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Systems of practice and the Circular Economy: Transforming mobile phone product service systems.

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Abstract

Of late, policy and research attention has increasingly focused on making the Circular Economy a reality. A key part of this agenda is the creation of Sustainable Product Service Systems (SPSS) that meet consumers' needs whilst lessening negative environmental impacts. Although the SPSS literature has grown recently, key aspects require further examination. In response, this paper discusses empirical research exploring consumers' reactions to a novel, hypothetical mobile phone SPSS, utilizing qualitative methods that included 'business origami'. It examines consumers' knowledge about current mobile phone life cycles, and responses to the proposed SPSS, drawing on a 'systems of practice' framework to discuss the potential for significant changes in phone purchase and use. It outlines barriers to alterations in practices, underscoring the centrality that connectivity and data storage now have in many peoples' daily lives, which have for some become clustered around the capabilities and accessibility of the mobile phone.

1. Introduction

Little is new in the assertion that current global production and consumption systems are highly unsustainable. For decades an array of actors and institutions have drawn attention to the need to alter how products and services are made and used, if we are to collectively maintain some semblance of environmental and social well-being into this century (European Commission, 2011; RSA, 2016; Stahel, 2006). While various pertinent discourses and approaches have waxed and waned in the public sphere (e.g. sustainable development, sustainable consumption, the Green Economy) one framework—the Circular Economy (CE)—has recently gained notable policy, business, and civic traction. For one, the European Commission’s ‘Circular Economy Roadmap’ (2011) argues that ‘closing the loop’ on linear product life cycles of make, use and discard, and transforming them into varying loops of re-use, repair, refurbishment and recycle, is a key strategy for Europe’s competitive growth into this century. In addition, an array of non-governmental institutions such as the Ellen MacArthur Foundation—along with small-scale civic and business-to-business social enterprises that aim to share and/or repair goods—are working to rethink and reconfigure how and why we create and utilize a range of material items and services (Ellen MacArthur Foundation, 2015; Hobson and Lynch, 2016; Lacey et al. 2014).

Such goals draw and build upon decades of theory and intervention within fields such as Industrial Ecology, Eco-efficiency, Cradle-to-Cradle and Sustainable Production-Consumption (Braungart and McDonagh, 2002; Gibbs and Deutz, 2007; Shove 2004; Spaargaren, 2003). A key component of these foundations, along with more recent work on the CE, is the concept of Sustainable Product Service Systems (SPSS). Here, the underlying impetus is to reconsider how material and service needs are being and/or can be met, working towards goods and parallel services that are more environmentally benign and materially / energetically efficient. Part of the SPSS rationale is to replace product ownership with renting and leasing to shift “the emphasis from selling product ownership to selling product use or its functions” (Edbring et al., 2015: 5). At the more radical end of the SPSS spectrum are attempts to ‘dematerialise’ or ‘servitize’ material goods to address fundamental needs (see

Roy, 2000) e.g. providing 'cooling' services rather than selling fans or air conditioning.

As the policy and academic literature around SPSS has gained momentum, debates have focused on valid conceptual frameworks, applicable typologies, and empirical case studies of real or hypothetical systems. These have included clothing (Armstrong et al., 2015), electric cars (Cherubini et al. 2015), bike and car sharing (Bardhi and Eckhardt, 2012; Zhang et al., 2014), office furniture (Besch, 2005) and prams (Mont et al., 2006). For some of this literature, the conceptual focus and language utilized is not that of the SPSS per se e.g. Bardhi and Eckhardt (2012) discuss access-based forms of transportation that demand recalibrated engagement and action from the user, rather than the creation of SPSSs to foster sustainable mobilities. However, taken together, this research highlights the manifold challenges and promises of operationalising SPSSs in their varied forms (e.g. Reim et al., 2014; Tukker, 2013; Vezzoli et al., 2015). These forms have been broadly argued to fall into three main categories i.e. Product-Orientated (selling a good with additional services); Use-Orientated (leasing or renting goods with attached services); or Result-Orientated (providing a service rather than just material goods) (see Mont, 2004; Tukker, 2004). However, recent critiques suggest that this 3-fold typology fails to capture the wide variations of materials, services, and contractual relationships within potential and actual SPSS (Cook, 2014; Ostaeeyen et al., 2013). And thus the field of SPSS research is still in need of further development.

Such development includes the noted tendency of SPSS research to draw upon and speak to specific sub-disciplinary epistemologies, methodologies and audiences. For example, a great deal of this work has been published in business, management and industrial ecology journals (Hobson and Lynch, 2016; Reim et al., 2014). Whilst this latter literature has, of course, great value in advancing the SPSS and CE fields of knowledge, it has been argued that there is also now a need to draw upon more interpretive social science epistemologies and methodologies (e.g. Cook, 2014; Hobson, 2016). The goal here is to further capture and understand how, for example, consumers engage with the ideas and concrete examples of SPSSs in ways that take into account a broad array of

contextual social, economic and cultural factors (Brocken and Short, 2015; Cook, 2014).

In line with such critiques this paper discusses a sample of consumers' responses to a novel, hypothetical mobile phone SPSS. This product category has to date received little attention in the SPSS literature, in terms of testing alternate approaches to providing the service of individual, mobile connectivity through hand-held devices (see Canning, 2006; Ongondo et al., 2011). This is in part understandable given the complexities of current mobile phone manufacture and use. However this product and attendant services do warrant attention, particularly as they arguably epitomise the manifold challenges of the CE agenda e.g. containing critical minerals, many of which are not recycled or re-used. The aim of this paper is therefore to provide some insight into individual and shared meanings around the use and ownership of these devices, drawing on qualitative data gathered through participatory 'business origami' interviews with members of the UK public.

This approach is in-keeping with arguments in this journal that more interpretive stances to SPSS research are required, making full use of specific, small-n case studies and including 'various voices' (Cook, 2014), such as in the design and evaluation of SPSSs (Wilson et al., 2015). In terms of epistemological approaches, this paper draws on recent social science work around 'Practice Theory' (PT) in relation to issues of meso-level or macro-level system transitions, including the development and actioning of new forms of SPSS. Broadly speaking, some recent iterations of PT—although a diverse and often highly contested field of debate (see, for example Shove 2010, 2011; Whitmarsh et al., 2011; Wilson and Chatterton, 2011)—stem from critiques of how policy makers, practitioners and oftentimes researchers approach issues of fostering more 'sustainable' everyday behaviours. In recent decades, educational or material interventions have been applied to single behaviours (e.g. recycling), often with less-than-ideal outcomes (Hobson, 2006). PT researchers have argued that this approach fails to comprehend how everyday (unsustainable) actions are part of complex circuits of other, linked behaviours; are enmeshed with shifting material cultures (e.g. new 'gadgets' such as mobile phones); and are

replete with individual and collective meanings e.g. changing norms of efficiency (Shove, 2004) or mobile connectivity. Thus:

‘The successful introduction of new products [thereby] comes to depend not just on their ‘mental appropriation’ by human agents, but equally on the levels of fit or misfit they show with respect to the existing portfolios of objects, bodies and meanings that are involved in practice’ (Spargaaren, 2013: 238)

As such PT enables the framing of mobile phone purchase, use and disposal not only as a historically situated practice, but also one that is now part of broader ‘systems of practice’ (Watson, 2012), linked to a whole series of other practices (e.g. work, child care, keeping fit) which in turn may or may not make the uptake of a new SPSS, like the one explored in this paper, more tenable. To that end, this paper aims to explore how prevailing practices around the mobile phone are perceived, and therefore potentially open to change within the aims and rationale of the CE and in response to a novel, proposed SPSS.

The remainder of this paper is structured as follows. The opening section explores why the mobile phone and electronic waste constitute a worthwhile case study for SPSS research, given the many challenges of transforming this sector in a resource scarce world (Hobson, 2016). Then the research project and methodology of this papers’ case study are outlined, followed by a discussion of the qualitative data gathered about research participants’ current practices and their reactions to an alternate phone SPSS. Finally, the concluding section reflects upon this case study and its contribution to rethinking the mobile phone in the CE.

2. Closing the loop on mobile phones: e-waste and transition scenarios

Consumer electronics is one of the fastest growing sectors in global markets. In the last decade the purchasing of such products has grown exponentially due to factors such as the availability of more affordable electronics and growing internet penetration across industrialized and industrializing markets (Euromonitor International, 2015). Sales in the global consumer electronic industry are expected to reach US\$ 2,976.1 billion by 2020—up from US\$

1,224.8 billion in 2014—with smartphones, tablets and ‘wearable’ technologies representing the largest growth markets (Euromonitor International, 2014).

Inevitably this unprecedented growth in consumer electronics has created a parallel increase in waste electrical and electronic equipment (WEEE) generated at a product’s supposed ‘end of life’: or more succinctly, its end of current usefulness or value to its user. Indeed, surveys have shown that over 60% of discarded computers and mobile phones, and almost 50% of cookers and hi-fi systems, are still useable and functional at the time of their disposal (Cooper, 2004). More generally, some estimates put the global quantity of e-waste generated in 2014 at approximately 41.8 Mega tones, expected to grow to 49.8 Mt in 2018: with only 16% being recycled or re-used, losing over £34 billion from production-consumption systems and economies (Baldé et al., 2015).

E-waste can therefore be argued as emblematic of the unsustainability of current produce-consume-discard systems, and has thus attracted considerable attention. One regional regulatory approach is the EU Directive 2012/19/EU (EU, 2012) that set out Europe’s WEEE targets i.e. the collection and recycling of 45% of electronic goods placed on the market in the previous two years, with that goal rising to 65% by 2019. Whilst some countries have responded well to these targets, collecting WEEE for recycling is still problematic in many contexts e.g. in the UK it is estimated that approximately 37% of unwanted electronic goods still end up in landfill (WRAP, no date) with only 3% of end-of-life mobile phones being recycled and 44% ‘hibernating’ unused in the original owners’ homes (see Scott 2014; see also Wilson et al., 2016).

While necessarily ambitious, targets such as those of the EU WEEE Directive face numerous challenges including regulatory barriers to the recycling and refurbishment of used phones (Ellen MacArthur Foundation, 2015) and highly complex waste management regimes (Sthiannopkao and Wong, 2013). Voluntary standards organisations (e.g. BS 8887 Design for manufacture, assembly, disassembly and end-of-life processing) have in turn perpetuated incremental design improvements that continue to hinder progress towards the CE e.g. batteries glued into phones and tablets to save space (Takeno et al., 2005). In addition—while the focus of WEEE governance is often on improving

the percentage of goods collected (e.g. Ellen MacArthur Foundation, 2015)—better collection does not necessarily lessen the amount of waste generated, and may indeed encourage ‘rebound’ behaviour (Hertwich, 2005; Tukker et al., 2008).

Given these numerous challenges there are now moves to rethink the design and use of mobile phones to lessen environmental and social impacts. For example, *Fairphone* is a Dutch social enterprise originally conceived to offer an ethical alternative to current mobile phone manufacturing and use cycles. Its phone contains only ‘conflict-free minerals’ using post-consumer recycled parts and materials (e.g. recycled polycarbonate retrieved from old devices)(see Fairphone, n.d.). Such approaches echo Reim et al.’s (2014) strategies to integrate sustainability into current product life cycles i.e. prolonged product or service lifetimes; improved recycling; incremental innovation addressing durability and usability; and product, service, and business model innovations.

Beyond creating new, niche products, the Ellen MacArthur Foundation’s 2013 report ‘Towards the circular economy’ proposes a system-wide ‘transition scenario’ towards more closed loop mobile phones. They argue this requires an increase in current device collection rates from 15% to 50%, with one-fifth of the phones being recycled, and the rest diverted to re-manufacturing and re-use (Ellen MacArthur Foundation, 2013). Whilst technically feasible, many barriers exist to this scenario, such as questions over whether consumers are willing to recycle their phones, given widespread concerns about data security of old phones (Speake et al., 2015; Yla-Mella et al., 2015). There are also claims that “products with fast innovation cycles, are more attractive for consumers to rent, but not to own” (Edbring et al., 2015: 10), opening up the potential to phase in one component of SPSS approaches, as highlighted above. However, does this claim apply to the mobile phone, particularly given that ownership and use touches on factors that include socio-cultural issues of conspicuous consumption and the now-ubiquitous imperatives of social networking and constant connectivity (Campbell and Kwak, 2010; Katz and Sugiyama, 2005; Walsh et al., 2009)? To explore these questions further, the remainder of this paper draws on research carried out as part of a UK-based project that examined some scientific,

engineering, design and social opportunities and challenges in creating a SPSS for mobile hand-held electronic devices.

3. Researching public reactions to a new mobile phone SPSS

The project ‘Closed Loop Emotionally Valuable e-Waste Recovery’ (CLEVER) was a multi-disciplinary, 3-year project that aimed to undertake fundamental research into key aspects of the mobile phone life cycle, to explore pathways for greater resource efficiency. It should be noted that although we use the short-hand term SPSS here to refer to CLEVER, the assumption was never made that the project processes, outputs and findings represent the epitome of sustainability in reference to the mobile phone. Rather, this research was an scientifically-driven, experimental project which aimed to examine the outcomes of one possible way that mobile phone life cycles might be made more sustainable, leaving the environmental and social credentials of the project open to critical questioning, both during the life of the project and in post-project evaluation (see Hobson and Lynch, 2015; Suckling and Lee, 2015).

To this end, the project began by rethinking the fundamentals of the current phone, separating it into three distinct parts. As Figure 1 shows, the phone was conceptualised as the outer casing, or the part that the user interacts with directly, labelled as the ‘*skin*’. The critical support components inside the device were the ‘*skeleton*’, and the hi-tech electronics that deliver the function were the ‘*organs*’ of the mobile phone.

<Insert Figure 1>

The scientific goals of CLEVER included investigating how novel bio-polymer based internal materials (the ‘organs’ and the ‘skeleton’) can be produced so component parts are quickly and efficiently accessed for recycling and metals recovery. These materials would be stable and robust while in use, with decomposition later triggered by enzymes when the device is taken apart for recycling (Bridgens et al., 2016). For the ‘skin’ the aim was to utilize and test materials which ‘age gracefully’: a concept of interest in recent years to design and structural engineering researchers (see Lilley et al., 2016). The intention was to explore if materials that take on unique wear patterns—which potentially mirror ownership history—can help foster owners’ emotional attachment to the

device to motivate continued usage and encourage the return of the internal electronics for upgrade rather than disposal.

For this reconceptualisation of the phone to be in any way actionable in reality, it was hypothesised that the organs and skeleton would be leased rather than owned by the user, to be returned for recycling and upgrading at regular intervals. Here the user gets the advantage of having periodic 'internal' upgrades as part of their contract, meaning they do not have to purchase or lease a new phone in entirety. This approach would however require changes to users' practices and norms of ownership: issues that were explored with a sample of potential future users.

To first flesh out how the above principles could be turned into a tenable SPSS the project team completed a 1-day workshop where 'business origami' was used to map out what the life cycle could look like and what it might require of the user / consumer. The 'business origami' method is a creative and interactive approach that enables the collective mapping and modelling of complex systems. It has become a part of manufacturing and design 'toolkits' of late (Fox, 2014; Kim et al, 2016; Martin and Hannington, 2012) used in design workshops to allow participants to "make explicit the value exchange between elements as they occur over time and within the context of a scenario" (Martin and Hanington, 2012: 24). Here, pre-prepared paper cut-out symbols represent nations (i.e. the flags of different countries), relevant sectors (e.g. manufacturers, retailers, users), objects (e.g. phone materials and components), sites (e.g. mines factories, communities), and technologies (e.g. supply chain logistics, manufacturing and recycling processes). This method was chosen for CLEVER as it allowed the project team to physically lay-out, discuss, debate, and then rework the basic structure of a tenable CLEVER SPSS, which is illustrated in Figure 2 (also see Wilson et al., 2015). That is, it presented a low-cost, re-useable, malleable, and collective means of illustrating and editing a proposed SPSS, providing rich visual data not available through oral discussion and debate alone: and also avoiding the limitations of undertaking such an exercise electronically e.g. resources and particular skill sets.

<Insert Figure 2 here>

Then, the above hypothetical SPSS was tested with members of the public. In total, 35 semi-structured interviews were conducted during 2016: 20 in London, UK (at the Loughborough University campus in Stratford), and 15 at Loughborough University's main campus. For the London interviews, participants were recruited using a market research agency, with the aim of sampling a wide range of mobile phone users from different ages (they ranged between 20 and 70 years old) and with a reasonable gender balance (12 females, 8 males). By contrast, the Loughborough interview focused on a younger cohort (aged 19-25) in line with some of the other strands of research undertaken during the project (see Lilley et al, 2016).

Each interview lasted between 20-45 minutes, depending upon the responses and level of engagement of the participant. All used the same 'business origami' technique to initially request each participant physically lay-out how they think their phone came into being. Beginning with where they bought it, participants worked backwards through the phones purchase and manufacture, ending with questions about materials used in making their phone, and where these materials might have come from, using the origami symbols to build up a picture of the phones life cycle (see Figure 2 for an example). The aim here was not the test whether each participant was correct per se, but to gain insight into extant mental maps of the geographical and material reach of their device.

Then, participants had the proposed CLEVER SPSS explained to them, and took part in a semi-structured interview to gauge their reactions to it. Here they were asked to reflect and comment on the SPSS, including their initial reactions from their personal perspective and whether mapping mobile phone life cycles might influence their consumption practices in the future. All of the interviews were video and audio recorded and fully transcribed, and coded by two researchers to cross-check results and further refine the coding process.

It should be noted that this research involves a purposeful interview sample and therefore does not claim statistical representation of UK mobile phone users. Rather, participants' narratives offered in-depth, personal experiences of owning, using, and living with mobile phones, utilizing a small-n case study rather than large-n representative sampling approach (see Cook,

2014). This research methodology is now common across the social sciences (Gerring, 2004; Hennik et al, 2010) including amongst PT researchers, to gain detailed understanding of how seemingly mundane and normalised behaviours are rather a complex of temporally, culturally and geographically situated materials (or objects); competences (or skills); and (individual and collective) meanings (Shove et al., 2009; Shove and Walker, 2010).

The hypothetical nature of the proposed SPSS limited the possibilities of more detailed responses from participants. It was not feasible to present and capture reactions to specific aspects of the proposed SPSS as these details were the next stage of development once the basic framework had been tested, and would have been educated guesswork at that point in time e.g. the type of contract or network on offer or the cost of the service being proposed. While some work into new forms of SPSS have been able to take a 'Living Lab' approach, testing actual experiences of using a new product/service configuration (e.g. see Davies and Doyle, 2015), this was not feasible for CLEVER given time and budget constraints and the challenges of getting aspects of a working model in place i.e. producing functioning prototypes and operating systems. Thus, there was never an intention to develop the SPSS as a workable, ready-to-market product, as this was a research project exploring a set of hypothetical questions about the broader possibilities of altering the ways in which mobile phones are currently used and made. In addition, complex implementation issues such as those of legal enforcement were not explored in this project in part for the reasons detailed above: and in part because one working hypothesis was that people would fully participate if they felt attached to the 'skin', thus the incentives to comply could be built into the SPSS itself, as if participants refused to return their phones—choosing to discard them or keep them—they would automatically lose out on the advantages of the very system they signed up to. As such, the qualitative data drawn upon below is an initial foray into this field of inquiry, with further qualitative and quantitative research required around the specifics of the business model that emerges from the proposed SPSS.

4. Knowledge of, and practices around, current mobile phone product service systems

While sustainable consumption interventions often aim to provide consumers with overt information about products via education or labelling (see Young et al., 2010)—with the implicit assumption that this knowledge leads directly to action (Hobson, 2006)—PT emphasizes the role that implicit or tacit knowledge plays in practices e.g. embodied knowledge and habits (Mylan, 2015). Thus understanding the links between knowledge and practice was a key area of investigation. For this project, participants had varying degrees of knowledge about their current phones' life cycle. Over half stated that before taking part in this research they had not given much thought to how phones are made, such as:

'To be honest, I am ashamed to admit that I've never thought about who is making them and where it comes from, where it's going'.

In terms of knowledge about the resources inside phones, the average number of materials mentioned in interviews was 4, with 9 participants mentioning 5 or more. While every participant made an effort to list materials in their mobile phones, awareness about precious metals in particular was relatively low. Most participants listed copper, plastic and glass—the most abundant materials in the phone—whilst only a few mentioned gold (3), silver (2) and platinum (1).

In addition, participants' estimates of the proportion of the phone currently recycled varied widely from 10% to 90%, with many assuming that it is the most 'precious' parts e.g. the printed circuit board (PCB) containing gold, that were currently being recycled. As this participant commented:

'I read about there's a shortage of gold and there's a tiny bit of gold in every phone, so they probably strip it down and re-sell the gold'.

In reality, estimates of mobile phone recyclability range between 65-80% (Molto et al. 2011), with aluminium, ferrous metal, copper fractions and thermoplastics (e.g. polycarbonates) being the most recoverable under current large-scale recycling systems.

Thus overall knowledge was diverse, and there was uncertainty around the contents of a phone, where materials come from, and what happens after end-of-use. This is not surprising given that actual recyclability rates publically available are estimates (as above). Plus, mobile phone contents and life cycles are highly complex and often hard to trace, particularly in relation to the actual origins of some materials, as scandals over, for example, Samsung's use of tin from Indonesian 'child labour' mines attest to (see Hodal 2013). In relation to this point, one participant rather despondently put it:

I don't know, I mean you know...it is kind of overwhelming about how much different sources there are, you know?

As such, the complex geo-political and ethical relations contained within the phone's material and embodied in the device are not easily made salient to, or resonate with, participants—a point returned to below.

Participants' current practices of phone ownership and use could be considered within the bounds of larger norms. No participant owned a Fairphone or few had engaged in other forms of alternate practices around the phone, such as self-repair. The number of phones participants had owned was on average 8.5 although some had difficulty recalling exactly how many they had owned, with some estimates prefaced with phrases like 'I reckon it's about...' etc. Although these ownership numbers may seem high, in the UK alone more than 32 million smartphones are purchased every year with a further six million handed down to others (Deloitte, 2015). And although the average life span of devices is 4.7 years, average UK replacement rates are 22.4 months (Green Alliance, 2015). Present phones aside, the fate of participants' now-disused phones varied, with 19 saying they had passed one or more on to others; 13 mentioning they had recycled phones in the past; and only 2 having undertaken any DIY repair.

Despite a sometimes vague recollection of actual devices—the 'materials' of PT—it was the function of the phones that had become paramount to participants. As previous research and social commentary suggests, available and affordable connectivity has brought about an array of profound socio-cultural and economic changes, from a global to a personal scale. From this research, there were comments about not being able to do without a phone for

social, family and/or work reasons. This is not so much about the phone meeting existing needs, but creating new ones: that is, as new functions and devices became available, perceived needs and norms shift to match these, as PT outlines (Shove, 2004). This was perceived as more acute for those under 25, with one female participant commenting:

'Teenagers today are very much glued to their mobiles. Text messages are coming in all the time, they're going on to social networking, Instagram, Facebook or whatever it is, and things are popping up all the time.'

Thus, for the most part, the phone itself were not seen as an object to develop attachments to, in reference to one of the working hypotheses of the CLEVER project (see Lilley et al., 2016). There were of course some exceptions. One participant kept hold of a phone that had belonged to her late partner and thus had sentimental value. Another kept an old phone because it contained 'precious' photos and videos of her child's first steps, which she could not remove or download.

Detachment from the object itself—but not what the object symbolizes via branding, a subject returned to below—may in part be due to the normalization of rapid phone turnover, with contract providers offering frequent upgrades: as well as fast technological and software innovation (although these cycles are starting to slow somewhat: see Recon Analytics, 2011). It may also be in part that these devices—while enabling precious connectivity as well as the storing of personal data and information—frequently became sources of annoyance and bemusement, particularly when one or more key aspects of phone workability fails, as with other 'background' technologies in our lives (Horrihan and Jones, 2008; Morosov, 2013). Participants told stories of seeming injustices and unfairness, of retailers and manufacturers charging for repairs, along with the demands of getting one's phone fixed, or the charges for making calls: in short, participants feeling 'locked in' to the need, expectation and norms of being connected and contactable, with little control over costs of services and durability of phones. For example:

'my phone broke, just stopped charging and so for example I wanted to try and get it back on my warranty but unfortunately this tab

snapped off and I was charged £125 to renew the warranty to re-fix the phone just because a bit of plastic had fallen off.'

For those few wanting to try to alter their own practices within current systems, such as considering the environmental impacts of their phone, it was a difficult to make significant changes given the nature of how phones are made and sold. For example:

'I know that it's not that easy to figure out where things come from. I do worry about that and I need to be more sustainable about smaller things, when it comes to things like electronics it's a bit harder to keep up to date with what you want and to get something powerful enough...you have to go a bit further to get that.'

This point speaks to previous research (Young et al., 2010) about how, even for self-proclaimed 'sustainable' consumers, being able and willing to buy 'greener' electronics/technology is perceived as harder than for other sectors due to cost, performance and knowledge of the origins and impacts of devices.

In relation to ethical concerns and knowledge, there was a general awareness of controversies over the manufacturing of mobile phones: not surprising given the publicity of human rights abuses in mineral mines (BBC, 2012) and electronics industry (The Economist, 2012). Comments from participants included:

'The simple word 'sweatshop' comes to mind...I think they are treated not how we would like to be treated. Big business is interested in making extra money and the government doesn't really give a care as long as the money is coming in.'

For most, this awareness did not translate however into any alteration of purchasing and use practices, except for one participant who commented that:

'It's part of the reason why I don't really buy Apple products because I know there's been kind of a lot of...for want of a better term, there's been a lot of blood involved in you know making the products.'

Do such quotes suggest that there is potential for alternate/niche SPSS like that of Fairphone to gain further ground in the mobile phone market and that knowledge of mobile phone origins could turn into altered practices? Although

possible, critical social science research into sustainable, green and/or ethical consumption has questioned whether knowing about detrimental human (or environmental) impacts of products will result in changes to behaviour (Barnett et al., 2005; Kollmuss and Agyeman, 2002). Whilst for some unpacking the exploitative practices and relations embedded in goods facilitates a supposedly emancipatory agenda (Hartwick, 2000) significant empirical evidence suggests that practices tightly linked in multi-level systems are highly recalcitrant (Ariztia et al., 2016). Although participants said taking part in this research had ‘made them think’, that was the express intention of the methodology utilised. The real test would come in how this ‘thinking’ resonates later—a point not verifiable here due to project time limitations. Indeed, when asked about the intention to change their mobile phone practices several participants said they did not intend to alter anything as they ‘already knew about the issues’. Or as one participant succinctly put it:

‘Well, you got me thinking about all the people in India and all that are in the slums and, well it’s an emotional thing...but I’ll probably forget about it in an hour.’

Other participants stated that they too did not think taking part in these interviews would make a difference to their behaviour once they left the room. This speaks to the point above about the tenability of users imagining and being affected by the manifold socio-ethical and environmental issues contained within one device: issues that range from child labour in mines to health impacts of illegal recycling in the Global South. As one participant put it, when talking about concerns over human rights in the manufacturing process:

‘when you’re in this sort of environment, you tend to ignore it because you’ve just got the end product. And you know when they release something new it’s like you don’t really think about what’s gone into it and where it’s going to end up because you’re just the middle user.’

The comment above about ‘this sort of environment’ is informative. This ‘environment’ undoubtedly pertains to the high consumption, information-driven context that UK participants experience as part of daily life. At a conceptual level, ‘phone use behaviour’ is thus not an isolated, repetitive act that

expresses personal preferences, but rather a practice that is now deeply entangled with other needs, meanings and capabilities. The very items that have enabled the new norms of constant connectivity and contact-ability (e.g. smartphones) have in turn quickly become central nodes (or a set of materials, competences and meanings) in diverse systems of practice that are hard to untangle e.g. making sure the children are safe, answering work emails and constructing the weekly shopping list (Holmes, 2016). It therefore makes sense that any voluntary changes that might disrupt this finely balanced status quo and place the functionality of this node into any disarray might be met with a lack of enthusiasm. But what then were participants' reactions to the CLEVER SPSS including their responses to the 'organs, skeleton and skin' model, and the impact this may have on their phone practices? The next section explores these questions in greater detail, outlining the viability of rethinking the device and the demands of the mobile phone.

5. Reactions to the CLEVER SPSS: updating, security and market share

The majority of participants had an initially positive reaction to the proposed CLEVER SPSS, in terms of its ability to address some of the issues and dilemmas that current mobile phones design and contracts raise for consumers. For example:

'The overall concept sounds brilliant, it means I would definitely use it. I wouldn't have to continually go out and buy a new phone.'

'I think it's a really brilliant idea. Really because I've often thought about this, funny enough, I've thought I get another phone like the iPhone 6 and I think, who needs it?'

This speaks to issues raised above about some participants expressing bemusement and/or frustration about the demands their current phones exact from them.

However, participants also expressed concern about some aspects of the CLEVER SPSS, including how it could somehow prevent the user from accessing the 'latest' or 'best' phone':

‘I do think that it is a good idea but then I think people may not go for it because they want the best phone...I’m not bothered now, getting a bit older, but before when I was younger I did want the latest phone’.

Thus, the retention of the ‘skin’ was at times conflated with not upgrading the ‘organs and skeleton’. This points towards definite challenges in getting users to conceptualise the phone differently as the CLEVER project proposes (skins, organs and skeleton), with a part-ownership, part-leasing arrangement for one small device not being an easy mental jump to make from the norm of perceiving the phone as an integrated object that does not need to be parsed apart as this project proposed.

The ability of the SPSS to maintain high functionality and performance to match customer expectation in the face of rapidly accelerating technology and competitor improvements was also raised as a concern. Comments related to potential problems in accommodating larger screen sizes if the dimensions of the device is fixed, whilst others seemed to equate the CLEVER SPSS with modular systems for component replacement, such as Project Ara/ Phonebloks. Another interviewee suggested that the continued innovation around the mobile phone could potentially present challenges, as internal components alter:

‘Because of the way things are shaped on the inside, even a slight bit different, it would be interesting to see how you could make new features fit. I mean the software you can chop and change, with hardware it’s different’.

The issue of data security was raised by numerous participants as a barrier to returning the phone for regular upgrading of the organs and skeleton. As with concerns about handing over mobile phones to a recycler (Tanskanen, 2013), some participants were concerned that—in bringing their phone in to have the ‘organs and skeleton’ upgraded—they would be exposed to potential data breaches. For example;

‘I think it’s a good idea, but people might struggle with the fact that if you have to strip things down then you might think...I’m

going to have to erase everything on my phone before I give it in, the personal things on there.'

Liability for damage or loss of data was also raised in relation to replacement of broken components, both on the part of the consumer (who may have inadvertently caused damage through use) and in relation to third party processors/suppliers who may cause damage when replacing component parts;

'if different companies were responsible for different materials in the phone and if they took them out and something went wrong then would they be liable?'

This points to the need for very clear supply chain liability clauses to be put in place as well as guidance on terms and conditions with regards replacement of faulty, obsolete or damaged components.

In terms of the implications to their everyday practices, how the upgrading process could potentially work did not appear to present many challenges. The CLEVER SPSS proposes existing phones are dropped off for 1-hour in convenient locations (supermarket, shopping centre, high street location, etc.) to undergo on-the-spot upgrading, which participants felt was reasonable. For example, when asked about their willingness to do this, responses included:

'Yeah, I think so, definitely. I mean if it's a...quite a relaxed environment, sit down, have a cup of tea and a slice of cake or something. Sometimes it's just easier just to say, 'OK, we'll have it done in half an hour, grab a seat, take it easy, we'll let you know when it's ready' So it's like a while you wait service...that's quite useful.'

However, for some, this seemed like too much to expect, particularly by those for whom their mobile phone, the social connectivity it provides, and the data contained within are unquestioned and omnipresent parts of their moment-by-moment lives (see Quinn and Oldmeadow, 2013; Walsh et al. 2009). For example:

'Me personally I would say I would wait the hour and wouldn't go off and wait there with a book and wait until I get it back. If you were to ask the same question to my 13 year old son, I imagine the answer would be no way.'

It was also notable that reputable, familiar drop-off locations were preferred in contrast to novel spaces or mechanisms such as vending machines or secure lockers. This points to the relative infancy of such autonomous 'unmanned' approaches in the public sphere as well as a desire for human contact to engender trust.

There were also questions raised about the broader appeal of the CLEVER SPSS, particularly in a landscape where there is fierce competition for market share and where providers like O2 are now rethinking their approach to maintaining sales (Coates and Benton, 2016). As one participant put it:

'The challenge is how competent would that device be next to phones like this [Apple] as an established brand to start with and then performance wise. I love the whole concept of recycling, taking things and I'm for reducing waste. And with that comes a lot of product innovation as well, but it's like, it would win more of the green minded person versus the 'techy' person, so my thoughts are, it's lovely but how do you compete with people like this [Apple]?'

This suggests that, as with Fairphone, the CLEVER SPSS might be viewed as a niche product for the technologically-minded person even though, in reality, the user has to do little more than be prepared to partake of the part-lease / part-own model, and return their phone at regular intervals (e.g. one every 18 months) for reasonably rapid upgrading.

Finally, the importance of the brand attached to the SPSS was raised. This speaks to the point above that, although the actual physical devices themselves were not deemed memorable by participants, what these devices symbolized and embodied mattered, with meanings seemingly more pivotal than materials (in PT terms). As has been previously noted, consumers care about brands, "both as a reassurance that their needs will be met, and that they are seen by peers in a good light" (Catulli et al., 2012: 12). Throughout the interviews, participants discussed phones via well-known brands, with comments like 'I'm quite a Samsung person'. Although no branding was suggested during the interviews,

participants brought up the fact—as in the above quote—that a lack of recognisable brand would be barrier for many, in part because:

‘Some people will only buy Apple products because they want Apple, period. But if you had a product that Apple endorsed, that was an Apple, part of the Apple range, that’s yours as well, that would be something that would attract people.’

Although CLEVER never planned to get beyond the fundamental social and physical sciences of the proposed SPSS, taking the concept from research to the market (including branding) remains a whole other project. This would prove highly pertinent to the success or otherwise of SPSSs like the one proposed herein, given the numerous challenges outlined by participants to introducing a novel SPSS into the currently fast-paced and highly crowded mobile phone marketplace.

6. Discussion and conclusions

This paper has aimed to contribute to debates about actioning the CE through SPSSs, outlining how a sample of UK mobile phone users currently think about the life cycle of their existing device, as well as reactions to a novel, hypothetical SPSS. In terms of the former, knowledge about the origins and creation of devices were mixed. There was little sense that giving users more information about the ethical and environmental dilemmas embodied in the mobile phone would make a difference to purchasing, use and disposal behaviour, as participants had latent knowledge of such issues but doubted they would remain salient beyond the research interview. Whilst most participants were broadly positive about the proposed CLEVER SPSS, there were challenges in engaging with the part-own / part-lease model of the SPSS, with participants finding it hard to parse apart the phone’s interior and exterior, as the newness of the ‘skin’ was equated with the newness of the ‘organs and skeleton’. In addition, issues of data, convenience and branding arose: all issues that would require further exploration in an empirical setting. As such, arguments that consumers prefer to lease products with fast innovation cycles (Edbring et al., 2013) do not currently appear to hold that strongly for mobile phones, although that may change as innovation cycles slow and the resale markets (potentially) grows (Coates and Benton, 2016).

In terms of the SPSS literature, this paper utilised the qualitative method of a 'business origami' interview to explore aspects of the 'systems of practice' (Watson 2012) around mobile phones. It has underscored how a novel device or actions that potentially interrupt or unsettle the multiple practices that the material and function of the phone are now inextricably central to, are viewed with definite concern, throwing up issues around potential adoption. As such, explorations into consumer responses to novel SPSSs arguably benefits from adopting a PT approach. This is because it can uncover not only how tightly or loosely practices are linked but also any hierarchy of practices. That is, systemically and quantitatively comparing SPSSs (Tukker, 2015) fails to illuminate how some products and the 'consumer behaviour' around them are arguably form central nodes in both shared and personalised practices, any alterations to which cut deep into the social norms and expectations e.g. connectivity and convenience. This underscores the values of adopting interpretive approaches to CE and SPSS research, as it facilitates a deeper understanding of the viability of changing complex mixtures of materials, competences and meanings.

Finally, this research supports Young et al.'s (2010) assertion that just offering 'green advice' or labels—and expecting this to kick-start widespread behavior change—unrealistically places the responsibility for agendas such as the CE onto consumers (Akenji, 2014). In this paper we have outlined how, even though CLEVER research participants were aware of the environmental and human rights issues around mobile phones, they struggled to connect such issues with the small, useful device in their pocket or bag. As such, any appeals to peoples' ethical and/or environmental concerns around the mobile phone look likely to remain a low impact endeavour. Young et al. (ibid: 30) also argue that 'coherent sustainable production and consumption policies across government departments' are required to address issues of unsustainable electronics. Although clearly vital, historically there is a paucity of strong sustainability interventions by central governments in the UK and beyond (Fuchs and Lorek 2005; Hobson 2013). Thus any positive alterations to current environmental and social impacts will require other actors and forms of intervention beyond policy to be mobilised, such as shifting common discourses around the phone, as well as

market incentives. For example, as there was some awareness amongst CLEVER research participants that different types of valuable and recyclable material are inside a phone, a cross-sector dialogue that emphasises the importance of their recovery for the future of the electronics industry (and thus, our personal connectivity) would arguably have more purchase with consumers than one that focuses on human rights abuses in factories in China. And in terms of market incentives, as this research has shown, participants were very sensitive to any additional work or cost being placed on them unless there were clear benefits to be had. Thus how to structure such benefits in a highly competitive and fast-changing market requires further interrogation.

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