Closing the loop or squaring the circle? Locating generative spaces for the circular economy

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Abstract

Heightened concerns about long-term sustainability have of late enlivened debates around the circular economy (CE). Defined as a series of restorative and regenerative industrial systems, parallel socio-cultural transformations have arguably received less consideration to date. In response, this paper examines the contributions human geographical scholarship can make to CE debates, focusing on 'generative spaces' of diverse CE practices. Concepts infrequently discussed within human geography such as product service systems and 'prosumption' are explored, to argue that productive potential exists in bringing these ideas into conversation with ongoing human geographical research into practices, materialities, emergent political spaces and 'everyday activism'.

Keywords

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Introduction

The need to go 'beyond incremental efficiency gains to deliver transformative change' (Preston, 2012: 1) is a long-standing entreaty within socio-environmental sustainability debates. However, what sort of change, transforming in what direction, and by what means remains undoubtedly highly contested. One framework that has of late received increasing political, research and civil society attention is that of the Circular Economy (CE)—the focus of this paper.

The CE has been defined as:

> 'an industrial system that is restorative or regenerative by intention and design. It replaces the end-of-life concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse and return to the biosphere, and aims for the elimination of waste through the superior design of materials, products, systems and business models' (Ellen MacArthur Foundation 2013b: 2; see also Aldersgate Group, 2012; Ellen Macarthur Foundation, 2013a, 2014; Lee et al., 2012).

Thus, moving towards a CE necessitates substantial transformations in design, production, consumption, use, waste and reuse practices. Overall, the goal is to keep valuable materials in circulation through a series of systemic feedback loops between life-cycle stages, powered through resource efficient industrial processes.

Calls for a significant shift towards a more circular economy through approaches such as closed loop manufacturing have existed for decades, emanating mostly from the field of Industrial Ecology (e.g. Lyle, 1994). While initially such calls were founded upon hypothetical systems of production and reuse, advances in technological, design and retrieval processes are rendering the theory of CE a more realistic proposition. This agenda has recently gained further impetus through political concern about issues such as 'resource security', believed to be creating price volatility and thus threatening long-term economic sustainability (e.g. Department for Environment, Food and Rural Affairs and Department for Business Innovation and Skills, 2012). As such, solutions that fundamentally

reconfigure current production-consumption patterns have made their way into high- level political agendas of late. For one, the European Commission has stated that resource efficiency and a move towards the CE is one of its 7 'Europe 2020' flagship initiatives, as 'the EU has no choice but to go for the transition to a resource-efficient and ultimately regenerative circular economy' (European Commission, 2011: 1). This transition is argued by the European Commission as a promising pathway to regional prosperity, enabling the 'reindustrialisation of the European economy on the basis of resource-efficient growth that will last' (European Commission 2012: 1).

As well as such high hopes at the European level, the UK Government's 'Resource Security Action Plan' (Department of Environment, Food and Rural Affairs, 2012) includes interventions that aim to foster the CE. Beyond formal policy circles, an array of non-governmental organizations is gathering around the possibilities of the CE. The Ellen MacArthur Foundation for example was founded with the sole purpose of promoting the CE, and have been gaining notable political and business traction recently, such as being placed front and centre at the 2014 World Economic Forum (see Confino and Holtum, 2014).

Given all of the above, the impetus for this paper is that is arguably apposite and timely to interrogate the implications of the CE. Extant academic, policy and business-led analyses frame transformations towards the CE as predominantly issues of innovation, technical systems, fiscal and business incentives, and reformulated business models. While these interventions are not dismissed here, this paper is prompted by the observation that within prevailing CE debates, little has been said about the socio-political implications and possibilities for shifting current production-consumption-use-waste practices. In addition, scant consideration has been given to other 'transformative' pathways and practices, currently elided by a focus on industrial systems and sustained economic growth. As such, crucial questions require greater consideration, such as the forms and processes of governance that would facilitate an effective and equitable CE. In addition, what are the implications of a CE for quotidian spaces and practices, as the patterns and rhythms of everyday socio-materiality are potentially reconfigured? Is the CE yet another iteration of capitalist crisis, reproduction and survival (Harvey, 2010; 2006), or does it productively merge disparate discourses

and actors to garner much-needed action around the manifold issues of global sustainability? And what forms of research/intervention might critical social scientists such as human geographers contribute to explore the above questions, informed by which streams of conceptual and empirical debate?

This paper aim to examine some of these questions, arguing that human geographers are well placed to make critical contributions to debates about the CE, given the fundamental disciplinary understanding that 'Production is…entangled with biophysical, social, political and cultural processes' (Sheppard, 2011: 324; see also Berndt and Boeckler, 2011). In making this argument, this paper adopts a generative stance (e.g. Head and Gibson, 2012). That is, it aims to locate and foster emergent research spaces, with an eye to the 'virtual presences' (Dittmer, 2014: 388) of contingent futures that remain underexplored within prevailing CE frameworks and advocates. As the concept of the CE touches on so many processes, peoples and places, no one paper can offer a complete dissection of its contents and implications. Therefore this paper focuses predominantly on questions of socio-material practices as a key area where human geographical debate has arguably much to contribute. Specifically, it aims to bring work around materiality, emergence, and everyday activism into conversation with concepts less often discussed in human geography—such as Product Service Systems and 'prosumption'—to map out fertile areas of debate and research. In doing so, this paper begins with an elaboration of the concept of the CE, discussing existing research that intersects human geography with Industrial Ecology. It then discusses some of the governmental implications of the CE, drawing on an example of electronic waste. The final section examines the possibilities for citizen engagement and reconfigured material practices around the CE, suggesting possible sites and topics for future research.

What is the Circular Economy and how do we get there?

Fundamentally, recent debates about the CE are in response to the widespread failure of existing sustainability measures, given proclamations that global production-consumption systems remain, and are becoming increasingly, environmentally and socio-politically unsustainable (Rockstrom et al., 2009; Wilkinson and Pickett, 2009). In this climate, ideas of the CE can, and arguably are,

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becoming potent and reassuring discourses of a sustainable future. In this section, the concept of the CE will be unpacked further, along with the political agendas behind its current rise. It is argued here and in following sections that some of the strategies currently in use to foster the CE are in danger of repeating the failures of 'weak ecological modernization' (Lane and Watson, 2012), as they sidestep pressing socio-political issues across scales and spaces.

Why then does the CE matter? At the global level, resource use has continued to grow rapidly in the past few decades, spurred on particularly by economic growth in Asia (Schandl and West, 2010). Thus, the essential absolute (not relative) decoupling of resource use from living standards is far from taking place (Dasgupta and Ehrlich, 2013; Jackson 2009). Not that positive inroads have been completely absent in recent years. There have gains from energy efficiency measures (Willis and Eyre, 2011) and notable increases in recycling rates e.g. 43% of UK domestic waste is now recycled (Department of Environment, Food and Rural Affairs, 2014). However, the overall picture is less than positive. A great edal of recycled material ends up 'down-cycled' and non-domestic recycling rates are less healthy e.g. 75% of construction and demolition waste still goes to landfill (Vefago and Avellaneda, 2013).

One plausible reason for the above is the predominance of 'weak' ecological modernization policy frameworks and interventions in post-industrial countries over the past few decades (e.g. see Lane and Watson, 2012). With an emphasis on continued economic growth and neo-liberal governmental/market-based interventions (Bakker, 2010; Bridge 2011, 2013), such approaches have been roundly critiqued as ineffective at addressing the core causes of environmental unsustainability. Instead their emphasis on 'win win' scenarios fails to question the status quo and offers weak policy instruments and easily co-opted discourses of green capitalism and consumerism (e.g. Dauvergne and LeBaron, 2012; Prudham, 2009). Yet, if recent analyses are even only partially accurate, such approaches have a fast-approaching expiry date. Semi-apocalyptic proclamations claim we are 'sleepwalking into a prolonged era of resource-related strife' (e.g. Lee et al., 2012: xiv), where food, minerals and water resources are stretched to breaking by over-extraction, compounded by geographically and socially uneven access and rights (e.g. McMahon, 2013; Rockstrom et al., 2009).

One facet of this bleak picture is the issue of 'critical resource security'. Here resources key to the production of goods and services are at heightened risk of becoming unattainable within a matter of years (e.g. House of Commons Science and Technology Committee, 2011; US Department of Energy, 2010; European Commission, 2011). In 2010 the EC released a list of 14 crucial minerals, such as Antimony, Graphite, Magnesium and Tungsten. Although not nouns that trip off the tongue in everyday talk, these minerals are currently vital components in goods and services many of us take for granted. For example, Antimony is used in medications and pharmaceutical products and Indium in LCDs, with both of them predicted to become inaccessible within the next 20 years (Cohen, 2007).

How then does a mineral become classified as in danger of being critically scarce? Not an uncontested classification, it rests upon evaluations of which minerals are (a) geologically rare and/or (b) financially unviable for extraction due to geological dispersion and/or (c) have a high risk supply due to political instability or centralised control in countries with the highest concentration, such as Tantalum in the war-torn Democratic Republic of the Congo (European Commission, 2010). As such, critical resource scarcity contains within it complex historical, geopolitical and socio-material relations. Geological patterns and the locations of key minerals intersect with a continued drive for primitive accumulation (Bridge, 2010), taking place in locations not easily rendered governable under current forms of variegated neo-liberalism (Bakker, 2010). Political geographical analysis has indeed underscored the inextricable relationship between the physical properties of minerals and other resources (oil, carbon), and the forms of (often far from progressive) politics that arise around their acquisition, use and control (e.g. Le Billon, 2008; Huber, 2008; Kennedy, 2014; Mitchell, 2009). For example, Emel et al.'s work on sovereignty and mining has underscored the mechanisms by which valuable and increasingly rare minerals are rendered accessible beyond their geological locations. These mechanisms hinge upon complex interplays between global capital and states that are fundamental to 'constructing a specifically national mode of territorial sovereignty' (Emel et al, 2011, p. 70). As such, the issue of critical resource scarcity raises pressing questions of capital, power and their uneven spatial manifestations, which human geographers have proven adept at illuminating.

One question that follows on from the above is how then to intercede in a socially and environmentally progressive manner. One tactic has been to lay bare the myriad injustices at the heart of some rare mineral extraction. For example, the campaign 'Raise Hope for Congo' highlights the violence perpetuated by 'mineral conflict', including naming and shaming electronics companies that fail to source 'conflict free' minerals (see http://www.raisehopeforcongo.org/companyrankings). Uncovering exploitative socio-political relations embedded within everyday 'things' have been framed as a 'radical' political strategy within and beyond human geography (e.g. Hartwick, 2000). Here, the social and environmental conditions of production are rendered partially visible through, for example, life cycle labeling and campaigning. This approach is argued as a valid tactic to open up spaces for 'a new politics of consumption' that works to illuminate the 'connections between precommodity and postcommodity phases of products' (Hultman and Corevellec, 2012: 2414). However, such an approach assumes much. For example, that a label on a product is able to significantly alter consumption patterns, despite considerable evidence otherwise (e.g. Auld and Gulbrandsen, 2010; Cowburn and Stockley, 2005; Eden, 2011; Grankvist et al., 2004). It also averages out the contingencies of commodity chain governance, assuming a certification label for example is able to adequately represent the variations in practices along a products' life cycle (see McDermott, 2012). And it arguably narrows the political register through which citizens can and do engage with issues of consumption, 'ethical' or otherwise (e.g. see Barnett et al., 2005; Cook et al., 2007).

Indeed, given the projections that numerous crucial minerals will become inaccessible, whether their sourcing takes places unjustly or not, it is their substitutability and recoverability that has become a focus for industry, research and government (e.g. Piesing, 2013). At first glance, this might suggest merely extending existing resource practices, such as more recycling of goods containing crucial minerals. While this is part of the picture, the quote that opened this paper underscored how a CE is deemed to necessitate all aspects of production-consumption be open to scrutiny and potentially recalibrated. This includes designing goods that both last longer (Cooper, 2005; Brook Lyndhurst, 2011) and from which re-usable materials can be more easily recovered. Also necessary is

the use of renewable energy during manufacturing processes and the reuse or 'return to the biosphere' of all materials.

Such propositions are not new, having been debated for decades mostly within the field of Industrial Ecology. This sub-discipline began synthesizing developments in ecology, systems theory and environmental science from the 1960's onwards (Deutz, 2009; Deutz and Frostick, 2009). Although a diverse field of writing, a key insight from Industrial Ecology is that ecosystem principles of organization and function could, in theory, offer a model for industrial system design. Such systems could be formed to repeatedly cycle biological (i.e. water) or technical nutrients (i.e. PET) through multiple productive lifetimes of use. Attendant notions of 'cradle to cradle' design, production and reuse/recycling have been further developed, such as Mcdonough and Braungart's (2010) writing on 'Cradle to Cradle' concepts (see also Lyle, 1994), which have contributed to a now lively field of research and practice in sustainable design (e.g. Lilley, 2009). In addition, small-scale institutions that aim to bring theory into practice now exist, such as the Centre for Sustainable Design in Surrey, UK; the Geneva-based 'Product-Life Institute'; and the Cradle to Cradle Products Innovation Institute, based in the Netherlands and San Francisco. Thus, ideas that have existed on paper since the 1960s are now coming to life, made feasible given advances in materials science, design practice, information technology and governance mechanisms (Preston, 2012).

To date, human geographers have engaged little with questions of the CE, closed loop manufacturing and Industrial Ecology although there are notable exceptions. For example, researchers have explored the planning and development of eco-industrial parks in USA. Such parks are considered an essential component of creating CE system, as companies can co-locate to facilitate the material interchange and 'energy cascading' necessary for closed production-consumption loops (Gibbs and Deutz, 2005; Gibbs et al., 2005). This research has found that, while viable on paper and framed as tenable regional growth strategies by policy makers, the development of such parks took place with little acknowledgement and engagement with all-important contextual socio-political processes, creating less-than-successful outcomes (Gibbs et al., 2008). As such, this research highlights the scope and the need for critical analysis of the socio-political and

economic mechanisms and pathways proposed and enacted under the name of the CE. This includes the governmental interventions that aim to foster business and broader socio-economic conditions amenable to the CE, which—as argued in the next section—have to date re-embedded existing regimes of governance and failed to give credence to all that is stake under the auspices of the CE while espousing significant and transformative societal change.

Governing the circular economy: the case of WEEE and the modernist myth

Within extant renditions of the CE, the transformative mechanisms proposed exemplify existing forms of environmental governance under advanced neo-liberalism(s) (Bakker, 2010; Rutherford, 2007). These include 'green' tax incentives, improved product collection and reuse, alterations to industry standards, and consumers making 'greener' choices via education and labeling interventions (Aldersgate Group, 2012). Replete with ecological modernization discourses of 'win-win' scenarios (see Lane and Watson, 2012), continued economic growth within the CE allows a certain form of business as (slightly un)usual to be sustained. For example, the Foreword to one of the three major Ellen MacArthur Foundation reports underscores the economic benefits—estimated at over US$ 1 trillion per year by 2025—of a 'more restorative' approach to production-consumption (MacArthur, 2014: 2). This unquestioning trajectory of continued resource throughputs stands in distinction to other, arguably more marginalized, discourses and visions of the future such as the 'DeGrowth' and 'Sufficiency' movements (Hobson, 2013). And as such, the proposed pathways to, and goals of, the CE arguably line-up with what Gille has labeled 'the modernist myth', wherein individual and collective intentions are believed to be fully realized and realize-able as 'human bodies, and materials can be molded to our liking given the right science and technology.' (2010: 1054; see also Rose, 2013). In relation to the CE, the fundamental assumption is that current complex and over-determined systems can be redesigned and reformulated *en masse* and *in toto*. This is to be done utilising existing policy tools and with little consideration of the 'incomplete and polymorphic nature' (Brenner et al., 2010) of contemporary practices and modes of governance, which encompass

'technologies, infrastructures, markets, norms, regulations and other constituents of systems across spatial and temporal scales' (Watson, 2012: 488).

To return to the above quote from the European Commission (2011), it essentially proposes that incremental 'resource efficiency' measures are the first step on the pathway to a CE. However, evidence suggests that instigating attendant policy interventions can create a form of governance lock-in, arguably closing down, or at least making less probable, more radical solutions. One example of relevance here is the European Waste Electronic and Electrical Equipment Directive (WEEED). Created in 2003, it requires European Union Member States to meet pre-determined electronic and electrical waste (e-waste) collection targets and recycling rates. Paragraph 12 of the WEEED (European Parliament and Council of the European Union, 2003: 25) states that it aims to establish 'producer responsibility' as a means to stimulate the design of goods that can more easily be repaired, reused, disassembled and/or recycled. Central here is the concept of Extended Producer Responsibility (EPR), where producers are responsible for the environmental impact of their goods, including 'upstream' impacts such as material sourcing and 'downstream' impacts such as product disposal (Atasu and Van Wassenhove, 2012). However, EPR as an actionable governance mechanism invariably intersects with and maps onto existing modes of production, along with extant 'modes of governing' waste (e.g. see Bulkeley et al., 2007), as well as socio-cultural practices and norms. As a result, in the UK for example, the translation of the WEEED into national law has meant that producers are now responsible for financing e-waste collection and treatment based on their market share (Sander et al., 2007). Thus, what has been created is a new layer of waste collection and recovery obligations, schemes, and actors which—while helping to decrease the proportion of e-waste going to landfill (see Lauridsen and Jorgensen, 2010)—has done little to bring eco-design principles front and centre of production-consumption systems (see Lane and Watson, 2012). As a result, there has been little shift the prevailing mode of waste governance, but rather a reinforcing of out-sourcing, market-based approaches to managing and acting on waste.

The above arguably reinforces as Lepawsky's point (2012) that debates such as those around e-waste management are about more than simply the efficacy of particular schemes. Rather, they are fundamentally about 'how democratic forms

of politics and capitalist forms of markets are to be assembled and distributed' (*ibid*: 1194). And it is these notions of assembly and distribution that the remainder of this paper focuses on. In particular, it is argued below that human geographical concepts and modes of research could enliven and enrich CE debates, bringing attention to the work done the diversity of actors, spaces, practices and materials that are gathering around the CE, and thus paying heed to Dittmer's call for us 'to cultivate our perception of non-human agency' (Dittmer, 2014: 389). In short, if the CE really requires a fundamental transformation of how resources are thought about and utilized, exploring the manifold—and often dispersed and experimental—ways such transformations can and are taking place constitutes a vital and missing component of CE debates.

Distributing politics and markets in the CE

Current interventions to facilitate a CE take, as argued above, the shape and rationale of existing modes of governance. For example, as part of the UK Resource Security Action Plan' (*ibid.*) a Circular Economy Task Force has in recent years been created in the form of a multi-sector, public-private body. Its role is framed as being one of 'developing links', 'addressing opportunities and concerns', as well as spreading 'leadership thinking and best practice and to provide a forum for policy innovation.' (*ibid.*:29). Such 'soft' goals and institutional forms are far from novel (Evans, 2012) particularly around issues of production and consumption (see Driessen et al., 2012). Political scientists for one have spent decades categorizing and explaining how and why these networked forms of governance come about and operate (e.g. see Bevir, 2011, 2013). Whilst also contributing to this literature, human geographers and other critical social researchers have been considering the implications of shifting regulatory and governance interventions into other modes and spaces (e.g. Amundsen et al., 2010; Bulkeley and Betsill, 2005; While et al., 2010). This includes examining how urban and community spaces can and/or do function as 'transition labs' (e.g. Nevens et al., 2013; see also Burch et al., 2014), an approach that recognizes the contingent and spatially specific nature of systemic change. Indeed, framing 'transitions' in the language of experimentation is not merely a metaphorical or rhetorical flourish. Rather it

touches upon a potentially productive line of inquiry and research within the 'generative' vein of scholarship referenced at the start of this paper.

For one, the Circular Economy Task Force (2013: 28) posits that the CE will require 'collaboration and experimentation' by a suite of actors and across a range of practices that extend beyond those currently at work. Such experimentation is of a different ilk to that being undertaken in the name of, for example, behavioural economics within various UK policy settings, such as in the Behavioural Insights Team or 'nudge unit' (see Cabinet Office Behavioural Insights Team, 2013; Jones et al., 2013; Whitehead et al., 2012). Rather, the collaboration and experimentation the Task Force, and indeed researchers, arguably allude to can be framed as] the incubation of spaces and modes of practice that forge new forms and modes of collective socio-material relations.

For example, there are now a number of semi- or non-governmental organisations working around and through ideas of the CE. Such intermediary organizations are considered crucial to connecting 'specific and often isolated local innovation projects with one another and with the wider world' (Hargreaves et al., 2013: 868: see also Head and Gibson, 2012). Such intermediaries currently include the environmental think tank The Green Alliance, which convenes the Circular Economy Task Force; WRAP, a not-for-profit company with a focus on facilitating greater waste prevention and resource efficiency; the Royal Institute of International Affairs (also known as Chatham House), which has undertaken research around the issues of resource insecurity and the CE; and the Aldersgate Group, 'an alliance of leaders from business, politics and society that drives action for a sustainable economy'. Finally 'The Great Recovery' is a CE project run by the Action and Research Centre of the Royal Society of Arts. It uses an array of online and in-person processes to bring together actors involved in all aspects of material design, use and recovery, including a 'New Designs for a Circular Economy' competition, 'Peoples Design' labs, and an 'Online Collaboration Board'.

The gathering of such diverse actors around the CE is neither novel nor surprising in and of itself, as intermediaries across a range of topics are already 'opening up space in different contexts (whether local, policy, market, social) for new and diverse kinds of activity' (Hargreaves et al., 2013; see also Carolan 2013). What is potentially intriguing around and within CE spaces are their potential to

acknowledge, reconfigure and redistribute socio-material agency throughout the 'on-going-ness' (Lepawsky and Mather, 2011) of goods. That is, to serve as spaces of contemplation and/or creation of new 'after lives' (Crang et al., 2013) of objects and their constituent parts, potentially mirroring, connecting with or varying notably from the existing 'piles of circularity' (Lepawsky and Mather, 2011: 249) that characterize many material relations in part of the Global South, often out of economic necessity.

For example, the Great Recovery regularly runs 'tear downs' of electronic devices, where goods are disassembled to display the entirety of their component parts. The 'tear down' has of late become a notable practice, sometimes for fun and art (McLellan, 2013), and sometimes as a way to encourage the creation of 'accessible, extensive, and repairable hardware' (http://makezine.com/04/ownyourown) through exposing the (il)logics of current devices, such as mobiles 'phones. As such, the 'new politics of consumption' (Hultman and Corvellec, *ibid.*) at work here is not just about exposing injustices embodied in goods but also redistributing forms of socio-material expertise, knowledge and techne. These practices thus arguably align and enrich modes of public engagement that human geographers argue work in an open-ended manner to redistribute various forms of expertise (e.g. see Landstrom et al., 2011; Lane et al., 2011). This work has explored knowledge generation around environmental controversies such as flooding, and situates itself conceptually within debates about 'political matter' (see Braun and Whatmore, 2010).

What then is the potential of 'hands on' forms of material engagements by an array of publics, in potentially envisioning new logics of socio-material relations via enlivened/new forms of *techne* (Flyvbjerg, 2001)? Such questions have at their heart the understanding that 'humans and non-humans alike are material configurations, not dividable, separate or separable, but integrated, co-constituted and co-dependent. (Tolia-Kelly, 2013: 154). This invites further consideration of the implications and potentialities of new forms of material configurations contained within or made possible through the CE. The next section of this paper explores this point further through one particular—and to date under-explored—component of CE debate: the role of everyday spaces and quotidian modes of resource-use practice.

Being a circular economy citizen: pathways to radical product service systems?

What then is the perceived role of the citizen within the CE, in both mainstream renditions of the concepts and alternate visions? Under a linear, non-circular economy', the role of the citizen is for the most part elided with that of the consumer. Here, the individual is willing and able to make well-informed and rational purchase choices, as well as undertaking the correct waste disposal behaviour all in the name of the environment (Lane and Watson, 2012). This includes buying more 'sustainable', 'green' or 'ethical' goods and recycling as much waste as possible from these (and other) goods. This framing of everyday sustainability has been roundly critiqued for its individualized and overly-rationalised rendition of what are fundamentally collective practices and challenges (e.g. Barnett et al., 2005; Burgess et al., 2003; Cohen et al., 2010; Dowling, 2010; Princen et al., 2002; Watson, 2012). Indeed, seemingly mundane behaviours, such as carbon offsetting and recycling, are argued as governmental devices that at once depoliticize the discourses of environmentalism while engendering forms of environmental citizenship in-keeping with the aims of weak ecological modernization (e.g. Hobson, 2006, 2013; Marres, 2011; McDonald et al., 2009).

For the most part, mainstream advocates of the CE do not envisage new roles or recalibrated modes of engagement for the consumer, but rather rehearse the above norms of the linear economy. The Ellen MacArthur Foundation for one claims that the CE 'largely replaces the concept of the consumer with that of a user' (Ellen MacArthur Foundation 2013a: 7), and creates 'a new contract between businesses and their customers' (*ibid*.). The main barrier to such a shift is argued as one of 'consumer acceptance' (e.g. Aldersgate Group, 2012) of altered systems of production and consumption, made palatable through through consumer education and engagement (e.g. Lee et al., 2012).

This movement from 'consumer' to 'user' pertains to the business models forwarded by CE advocates. For example, goods that are now purchased and owned, such as carpets, washing machines or garden tools, are instead leased. This allows (in theory) consumers to access goods when needed, and businesses to recycle, repair and reuse goods through maintaining control of ownership. Within current CE debates, such business models are uncontroversial, and successful

examples exist, such as carpet leasing company Interface. However, within CE debates little consideration has been given to what exactly is at stake vis-à-vis the acceptance or rejection of these modes of consuming by citizens. For example, how and to what ends do such business models shift or clash with perceptions of consumption, consumerism and private property? How might becoming a 'user' alter the spatial-temporal patterns of how households and other collectives locate, exchange and return goods? If goods now not only have 'after lives' (Crang et al., 2013) but also 'on going' and multiple lives, how do the current ways that households deal with unwanted goods—that include gifting, swapping, selling on, recycling, and storage (Bulkeley and Gregson, 2009; Crang et al., 2013; Gregson and Crang, 2010; Lane, 2011; Moore, 2012)—become enlivened, enrolled and/or reconfigured in the CE?

The concepts of the Product Service System (PSS) and 'servitization' provide useful means to think through some the above questions. These frameworks and attendant literatures may be unfamiliar territory to many social scientists, with debates around these concepts appearing for the most part in industry, management and operations publications such as Journal of Cleaner Production (e.g. see Beuren et al., 2013; Lightfoot et al., 2013). However, there is an emergent literature within the social sciences that speak to ideas of PSS through connecting work on theories of practice with debates about socio-technical transformations. That is, rather than seeing individual behaviours as the necessary unit of social change, work on practices emphasizes how patterns of action (e.g. showering) are co-constituted by histories, technologies, norms and preferences around issues of cleanliness. As such, making practices more sustainable requires questioning how and why current needs are met, and thinking creatively about other ways to meet needs such as mobility, warmth, cooling and cleanliness (e.g. Davies et al., 2014; Givoni and Bannister, 2013; Watson, 2012): in short, reworking the ways products and services are calibrated to meet human needs.

Tukker (2004, 2013) has mapped out the range of possible PSSs along a continuum. At one end, there are business models that remain for the most part product orientated with a few extra services included, such as leasing, renting and sharing components of a practice. One example is the much-lauded rise of car-sharing schemes, which provided rented, short-term (i.e. 1 hour upwards) access

to a communal car, thus aiming to alter patterns of habit and mobility (see Kent and Dowling, 2013). However, car sharing arguably does little to challenge the centrality of the car as the predominant mode of mobility and has been captured as a model for business expansion by large corporations, such as Avis who bought Zipcar. At the other end of the PSS spectrum are 'result-oriented' services where the client and provider agree in principle upon the result required with no pre-determined product involved. Such indeterminacy and openness to the ways and means of meeting needs is considered the more 'radical' end of the PSS spectrum. That is, an approach with potential to challenge current patterns of resource intensity and overuse, but also the most difficult to envisage, enact and create. Perhaps then there are ways in which human geographers can be part of envisioning and exploring the possibilities of radical PSSs, starting not so much from planning them on paper as an exercise in abstraction but rather paying attention to the emergent properties of current and nascent socio-material assemblages that speak to the inherent openness of radical PSSs.

To explain, in this journal Dittmer (2014) argues for consideration of the capacities rather than just the properties of geopolitical assemblages, understood as 'emergent wholes defined by their properties, tendencies, and capacities' (*ibid.*, p. 392). Here, while features and structures matter in terms of outcomes, it is also how properties interact with other assemblages, creating a range of contingent futures that may not or are yet to be realised in material form yet still can exert a 'virtual presence'. Arguably traces of such virtual presences can be located in current practices reshaping the ambit and forms of engagement with everyday consumer with goods and services, potentially opening up spaces for forms of radical PSS to emerge. In this context, the role of human geographical research could be to look closer for the 'possibility spaces' (*ibid.*) amidst these practices, with an eye on the 'vitality' of the materialities at play (Gregson and Crang, 2010). But what practices are being referenced here? There have of late been claims about an apparent demise of prevailing consumption patterns and norms, wherein the sovereign consumer is being usurped by the rise of the 'prosumer' (e.g. Ritzer et al., 2012). This term—an amalgamation of producer and consumer—does in part hark back to a past when most human prosumer, producing and consuming food, clothes etc. for themselves and their communities

(Ritzer et al., 2012). In its current iteration however, the idea of the prosumer encapsulates a wider range of processes only tenable under the conditions of (post)modernity. These range from productive practices (e.g. ideas, designs) being taken up and co-created by external agents such as for-profit companies to produce value: to more long-standing practices of do-it-yourself, crafts, and other examples of so-called 'post-consumerism' (Belk, 2014; Botsman and Rogers, 2011; Cohen, 2013). In relation to the former, it is feasible to assume that processes that aim to co-create value between citizens and organisations are another example of capitalist exploitation and cooption in the face of shrinking margins (Rifkin, 2014). However, there are other examples of joint value-creation, that may—and indeed, on paper seek—to go beyond the creation of a new good or service, to potentially create the emergent assemblages that Dittmer (*ibid.*) writes of.

For example, the social enterprise Fairphone (http://www.fairphone.com) is a Netherlands based organization whose core business is the creation of a smartphone made with conflict-free minerals, with a design that allows recovery, repair and recycling in line with CE principles. The Fairphone website states that their key principle is that of 'responsible design' which consider the life cycle of the 'phone and 'gives you complete control over how to use and configure it. Our adopted manifesto is "If you can't open it, you don't own it"' (see http://www.fairphone.com/2013/05/17/three-years-in-the-making-road-to-a-fairer-phone). For the Fairphone user, this 'complete control' requires learning how to 'use and configure' the Fairphone, which takes place virtually via website information and online discussion forums. A quick glance at the content of these online forums highlights the challenges of learning to configure a smartphone and negotiate the responsibilities and challenges of electronic devices that have functional and material flexibility built into them. But it also highlights the capacities and willingness of citizens to engage with the technical specifications of coding and configuring, potentially fostering an emergent 'Fairphone movement' that the social enterprise speaks of on its website. This movement is based not just on the technical components of the smartphone but also on 'creating the fairer economy' (*ibid.*). Such as economy is one where exploitative extractive practices are eliminated through conflict-free resources, with capital generated through

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crowd-sourced financing. For Fairphone this generation of capital entailed several thousand individuals purchasing the phone before it could go into production: a move that they state aimed to displace the politics and power of 'old capital', engaging online communities of interest and shared ethics (Gibson-Graham, 2006).

This is not to hero worship Fairphone or to assume that all that appears on their website mirrors what happens in practice. But then, that is partially the point. That is, the above example raises questions about what emerges from assemblages such as Fairphone, as they seek to co-create a PSS that takes on board CE thinking whilst bringing in agendas of fairness, participation and socio-material engagement of citizens. Indeed, how do investors/users/participants—and indeed, people who are all 3 at once—become enrolled into and/or create new 'possibility spaces' through engagement with the contingent functionality of the Fairphone, which requires being more than a standard 'phone user? And how do these emergent properties speak to other generative spaces, such as Repair Cafés (see http://repaircafe.org), that form in-person, temporary collectives around repairing everyday goods? And finally, what forms of 'everyday activism' emerge, wherein individuals and groups 'self-manage and develop workable and replicable models for a better life' (Chatterton and Pickerill, 2010: 476; see also Chatterton, 2010; Pickerill and Chatterton, 2006)? While research into forms of everyday activism has not foregrounded the socio-material engagements of emergent political practices, it does focus attention on 'the social and spatial settings where matters of importance get politicized' (Hakli and Kallio, 2014: 189). Such an approach to locating and fostering spaces of activism stands in contrast to those that predetermine what can be and is labeled as political around the issues of sustainable production and consumption (cf. Hultmann and Corvelec, 2012). Instead, it requires that paying close attention to spaces where disparate forms of CE may emerge and/or be fostered in forms and ways that current analyses of the CE omits or at least obscures from view.

Concluding comments

This paper has aimed to bring recent and growing debates around ideas of the CE into conversation with some facets of human geographical research. The aim is to

outline how research into a CE requires much broader analytical lenses than are currently deployed, given the profound 'transformative change' advocates speak of. The purpose here was to provisionally locate generative spaces and practices that embody a CE which goes beyond re-jigged industrial systems and business models. Rather, the case is made that any consideration of the CE must encompass forms of 'everyday activism' that foreground the 'vital materialism' (Gregson et al., 2010: 853) necessary to rethink, re-envision, recreate, reuse and 'move on' the goods and services that currently meet everyday needs. In other disciplines, researchers and practitioners talk of addressing unsustainable production and consumption through frameworks such as Product Service Systems. This (perhaps rather dry) phrase is not found a great deal in human geographical work, but does intersect with—and arguably has much to contribute to—research that explores practices embedded within, and enacted through, multi-scale socio-technical systems (Davies et al., 2014; Watson, 2012).

Advocates of the CE appear to consider the role of citizens as being the acceptance (or not) of practices that have been formulated on their behalf by designers, engineers, economists and policy makers. One key aim of this paper has been to highlight how this presents an impoverished view of the properties and capacities that new assemblages of the CE are, or could, bring forth, That is, a seemingly narrow set of practices and spaces for citizen action (e.g. the High Street) are supplemented and/or challenged by the multifarious practices of the designer-consumer-user-repairer citizen. Indeed, as mentioned above, the Ellen MacArthur Foundation suggests that a new contract is emerging between business and the consumer. In their understanding, this relates to a direct and legally binding agreement between two or more parties. Yet this paper is essentially arguing that broader notions of a contract can be evoked here, where roles, competencies and responsibilities are redistributed and reconfigured throughout the lifetime of products and services, recalibrating the social relations and arrangements that currently favour the purchasing-ownership-disposal model of citizen-consumer practices. Such socially transformative enactments of the CE are thus implicit but under-explored within current debates, and this paper has aimed to highlight the potential for rich engagement, through both further conceptual and empirical exploration.

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