BUILDING CONSERVATION AND THE CIRCULAR ECONOMY: A THEORETICAL CONSIDERATION

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Article classification

Conceptual paper

Structured abstract

Purpose

The purpose of this conceptual paper is to discuss the relation between building conservation and circular economy (CE), which are often erroneously seen as inherently contradictory to one another.

Design / methodology / approach

The work draws from a comparative approach. The paper reviews a body of literature on architectural conservation and CE to establish an understanding on the state-of-the-art for both disciplines separately. Then, the relation between thereof is developed through a theoretical discourse.

Findings

Both architectural conservation and CE aim at safeguarding value, although they define 'value' differently. Fabric-focused conservation and CE favor minimal intervention to material, albeit they arrive at this conclusion from different bases. Consequently, both approaches struggle with the low cost of virgin resource extraction and waste production and the high cost of human labor in contemporary Western societies. CE could be harnessed for building conservation by adopting its vocabulary and methodology, such as life cycle assessment and material flow analysis. Transitioning towards CE can help increase the preservation of built heritage while redefining what is meant by 'heritage' and 'waste'.

Originality / value

Prior to this paper, there have been no articles addressing the relationship of the concepts explicitly and to this extent. The paper provides a theoretical basis for further discourse and outlines some implications of CE for the construction and built heritage disciplines.

Introduction

The circular economy (CE), that is, the reuse of pre-used objects and materials, was conceived as something undesirable in the consumption and growth oriented Modernist societies of the 20th century: a sign of poverty, marginality and backwardness of its users (Kinney, 2011a:2). During the last decades, the disciplines of environmental economics and industrial ecology have, nevertheless, increasingly proposed CE as a solution for combating the impeding global environmental and climate crisis, rooted in the 'take-make-dispose' model of the industrial linear economy. Because CE is typically conceptualized through slogans such as 'waste as a resource', 'to circulate' may at the first glance seem to contradict what it means 'to conserve'. Under these circumstances, it is hardly surprising that issues related to the circularity of heritage objects have only been addressed in conservation theory to a very limited extent, and the discipline's stance towards the idea has been fairly negative. Conservation doctrines (e.g. ICOMOS, 1964; ICOMOS, 2013) tend to reject re-contextualization and other redefining activities except in extraordinary cases, although the paradigm has shifted from strict preservation towards more permissive ideas of conservation, adaptation, and utility (Ashworth, 2011). Yet, it is symptomatic of the discipline's attitude towards circularity how poorly partial preservation is valued even under the one subtopic of the heritage discipline that deals specifically with reused objects, the research into 'spolia' (architectural reuse of components, typically medieval reuse of Greco-Roman marbles). More often than celebrating the survival of the fragments or the creativity of their salvagers, scholars express distress over the 'violence' the donor buildings have assumedly experienced (e.g. Kinney, 2011:4 or Wharton, 2011: 179) or disdain over the lack of imagination or courtesy of the users of spolia (e.g. Liverani, 2011:45; Meier, 2011:223; Wharton, 2011:187). While positive takes on spoliation as ecological and cultural adaptation, preservation and translation have increasingly emerged (e.g. Brandenburg, 2011; Esch, 2011; Hansen, 2003; Kalakoski & Huuhka, 2018), the fact that many prominent researchers in the field still portray the target of their research as a 'parasitic' activity at best does send a message.

The current paper argues that the discipline's disregard or distaste for circularity may largely result from a lack of understanding of what CE in fact is, and what are its fundamental principles. This is understandable, as the wider society outside the industrial ecology discipline from which the CE concept emerges is also only starting to grasp what CE is about, and its guiding principles are too often misrepresented or not presented at all in the non-professional discourse. So, the purpose of this paper is to present a discussion from a blue-sky perspective that brings together the ideas of CE with heritage conservation theories, in order to analyze when their principles are compatible and when they may contradict one another. The paper works with the concepts of circularity and conservation in the context of the built environment and built heritage. Unlike in archaeology and object conservation, architectural conservation seems particularly skeptical towards heritage objects (buildings or their parts) being relocated, repurposed, and thus, re-contextualized or reinterpreted. Simultaneously, though, what is understood with 'heritage' is undergoing a major transformation. First, the very definition of heritage is in and of itself expanding and becoming more fluid, and academics are increasingly tapping into the present utility and meanings of heritage instead of its physical features (e.g. Smith, 2006; Ashworth, 2011). Second, the amount of potential built heritage has increased exponentially as a result of post World War II construction boom (Hassler 2009). Third, this Modernist heritage differs significantly from the traditional buildings the discipline is used to dealing with (Hassler 2009; Figure 1).

Figure 1. The majority of building conservation tends to address traditional, pre-industrial buildings (left) that are few in number and artisanally handcrafted. One of the main challenges for the discipline in the 21st century is dealing with the industrially mass-produced built heritage (right). For rather obvious reasons, processes developed for the former type of heritage are not easily applicable to the latter.

These facts call for rethinking conservation in the 21st century. There is a growing understanding that the built heritage can contribute to sustainable development (e.g. ICOMOS, 2019). Adaptation has long been part of the conservation discourse (Ashworth, 2011), arguments have been made for the embodied energy of heritage buildings (e.g. Jackson, 2005), and CE has been introduced to some extent in the context of Historic Urban Landscapes (e.g. Fusco Girard, 2017). Nevertheless, no explicit elaborate discussion on how the theories of CE and conservation can be related seems to have been put forward prior to the article at hand. The paper argues that embracing the principles of CE could be one way for the discipline to address some of the current and future challenges. The research draws from a comparative approach. It is based on a body of literature from architectural conservation and CE, providing a condensed overview of the fundamental ideas underlying the two disciplines. Then, the relationship is developed in a theoretical discourse. The paper aims to produce a foundation that enables further discussion on the relationship between heritage and circularity in the built environment.

On architectural conservation

Architectural conservation theory can be seen to take a two-fold stance towards circular activities. On one hand, reuse is considered as an innate feature of vernacular built heritage. It is believed that building parts and materials of vernacular buildings were 'designed' for recurrent renewal (Matero, 2007:77). This kind of practice is regarded as particularly natural for wooden structures, such as Nordic log houses or Japanese timber buildings. Typically building parts were also passed down from buildings of higher requirements, such as residential buildings, to those of lower ones, such as outbuildings (Kalakoski and Huuhka, 2018:192). The fact that the building parts were still considered as usable for other purposes demonstrates that their value had not been completely drained during the earlier uses. Today, this is not seen as reuse but 'continuous use' (Kalakoski and Huuhka, 2018:209), which, unlike spolia, is not usually considered ethically dubious but natural and intrinsic. Perhaps this interpretation draws from the reuse as defined within one specific culture and in the context of less material abundance. Such reuse practices which derive from true necessity supposedly make the intentions of their makers pure.

On the other hand, such practices are usually not seen as acceptable for professional building conservation. The discipline emerged when Western societies industrialized and modernized, and distanced themselves from the natural world and the vernacular. The emergence of new materials, such as steel and reinforced concrete, and construction methods stirred seminal thinkers like Alois Riegl, John Ruskin and Eugène Viollet-le-Duc into developing philosophies that laid the foundations for modern conservation theories. Today, architectural conservation is largely driven by the belief that historically 'authentic' physical material of heritage objects carries the memories and values associable with them (Jones and Holden, 2008:95; Jones, 2009:137). So, the purpose of conservation is conventionally seen as preserving the material fabric within its built context to as great a degree as possible (Kemp, 2009:61), although it is regularly debated whether the 'original' form of an object or the material evidence should be conserved if preserving both is not viable (Matero, 2011:1–3).

What feeds this debate is that the value-constituting features of heritage are considered multi-dimensional and subject to interpretation (Orbaşlı, 2008:52). Features such as location, function, provenance, design and construction techniques are usually considered, and matters such as rarity or typicality can also be acknowledged. In practice, conservation usually looks for an acceptable compromise between the authenticity of the material substance and the integrity (completeness) of the historical and artistic ensemble (Jokilehto, 2017:429). Moreover, the 'original' is not conceived to consist solely of the first state of the building but also all major events that occurred during its past which it witnessed and which therefore contribute to its unique meaning (ICOMOS, 1964: Articles 7 and 11). Therefore, restoration to an earlier state is usually not seen as desirable. This view is also connected to understanding authenticity as 'honesty': that the appearance of things should portray their 'true' inner nature. Thus, all time layers, including conservation activities, should bear a stamp of their time in terms of surface patina and crafting techniques, and so avoid 'falsification' (ICOMOS, 1964: Articles 9 and 12).

Essentially, conservation theory is premised on qualitative argumentation. While objective material science can contribute to conservation decisions regarding e.g. decay, it does not answer whether an object should be deemed valuable and selected for conservation. These decisions are based on subjective interpretation and are therefore prone to debate. The passages above attempt to portray the prevailing dogma of architectural conservation as set forth by authorities such as ICOMOS. Real-life practices are naturally more flexible than the doctrines admit. Furthermore, since the 1990s, the fabric-focused tradition has been increasingly challenged by an emerging 'constructionist' paradigm that deems the significance of heritage as a construct of its users, rather than something embedded in the objects themselves (Smith 2006; Ashworth, 2011). This approach often moves away from Euro- and material-centricity and taps into the intangible aspects of heritage, such as traditional crafting techniques or oral histories – concepts that may resonate with non-Western and indigenous cultures. In an extreme form, though, this cultural relativist view could decouple the meaning of an object from its history, as a user can

give any object any meaning that is then 'authentic' to them. So, in addition to the long-running debates within the fabric-focused tradition, the emergence of this novel, competing paradigm towards a democracy of voices and a focus on utility over other types of values is a further source of internal controversy in the discipline.

On circular economy

By the mid-20th century, the ecological limits of the 'take-make-dispose' model of the linear industrial economy started to become perceivable. In the 1960s, ecological economist Kenneth Boulding (1966) compared the Earth to a spaceship: both are closed systems that have neither unlimited resources nor infinite sinks for waste. Environmental awareness grew through the Club of Rome report 'The Limits to Growth' (Meadow et al., 1972), which highlighted the problematics of industrialized societies' flawed perception of unlimited natural resources. A vision to mitigate the problem was commissioned by the European Union and put forward by architect Walter Stahel and social economist Geneviève Reday-Mulvey (1981). They proposed extending the lifespan of products, i.e. conserving their performance, as a strategy that would efficiently substitute work for fossil fuels and virgin materials, and envisioned an economy in loops, where labor-intensive repair and repurposing would contribute positively to economic profitability.

Over the decades, the notions on the Earth as a closed system within which the economy must operate led to the emergence of an entire discipline, industrial ecology, applying the logic of the natural realm to industrial production (e.g. Bourg and Erkman, 2003). Ideas of 'metabolisms', with flows and stocks of materials, energy and nutrients, are integral to this kind of systems thinking (e.g. Meadows, 2009). Many of these thoughts were popularized outside of academia in the 2002 book 'Cradle to cradle: Remaking the way we make things' by architect William McDonough and chemist Michael Braungart. They spread awareness of the closed loop i.e. cradle-to-cradle principle and promoted the idea of 'upcycling'. This concerns how design can increase the economic value of a reprocessed product, as opposed to the

value decreasing in the usual recycling process, i.e. 'downcycling'. Designer items made out of waste materials are prime examples of this. A somewhat contrasting idea to upcycling is 'cascading', which proposes a sequential, lengthened downcycling process (Fraanje, 1997; Figure 2). Interestingly, cascading is essentially the same as the continued use practice in vernacular construction, in which the building parts proceed from prestigious buildings to mundane ones. McDonough and Braungart (2002) also drew attention to the need to separate natural and industrial metabolisms from the start in designing production processes. Technological materials are considered to disrupt the biological cycle and vice versa; they therefore called for changes in the design of products so that they could more easily enter these loops at the end of their lifecycles. In 2010, ideas on CE were picked up by the then-founded Ellen MacArthur Foundation, which gathered them under one conceptual umbrella and published the well-known 'butterfly' diagram (Figure 3).

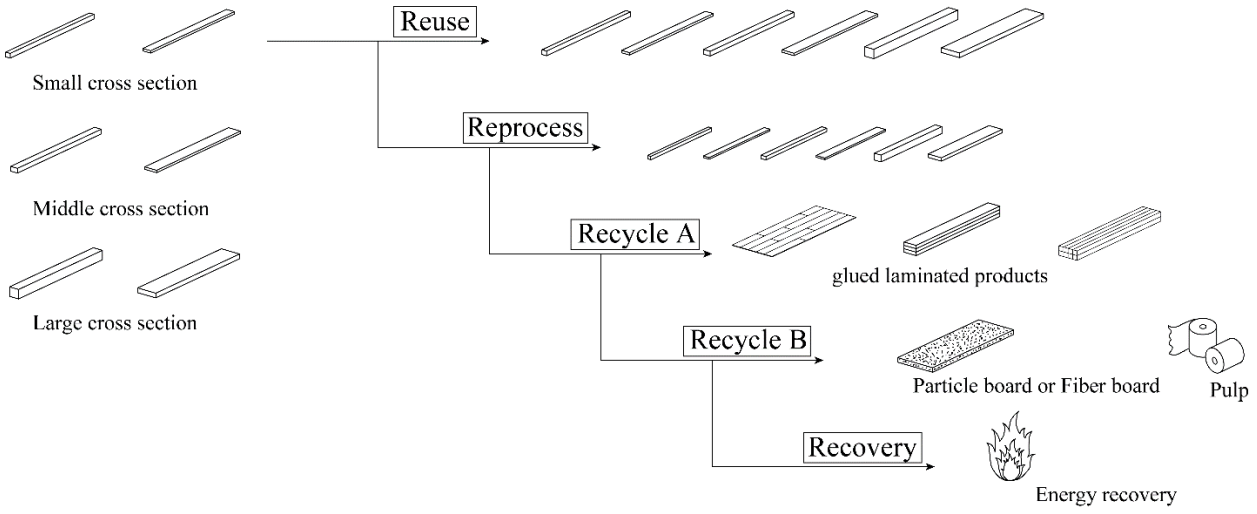

Figure 2. An example of a cascading flow for timber members from a deconstructed building (Sakaguchi 2014). Image courtesy of Daishi Sakaguchi.

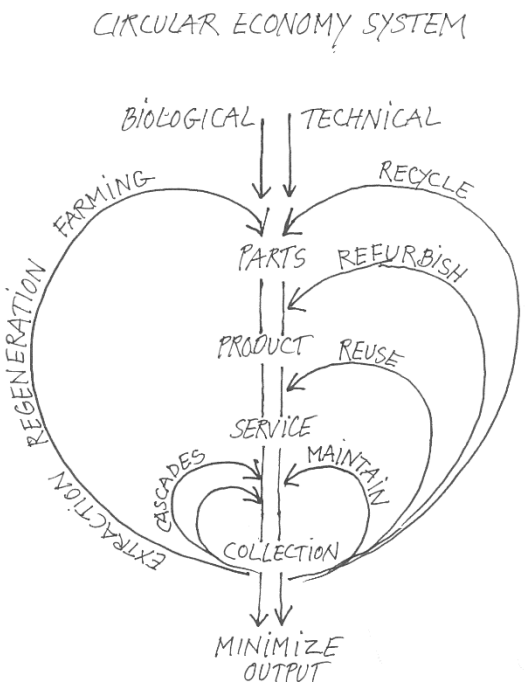

Figure 3. A popular conceptualization of CE. The closer to the core the measure is, the more preferable it is considered. Adapted from Ellen McArthur Foundation (2015:20).

To summarize, CE is founded on extending the lifecycles and conserving the environmental and economic values of already extracted and refined natural resources. The primary purpose is to avoid material extraction and resource depletion as well as the related energy use and greenhouse gas emissions. This is best achieved through the maintenance, repair, repurposing and recycling of products, in this very order, and by moving to a lower-level approach only when a higher-level option is no longer feasible. CE also proposes fundamental changes to new production to improve a product's circular capacity. However, the lifecycle extension of currently existing stocks of goods is seen as the main priority, despite the fact that their reparability and adaptability properties may not always be ideal. The idea of buildings acting as 'material banks' for future construction at the end of their life is focal for CE, but the premature demolition of buildings to access raw materials is never encouraged. The current authors' personal experience is that this is a common misunderstanding among practitioners. It may stem from

the fact that the majority of the circularity discussion has taken place in the context of fast-moving goods, such as consumer electronics, for which a quick phase-out of linear technologies in favor of more circular ones is, of course, practically more feasible than for the long-lasting built environment.

Remarkably, most works applying CE on buildings (e.g. Arup, 2015; Cheshire, 2016) still focus excessively on new build. Perhaps the Modernist obsession for all things new, still highly influential among construction profession, may best explain this phenomenon. Yet, it is particularly striking against the fact that annual new construction represents at most one percent of building stocks in most Western countries (Hassler, 2009). Figure 4 presents the current authors' conceptualization of the priorities of CE in buildings' context, the emphasis being on the conservation of the existing stock. Notably, only the oldest heritage can be considered fit for the biological cycle, whereas modern buildings inevitably belong to technologically defined loops. As illustrated in Figure 1, pre-modern buildings were made of stone, timber, or clay without any substances that would prevent the biological processes from reabsorbing the materials at the end of the lifecycle. Modern buildings, on the other hand, are based on complex composite structures made out of extensively manipulated substances, such as reinforced concrete, engineered wood, mineral wools and plastics. The capacity of such materials to return to the natural cycle is severely hindered, and some substances can even be hazardous if released to the environment (cf. Cheshire, 2016:69).

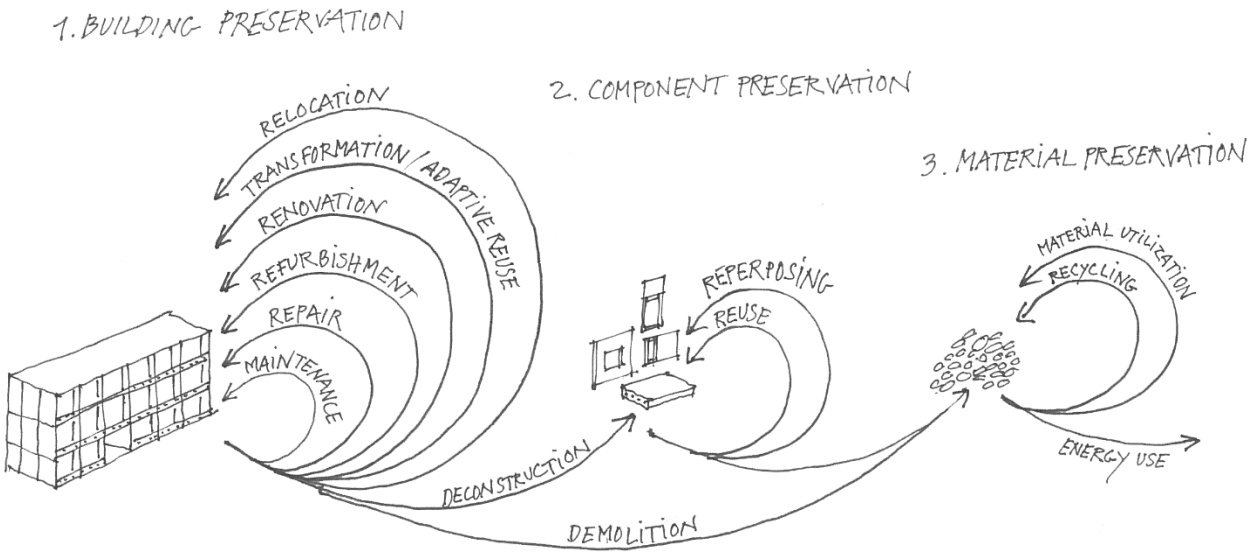

Figure 4. CE in the context of buildings. The priority order proceeds from left to right and from inner loops to the outer ones. New build from virgin materials is omitted due to its small significance, but its design principles can be found in e.g. Cheshire, 2016.

Whereas the underlying theory on CE is qualitative (as any theory), the priority order of CE (continued use over reuse, reuse over recycling, recycling over virgin extraction and disposal) is backed up by hard science such as lifecycle (LCA) and material flow (MFA) analyses. These quantitative methods demonstrate the environmental benefits of extending buildings' lives in terms of saved energy and materials, and avoided emissions and waste (e.g. Jackson, 2005). The assessments' robustness relies on the identification of all relevant energy and material flows into the product or system, including any losses, and assigning them with correct environmental impacts. While the results may be contested, based on for example the accuracy of the underlying environmental impact database, there are few subjective dimensions to the methodology itself.

Theories collided

When the fundamentals of CE and architectural conservation are placed side by side, it becomes obvious that they share the aim of conserving, restoring and/or re-creating value, although the definition of value differs between the approaches. In architectural conservation, the value propositions can be manifold and contradictory between competing paradigms, or even within one paradigm. According to the conventional, fabric-focused approach, the primary values are the cultural and historical values, which are embodied in physical features, even if they can be underlain by different characteristics (design, artisanship, et cetera). The authentic historical building material is usually seen to carry much of the values. Thus, the material substance is considered the main target of the conservation, and minimal intervention is often viewed as the most appropriate approach. In CE, the environmental value is prioritized, understood in the terms of the amount and degree of refinement of the natural resources embedded in the building and its parts and the use value. There is an underlying idea that in an ideal CE, in which negative externalities on the environment have an appropriate price, these features would translate directly into economic value. CE relies primarily on extending buildings' lifetimes through maintenance and repair, so it discourages any unnecessary removals of existing material or additions of virgin material. This leads to a minimal intervention principle very similar to fabric-focused conservation. Here, CE and architectural conservation arrive at similar conclusions from different directions.

While architectural conservation had conventionally focused on singular, often monumental buildings (Smith, 2006), CE does not make this kind of distinction. Of course, the more artistic effort in terms of artisanship or (industrial) design has gone into an object, the more refined the material has become, at least in many cases. This means that cultural artefacts like architecturally significant buildings would be viewed highly in CE, too. Nevertheless, the differences in the breadth of their scope does also set conventional conservation and CE apart. Even though the built heritage is today increasingly understood from perspectives larger than single buildings, exemplified for one by the Historic Urban

Landscapes approach, many heritage tools, such as listings, innately exclude certain buildings and sites while including others. Smith (2006) has argued that this kind of exclusivity and discrimination are rooted deep in the current heritage system. One of the problems of listings is that they can only cover a limited proportion of all heritage. In Switzerland, for one, only 14 % of the building stock has been inventoried, and 3 % has been officially protected (Hassler, 2009:558). Listed items are typically selected from a group of similar cases, only few of which are elevated into the position of 'heritage' (this is usually the most representative, i.e. the 'purest' building or site, the one with the least historical complexity). An adverse consequence is that the outliers are simultaneously labeled as 'not heritage'. From the sustainability perspective, the issue is that what is not affirmed as heritage is often susceptible to stripping or demolition. The access to the resources of heritage management, such as the knowledge base on the fabric-preserving conservation methods, is also hindered. So, even though the built heritage would be understood from a perspective broader than monuments, the practical tools are often inadequate to promote the conservation adhering to the minimal intervention principle on a larger scale.

Hassler (2009:565) has in fact highlighted this as one of the most vicious problems of conservation in the face of the immense mass of Modern built heritage. According to her, the market mechanisms (of the linear economy) are too shortsighted to preserve all assets in the building stock in the long term, but the conventional methods of building conservation are not expandable over the entire building stock, either. Consequently, technically viable Modernist buildings are razed all over the world in great numbers to provide land for new buildings, with little to no concern over the inflicted ecological burden, potential heritage values or social repercussions. In this regard, it can be argued that the transition to CE would have a greater potential capacity to conserve historical and cultural values in the building stock than what can be achieved through institutionalized heritage conservation, even though this is an unintended consequence of CE. Safeguarding the values, albeit different but resulting in the same ends, sets both fabric-focused conservation and CE apart from the current linear economy, which creates value out of

consuming, not conserving. Alas, neither the value-constituting features of conservation or CE usually translate easily into financial value in the linear economy, where the price of materials, energy, waste and emissions do not reflect the true cost of the damage inflicted on the planet's livability, and where human labor remains disproportionally high-priced. This dilemma is an enormous hindrance for the practical implementation of CE in near future.

Furthermore, thanks to the cascading approach, CE acknowledges the significance of partial preservation (cf. Figure 4), which architectural conservation tends to disregard as 'waste'. Despite the conservation theory seemingly favoring complexity, practical conservation often struggles with hybrid and heterogeneous objects. Even if value constitution is ostensibly subject to interpretation, the current dogma considers buildings as immobile, so the site becomes a nearly non-negotiable feature (Brilliant, 2011:173; Gregory, 2008:113). The skepticism towards partial preservation is understandable, since endorsing it in the current linear economy would likely open a Pandora's box for destructive, uncircular operations. Alas, it can also lead to absurd situations where ruination in situ becomes practically preferred over preservation via relocation, exemplified for one by museum authorities (Härö et al., 2013) disapproving of the salvage of components from dilapidated houses deserted in rural peripheries with no realistic prospects of resettlement. So, in spite of the stated admiration for the material evidence, building conservation sees too little value in partial preservation (Kalakoski and Huuhka, 2018:209). Even in archaeology, where conservation activities typically revolve around mobile objects, artefacts in non-primary locations or uses become easily labeled as less authentic, i.e. less valuable, and modified objects are often restored to strip them of their later added features (Jones, 2010:184,188). In building conservation, Modern built heritage seems to be a category particularly prone to attract such stylistic restoration. The argument has it that since Modernism was all about exploring the new possibilities offered by novel materials and technologies, Modernist buildings, unlike traditional ones, were intended

to stay forever young and therefore, traces of age or change disturb their integrity (Fixler, 2008; Figure 5). This idea is in direct conflict with the minimal intervention principle, and as a result, with CE.

Figure 5. Patch repairs in a traditional wooden building (left) and a modern concrete building (right). Both repairs represent conservation based on the minimal intervention principle, so they also implement CE exemplarily. It is argued, however, that most of the practicing architectural conservationists would find the former acceptable, but fewer would be ready to embrace the latter one.

Interestingly, the relation of CE to the emerging paradigm that emphasizes utility and meanings of heritage over its physical conservation is less clear. In this approach, the value of authentic substance is not inherent but relational to present needs. Symptomatically, researchers tapping into this paradigm in the current linear society may find physical heritage as uninteresting and the focus on fabric conservation as misguided. Then again, in a society that would acknowledge the planetary environmental boundaries as a precondition for human activities, fabric-focused conservation would directly connect with the society's aims, thus contributing to a high contemporary value.

In fact, the transition from the linear economy to a circular one could in fact render many of the internal conflicts of conservation discipline obsolete. First, the debate between fabric focused and use and meaning focused paradigms would become redundant in that the former would serve the present interests. Second, the minimal intervention principle would be consolidated (over the restorative

approach) on an ecological basis, verifiable through the means of LCA and MFA. Conservationists could contribute to the transition by harnessing these quantitative tools, which provide hard evidence on the significance of long service-lives that is more digestible for the current techno-econocratic society than the slippery slope that the conservation discipline's value-infused argumentation often is, despite its undisputed importance. It would also enlarge the scope of conservation towards both the wider building stock and towards partial preservation, increasing the discipline's potential societal relevance exponentially. Of course, CE will not answer in architectural terms how a fabric replacement should be done if it is truly inevitable, that is, whether the replacement should fit in for integrity or announce itself for authenticity. CE does propose, though, that using already existing building parts reclaimed from dilapidated buildings should be prioritized over manufacturing new ones from virgin materials. In this sense, CE may also contradict and challenge some of the current conservation doctrines, such as the constructionist focus on preserving fabrication traditions over historic material substance, or the principle that replacements should be distinguishable as new additions. These aims and circularity, manifested through reuse, may in some cases be difficult to reconcile, so CE will also encourage exploring previously unknown horizons in conservation theory.

Conclusion

Prior to this paper, the relationship of architectural conservation theory and CE have not been addressed explicitly and to this extent. The purpose here has been to provide the first brief joint overview of the prevailing theories in these disciplines and to form a basis for further discourse. It seems rather obvious that pre-modern, vernacular construction followed the principles of circularity, that is, avoided waste and dissipation and approached redundant buildings, objects and materials as resources. The industrial revolution changed this, and in doing so, also gave birth to the heritage discipline. Although conservation is often seen a counter-reaction to the way Modernism was fascinated with artistic and technological avant-gardism and breaking with the past, it is noteworthy that from a materials perspective it is largely

premised on the same ideological basis. This is manifested in conservation theory currently rejecting circular practices as acceptable conservation approaches.

Even so, the discipline has also transmitted tacit knowledge of the pre-modern era on circular building practices, founded upon an inbuilt balance with environmental limits, through the Modern times to the present one, which seeks to overcome the problems of the industrial take-make-dispose economy. In the transition towards CE, the need for the conservation discipline in the Modernist sense will diminish, while in practice conservationists' knowledge base will also become more important than ever. To implement CE in its highest level in the built environment, urban development and construction activities need to be based on the maintenance, repair and adaptation of the existing stock, not on its replacement. Here, a lot remains to be learned from the conservation discipline, because most literature addressing construction from a CE viewpoint still focuses excessively on new construction. In a CE, conservation should become a mainstream activity situating at the heart of the construction sector; what is now known as 'conservation' would simply be called 'construction'. In addition to supplying its body of knowledge on fabric-conserving practices for wider use, the discipline may also contribute to sustainable new build by revisiting the waste-free construction methods of the past to recreate ways to build adaptable, relocatable, recyclable and non-toxic buildings in the future.

At the same time, though, conservation needs to learn to identify better material and ecological values, in particular in the vast mass of modern built heritage, and to acknowledge the value of partial preservation and relocation of buildings and their parts. The unsustainable demolition and construction practices of industrialized societies and the effort to conserve at least some of their built heritage are two sides of the same linear economy system, and it is this very system that sets the limits to conservation as the discipline is currently understood. As follows from the fundamental principles of CE, such as product life extension and minimal intervention, a society that is more circular in the true sense of circularity will in fact automatically conserve more built heritage than a less circular one. Interestingly, this may result in

a transformation of what is understood as heritage. When all things material are valuable and almost nothing is waste, less conservation's time can be spent on debating what should be conserved and how, so more opportunities may arise to focus on people's relationships with the material realm. The authors would like to offer this essay as an invitation for further reflections, not only recognizing opinions that resonate with their own, but also warmly welcoming views that contradict or challenge this thinking.

References

Arup (2016), *The Circular Economy in the Built Environment,* London: Arup, available at https://www.arup.com/-/media/arup/files/publications/c/arup_circulareconomy_builtenvironment.pdf

Ashworth, G. (2011), "Preservation, Conservation and Heritage: Approaches to the Past in the Present through the Built Environment", *Asian Anthropology,* Vol.10 No.1, pp.1–18, doi:10.1080/1683478X.2011.10552601

Boulding, K.E. (1966), "The economics of the coming Spaceship Earth", in Jarrett, H. (Ed.) *Environmental quality in a Growing Economy*, Johns Hopkins Press, Baltimore, pp. 3–14.

Bourg, D. and Erkman, S. (Eds.) (2003), *Perspectives on Industrial Ecology,* Greenleaf Publishing, Sheffield.

Brandenburg, H. (2011, reprinted 2014), "The Use of Older Elements in the Architecture of Fourth- and Fifth-Century Rome: A Contribution to the Evaluation of Spolia", trans. B. Anderson, in Brilliant, R. and Kinney, D. (Eds.) *Reuse Value: Spolia and Appropriation in Art and Architecture from Constantine to Sherrie Levine*, Ashgate, Farnham, pp.53–73.

Brilliant, R. (2011, reprinted 2014), "Authenticity and Alienation", in Brilliant, R. and Kinney, D. (Eds.) *Reuse Value: Spolia and Appropriation in Art and Architecture from Constantine to Sherrie Levine*, Ashgate, Farnham, pp.167–77.

Ellen MacArthur Foundation (2015), *Delivering the Circular Economy: A Toolkit for Policymakers,* Ellen MacArthur Foundation, Cowes, available at https://www.ellenmacarthurfoundation.org/assets/downloads/government/EllenMacArthurFoundation_Policymakers-Toolkit.pdf

Esch, A. (2011, reprinted 2014), "On the Reuse of Antiquity: The Perspectives of the Achaeologist and of the Historian", trans. B. Anderson, in Brilliant, R. and Kinney, D. (Eds.) *Reuse Value: Spolia and Appropriation in Art and Architecture from Constantine to Sherrie Levine*, Ashgate, Farnham, pp.13–31.

Fixler, D.N. (2008), "Appropriate Means to an Appropriate End: Industry, Modernism, and Preservation", *APT Bulletin: The Journal of Preservation Technology,* Vol.39 No.4, pp.31–36, available at https://www.jstor.org/stable/25433963

Fraanje, P.J. (1997), "Cascading of Pine Wood", *Resources, Conservation and Recycling,* Vol.19, pp.21–28, doi:10.1016/S0921-3449(96)01159-7

Fusco Girard, L. (Ed.). (2017), Circular City and Cultural Heritage Interplay [Special issue]. *Bollettino Del Centro Calza Bini,* Vol.2017 No.1*,* available at http://www.bdc.unina.it/index.php/bdc/issue/view/424

Gregory, J. (2008), "Reconsidering Relocated Buildings: ICOMOS, Authenticity and Mass Relocation", *International Journal of Heritage Studies,* Vol.14 No.2, pp.112–30, doi:10.1080/13527250701844027

Hassler, U. (2009), "Long-term building stock survival and intergenerational management: the role of institutional regimes", *Building Research and Information,* Vol.37 No.5–6, pp.552–68, doi: 10.1080/09613210903189533

Hansen, M.F. (2003), *The Eloquence of Appropriation: Prolegomena to an Understanding of Spolia in Early Christian Rome*, L'Erma di Bretschneider, Rome.

Härö, M., Heikkilä, E. and Holopainen, R. (2013), ”Autioituvia taloja ei pidä purkaa”, *Helsingin Sanomat*, 28 September, available at: http://www.hs.fi/mielipide/a1380260049034

ICOMOS (1964), *International Charter for the Conservation and Restoration of Monuments and Sites (The Venice Charter 1964)*, available at http://www.international.icomos.org/e_venice.htm

ICOMOS (2013), *The Australia ICOMOS Charter for Places of Cultural Significance (The Burra Charter)*, available at http://australia.icomos.org/wp-content/uploads/The-Burra-Charter-2013-Adopted-31.10.2013.pdf

ICOMOS (2019), *The Future of Our Pasts: Engaging Cultural Heritage in Climate Action,* available at https://indd.adobe.com/view/a9a551e3-3b23-4127-99fd-a7a80d91a29e

Jackson, M. (2005), “Embodied Energy and Historic Preservation: A Needed Reassessment”, *APT Bulletin: The Journal of Preservation Technology,* Vol.36 No.4, pp.47–52, available at https://www.jstor.org/stable/40003163

Jokilehto, J. (2017), *A history of architectural conservation,* 2nd ed., Routledge, London.

Jones, S. (2009), “Experiencing Authenticity at Heritage Sites: Some implications for Heritage Management and Conservation”, *Conservation and Management of Archaeological Sites,* Vol.11 No.2, pp.133–47, doi:10.1179/175355210X12670102063661

Jones, S. and Holden, J. (2008), *It’s a material world: caring for the public realm*, Demos, London.

Kalakoski, I. and Huuhka, S. (2018), “Spolia revisited and extended: The potential for contemporary architecture”, *Journal of Material Culture*, Vol.23 No.2, pp.187–213, doi:10.1177/1359183517742946

Kinney, D. (2011, reprinted 2014), “Introduction”, in Brilliant, R. and Kinney, D. (Eds.) *Reuse Value: Spolia and Appropriation in Art and Architecture from Constantine to Sherrie Levine*, Ashgate, Farnham, pp.1–11.

Kemp, J. (2009), “Practical Ethics v2.0”, in Richmond, A. and Bracker, A. (Eds.) *Conservation: Principles, Dilemmas and Uncomfortable Truths*, Routledge, London, pp.60–72.

Liverani, P. (2011, reprinted 2014), “Reading *Spolia* in Late Antiquity and Contemporary Perception”, in Brilliant, R. and Kinney, D. (Eds.) *Reuse Value: Spolia and Appropriation in Art and Architecture from Constantine to Sherrie Levine*, Ashgate, Farnham, pp.33–51.

Matero, F. (2007), “Loss, Compensation Authenticity in Architectural Conservation”, *Journal of Architectural Conservation,* Vol.12 No.1, pp.71–90, doi:10.1080/13556207.2006.10784961

Matero, F. (2011), “Confronting time: On the Modalities of Conservation”, *AIC news* Vol.36 No.1, pp.1–4.

McDonough, W. and Braungart, M. (2002), *Cradle to Cradle: Remaking the Way We Make Things.* North Point Press, New York.

Meadows, D.H., Meadows D.L., Randers J., Behrens W.W. III (1972), *The Limits to Growth*, Universe Books: New York.

Meadows, D.H. (2009), *Thinking in Systems: A Primer*, Earthscan: London.

Meier, H.-R. (2011, reprinted 2014), “Spolia in Contemporary Architecture: Searching for Ornament and Place”, trans. B. Anderson, in Brilliant, R. and Kinney, D. (Eds.) *Reuse Value: Spolia and Appropriation in Art and Architecture from Constantine to Sherrie Levine*, Ashgate, Farnham, pp.223–36.

Orbaşlı, A. (2008), *Architectural Conservation: Principles and Practice*, Blackwell Science, Oxford.

Sakaguchi, D. (2014), *Potential for cascading wood from building,* Aalto University, Espoo, available at http://urn.fi/URN:NBN:fi:aalto-201409172618 (Accessed 28 June 2019).

Smith, L. (2006), *Uses of Heritage*, Routledge, London.

Stahel, W. and Reday-Mulvey, G. (1981), *Jobs for Tomorrow, the Potential for Substituting Manpower for Energy,* Vantage Press, New York.

Wharton, A.J. (2011, reprinted 2014), "The Tribune Tower: Spolia as Despoliation", in Brilliant, R. and Kinney, D. (Eds.) *Reuse Value: Spolia and Appropriation in Art and Architecture from Constantine to Sherrie Levine*, Ashgate, Farnham, pp.179–97.