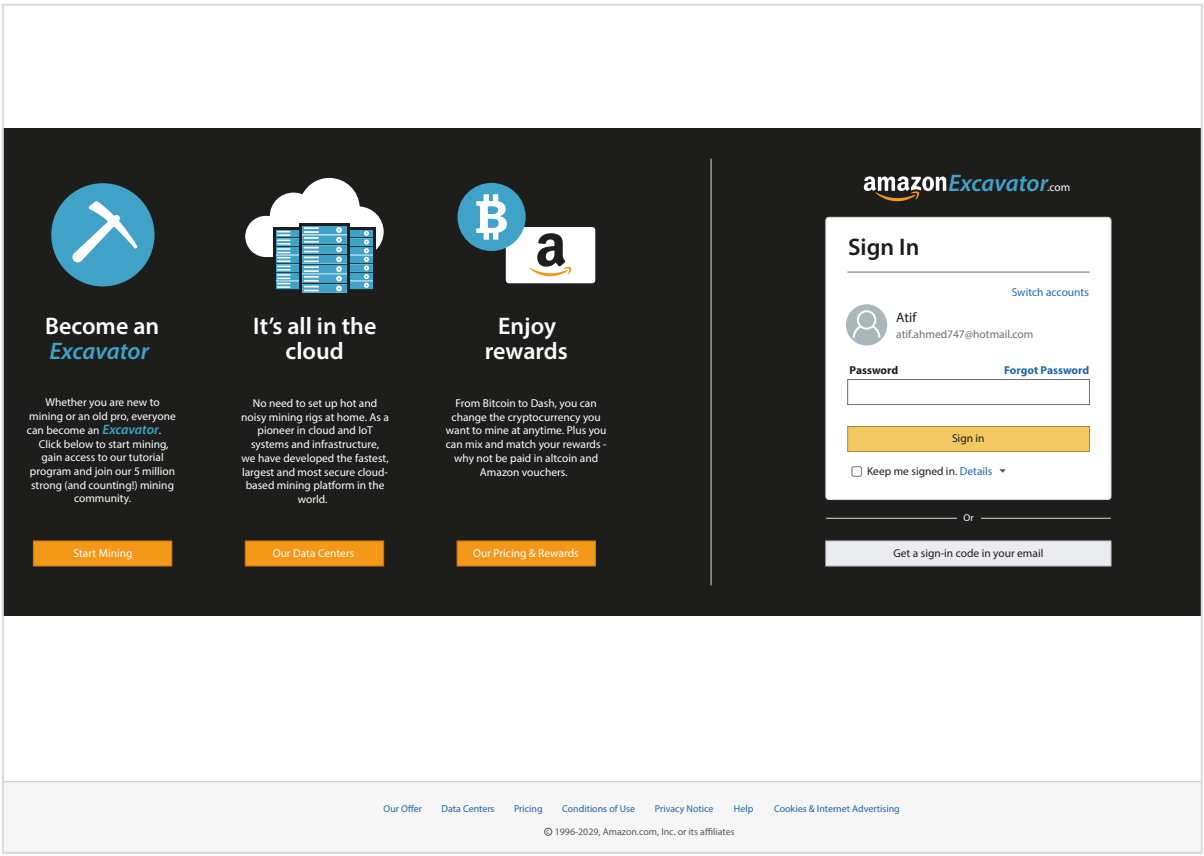

Figure 9. A web interface for a fictional cloud data-mining platform operated by the Internet giant Amazon. So called 'excavators' can sign up to mine the vast silos of spime product metahistories for crypto-rewards. In our world, Amazon would accumulate membership fees and percentages from successfully mined metahistory blockchains. Source: Authors.

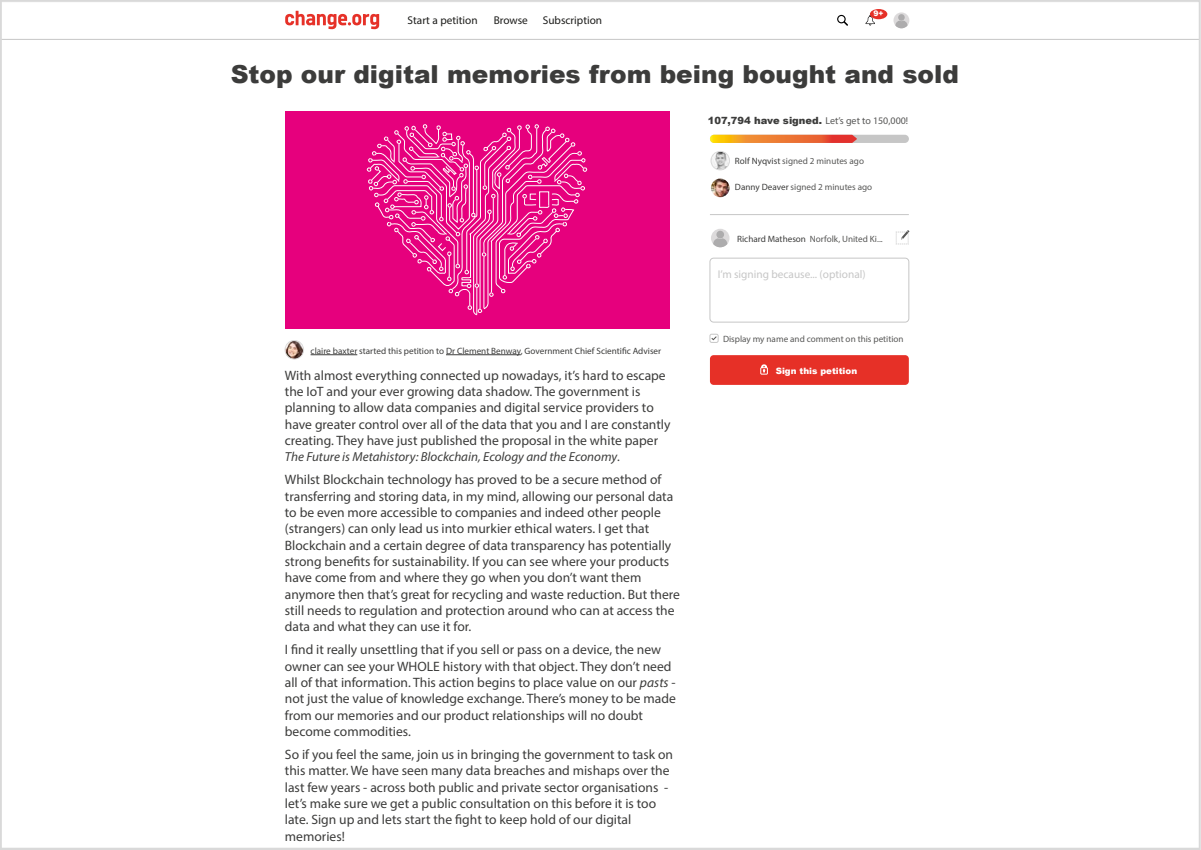

Figure 10. This petition highlights concerns that some people might have regards future 'open traceability' and the widespread adoption of blockchain enabled meta-transactions. Source: Authors.

5 A Plausible As Opposed To Preferable World

Established thinking suggests that the side of the IoT that we do not see – the 'invisible' digital processes and infrastructure which covertly distribute peoples' data – should be made more explicit to *individual users* in order to restore and maintain user privacy and security (Authors, 2018b). Through *The Future Is Metahistory* fiction, we have envisioned how the use of immutable blockchain technologies to permanently record and share spime metahistories could be a plausible means of achieving such a goal. But spimes would also go further. To return to Sterling's (2005) original synopsis, metahistory data would remain 'available online for historical analysis by [its user] and *any other interested parties*'. The latter characteristic is problematic, in that it suggests that metahistories would be explicit, not only to a product's owner, or the succeeding owner(s) of the device, but in fact, explicit to *everyone*. Indeed, the caveat of the metahistory concept is that such data would be accessible, searchable and mineable by anyone who is interested in doing so. This seeming contradiction rightly provokes the question – *if everyone has the ability to access metahistories, how is our personal data any more private or secure within the fictional future than it is today?* Emphasising the commercial rewards that could be made from mining personal metahistories, the Amazon platform begins to allude to this issue. The fictional *Change.org* petition is more overt, highlighting the concerns that people might have regards the widespread adoption of 'open transparency' and 'asset traceability'. Should the adoption of metahistory be viewed as a trade-off then? The data would be secure and unalterable when stored in a blockchain but it appears privacy would still be comprised. In our spime-

based paradigm, are improved sustainability credentials more important than the users' privacy?

Another issue we must also reflect upon is the known unsustainability of data mining practices. This is more subtly referenced within our fictional world through the anti-metahistory badges and photo of protestors with 'Say No To Server Farms' placards at the *Make Metahistory HISTORY* march through London in June, 2028 (Figure 11). While the impacts of blockchain technologies themselves are not of specific detriment to the environment, some of the mining activities that they facilitate – Bitcoin being a prominent example – have been shown to be incredibly resource intensive. Mining crypto-currencies consumes copious amounts of energy, increases carbon emissions, and generates large amounts of heat (O'Dwyer & Malone, 2014). Do the negative impacts of mining practices in general, and by association metahistory nullify any sustainable benefits that might result from adopting spimes as an alternative to the IoT?

Figure 11. Protest badges and a photo of protestors at the Make Metahistory HISTORY march through London, June 2028. Source: Authors.

Our design fiction does not aim to answer the preceding questions, but it does seek to provoke a debate around such issues. We have purposely included the artefacts in Figures 9 - 11 to connote to audiences that the fictional world we have built is not a *sustainable utopia*. Instead, we have aimed to build a mundane, *plausible* and sometimes messy world – not a pristine, didactic nor unquestionably *preferable* future. The world depicted within our fiction is *one* of *many* plausible spime-based paradigms. To make more sense of the differences between *plausible* and *preferable* futures, Dunne and Raby appropriated a diagram – the *Futures Cone* – which was first put forward by Voros in 2001. They note that the idea of

envisioning preferable futures presents difficulties because the practice raises the question 'what does *preferable* mean, for whom, and who decides?' (Dunne and Raby, 2013). In their interpretation, the diagram is separated into four 'design futures cones' – probable, plausible, possible and preferable. The preferable cone (purple) intersects both the probable and plausible. Figure 12 depicts our own version of the diagram which is based upon our reflection of our design process for *The Future Is Metahistory* fiction, and our previous research into spimes.

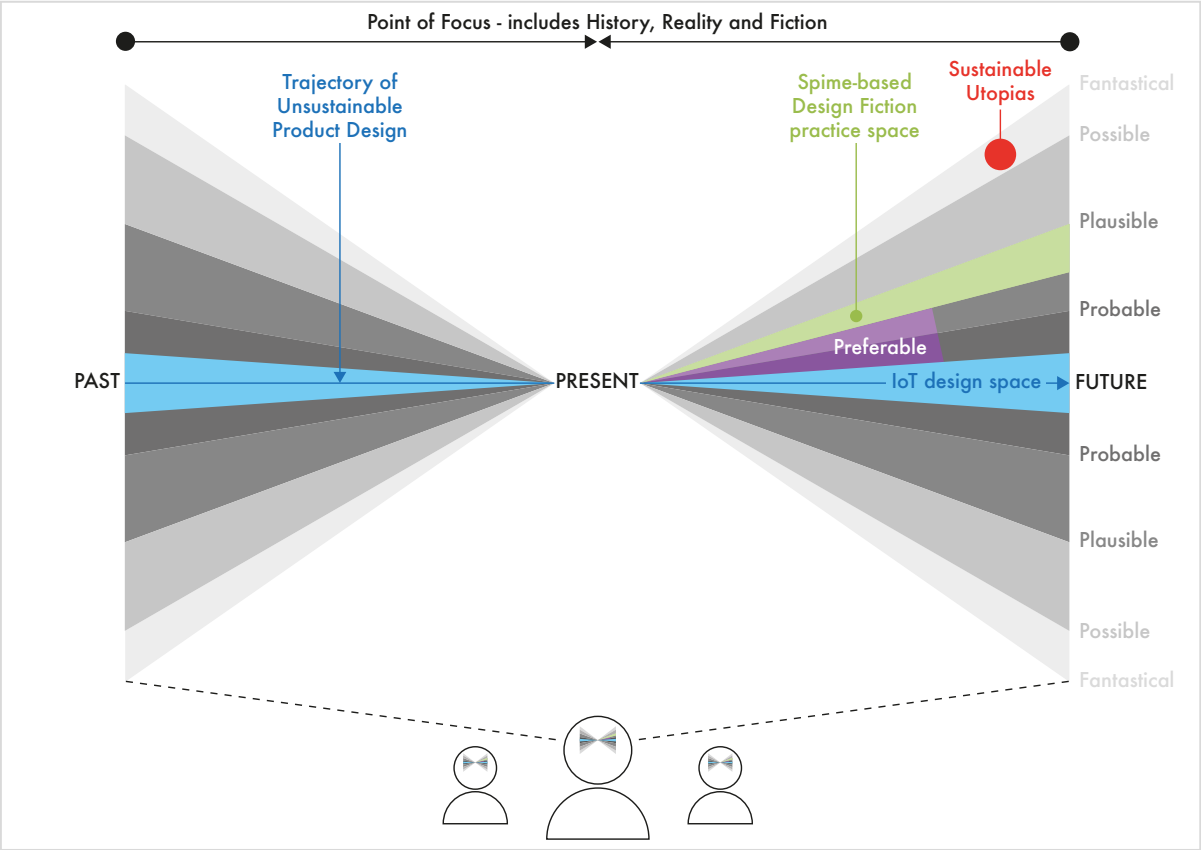

Figure 12. The Futures Cone diagram which distinguishes Spime-based Design Fiction practice from unsustainable IoT design practice and the notion of a sustainable utopia. Source: Authors.

We have positioned spime-based design fictions entirely within the plausible cone (green) and have also posited where we consider the ongoing trajectory of IoT design practice (blue) to be situated. As we outlined earlier, currently, the design of IoT devices follows long established models of production, consumption and disposal which are proven to be profoundly damaging to the environment (Papanek, 1971; Fry, 2009). As a result, we have positioned the IoT on a fixed path within the probable cone. This *Trajectory of Unsustainable Product Design* extends from the end of World War Two and is defined by mass-production, conspicuous consumption, free markets, globalisation and the adoption of the Internet. Augmenting the diagram further, we have included an additional *fantastical cone* within which we have placed the notion of sustainable utopias (red). This is to clearly distinguish mundane and plausible spime-based design fictions from these more chimerical visions of the future which are often marked by technological 'solutionism' (Morozov, 2013). Our diagram also makes reference to both the past and *pluralities of design futures*, that is, the notion that people interpret speculative futures and design fictions in their own individual way, based upon their past and current lived experiences. The benefit of this plurality is that

different interpretations can lead to new insights and fresh discourse beyond the scope of what those who have envisioned the futures might have originally intended.

6 Spimes As A Lens

As we noted when introducing the concept, it would be easy to view spimes merely as a type of potential internet connected device which would be designed to be more sustainable than present day IoT products. Having produced our series of spime-based fictions, we contend that the real *design value* of the spime approach lies when it is applied as a *theoretical lens*. While the artefacts that make up the *Toaster for Life*, *HealthBand* and *The Future Is Metahistory* fictions centre on highlighting potential sustainable design *attributes* of spime objects, applying the concept as a lens allows us to consider the broader sustainable, societal and ethical *implications* of adopting a spime culture. For example, we incorporated design specifications like repair and recycling into the *Toaster for Life* prototype as a way to help us envision an environmentally sustainable connected product. More importantly however, by reflecting upon the prototype and the Design Fiction process that we followed to produce it, we have been able to develop a broader theoretical lens which emphasises the wider impact such sustainable design specifications could potentially have on *IoT Product Business Models* and *IoT Product User Behaviour*. Similarly, looking back upon *HealthBand's* fictional crowdsourcing campaign and design process allows us to more thoroughly consider what sustainable impact democratised technologies and practices may have on connected product design legislation and social innovation user engagement. This analysis resulted in the development of a second lens – *IoT Design Policy and IoT User Innovation*.

Through *The Future Is Metahistory* fiction, we have aimed to highlight the potential sustainable advantages and disadvantages of making connected product data more transparent and traceable. Reflecting upon our process has enabled us to identify a third theoretical lens for spimes – *IoT Data Ethics and IoT Data Ownership*. For spime metahistories to become optimised in the near future, and, to subsequently help bring about sustainable change, technology platforms and services would have to make all their data processes and digital infrastructures more open and transparent to users. As outlined in our introduction, the way in which peoples' personal data is handled throughout the IoT today is incredibly complex. Dense constellations of algorithms, 3rd party platforms, data concentrators and server networks make personal data difficult to trace and almost invisible to users. Such methods are probably unlawful in certain aspects. In light of recent breaches like the Facebook/Cambridge Analytica scandal, the ethical parameters of IoT data transparency is something tech firms need to consider with a matter of urgency. In addition, as it is very difficult to understand and keep track of what happens to it, IoT data is something we, as users of connected products and services need to consider more thoroughly. We need to start taking back ownership of our IoT data and do more to protect it, perhaps by being more careful in regards to how we interact online and what information we share.

The interdependency of our three theoretical lenses is illustrated in Figure 13. One can see that when positioned together, they form an overarching *multidimensional lens for spimes*. It is through this multidimensional lens that we are able to demonstrate that spimes as a concept, is concerned with more than the technical specifications of near future connected devices. Spimes can, as we have evidenced through our work, be applied as a credible and

purposeful research lens through which design researcher-practitioners can explore the meanings and implications of sustainable connected product futures.

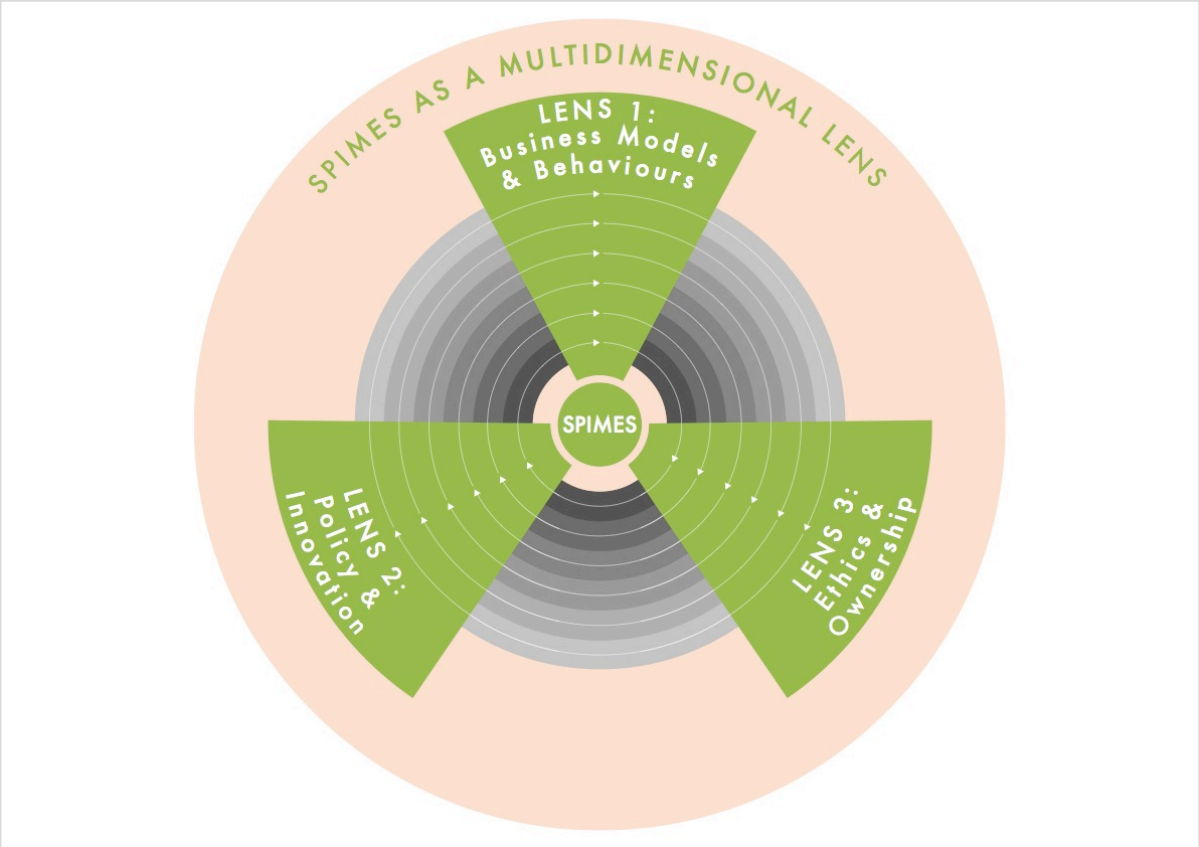

Figure 13. When viewed together, our three sub-lenses form the macro Spimes As A Multidimensional Lens. Source: Authors.

7 Conclusion

Despite our reframing of the *Futures Cone* diagram, Design Fiction should not be viewed as a method for *predicting* the future but rather it is an effective way of extrapolating emerging technologies and practices in order to raise questions about the implications of adopting them in the present. We generated our range of artefacts for *The Future Is Metahistory* fiction as a means to emphasise how IoT product manufacturers, governments, Internet service providers and ordinary citizens often brazenly embrace a developing technology like blockchain, yet, never consider the wider impacts of such action, particularly the potential consequences for sustainability. Our intent is not to provide the 'answers' nor an end solution to the unsustainability of the IoT, but to present a provocation that empowers and drives forward discourse about the growing problems of e-waste and material scarcity. We have sought to do this by positing that increased transparency of connected product data would place greater accountably upon designers and producers in relation to the resources they deplete to manufacture connected products as well as making these issues more explicit to the users of such devices. Through fictional artefacts like the *Amazon Excavators* interface and *Change.org* petition, we have aimed to build a more fully rounded world in which spimes can be shown to plausibly exist.

We believe that through our design process we have contributed to the theoretical underpinnings of the spimes concept. We utilized the DFasWB approach to unpack the

metahistory criteria and, in doing so, like our two previous spime Design Fictions, we developed a third sub-lens for spimes-based research – *IoT Data Ethics and IoT Data Ownership.* When viewed together, our three lenses form the macro *Spimes As A Multidimensional Lens*. To this end, we argue that spimes should not only be seen as a class of sustainable devices built on nascent technologies and practices but more so as a rhetorical lens which design practitioners and researchers can harness in an effort to move away from a focus on obsolescence, and instead begin to reframe their design practices and use of technologies around the creation of a more sustainable IoT product paradigm.

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