

**Welcome to the End of the Circle.
Limits of Circular Economy Models for Design**

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Abstract. The circle is a ubiquitous metaphor in the current scientific and political debate on possible strategies for coping with the changes brought by the so-called “Anthropocene”. Terms such as “recycling”, “upcycling”, “downcycling”, “life cycle” or “circular economy” all refer to the same geometric shape, which in turn can be found in numerous diagrams illustrating the respective design approaches and political strategies. But how does the circle shape the way we think and act as designers? Is it an appropriate metaphor to guide us to feasible actions, or is its degree of simplification too far removed from reality? In this article we look at the circular economy as a *designed* model, and question the circle as a communication tool for the cultural project of sustainability. As the circle may carry the risk of an oversimplified, unattainable, even disillusioning ideal, we discuss various alternative images and forms for their potential to become metaphors of alternative models. The hole, the plate, the pasture, the wheel, the mill wheel, the hamster wheel, the vortex, the double helix, the spider web and the rhizome – as metaphors, they each open up different perspectives and approaches to reality, they each construct different relationships and dependencies between nature and culture. The aim of this article is less about postulating the end of the circle as a metaphor in the sustainability debate, as it is about to fathom the circle’s ends as a metaphorical tool. In other words, when does the metaphor of the circle become too abstract? As designers we can say that falling in love with a form right at the beginning of a design process can be rather limiting, as hardly any alternatives will be considered, and all further decisions are subordinated to achieving the desired shape. Therefore, we would like to emphasise the contingency of the circular economy as a model. We would like to welcome the thought that the circle has an “end”.

CIRCULAR ECONOMY, SUSTAINABLE DEVELOPMENT, METAPHORS IN DESIGN, TRANSFORMATION DESIGN

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Welcome to the End of the Circle. Limits of Circular Economy Models for Design

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In the current scientific and political debate on possible strategies for coping with the changes brought by the so-called “Anthropocene” (Crutzen and Stoermer 2000), the circle is a ubiquitous metaphor – both linguistically and figuratively. Terms such as “recycling”, “upcycling”, “downcycling”, “life cycle” or “circular economy” all refer to the same geometric shape, which in turn can be found in numerous diagrams illustrating the respective design approaches (McDonough and Braungart 2002; Webster 2015; Stahel 2019: 37; Wilts and Bakas 2019: 8) and political strategies (European Commission 2020; European Environment Agency 2017: 8). While scientific models are always attempts of simplifying a far more complex reality, “everything should be made as simple as possible, but no simpler” (Einstein 2011 [1933]: 384-85). And as it might be necessary in the political arena to simplify matters, the circle may carry the risk of an oversimplified, unattainable, even disillusioning ideal.

The hope of endlessly circulating material inside the technosphere is based on the “notion of a nature/culture binary [which] is a cultural construction that has had particular currency in Western thought over the last 200 years” (Yates 2008: 194). So, how does the circular shape shape the way we think and act? Does the circle guide us to feasible actions, or is its degree of simplification too far removed from reality? What relationships and differences between humans and nature are constructed and manifested through the symbol of the circle? And with regard to the design profession: how does the idea of the circular

economy affect design practice and vice versa, how does design practice work on the idea of the circular economy?

As “[u]sing different metaphors leads people to reason differently about social issues and to follow different paths of inference” (Thibodeau and Boroditsky 2015: 1), we would like to fathom the *circle’s ends* as a metaphorical tool. After all, betting on the wrong horse – to use another metaphor – could have fatal consequences given the scale of the challenges ahead.

Language does not represent something that would be there without it, but actively creates reality (Habeck 2018: 12; Wehling 2016: 62). Thus, the metaphor of the line that is to become a circle creates a certain idea about the structure of a system and the possibilities of its transformation through design. Both linguistic and figurative metaphors influence the thinking and acting in the design processes. In order to discuss the political strategies by the European Union without being misled by the metaphor of the circle, some have already replaced the term “circular economy” with the random sequence of letters “dfkjdrl haqwnmz” (Kovacic, Strand, and Völker 2019: 50) – a placeholder that, due to its meaninglessness, should make it possible to develop strategies beyond the idea of circles. In analogy to this rhetorical trick – and with the awareness that “[k]nowledge graphics create unique access to knowledge” (Baur and Felsing 2019: 65) – we would like to start with a white paper again, and begin a process of – what Herbert A. Simon once called – “mental window shopping” (Simon 1985: 188) for alternative forms and images that become metaphors for alternative models that might create new perspectives or provoke different actions. But before we get to that point, let’s walk a little on the trail of the circle.

The circle is a deeply religious symbol that can be found in almost all world religions, but is especially prominent in Christian depictions of Jesus, or god. To quote the Italian designer Bruno Munari:

While the square is closely linked to man and his constructions, to architecture, harmonious structures, writing, and so on, the circle is related to the divine: a simple circle has since ancient times represented eternity, since it has no beginning and no end. An ancient text says that God is a circle whose centre is everywhere but whose circumference is nowhere. (Munari 2012: 5)

On IDEO’s Circular Design Guide website one can watch the design consultancy’s chairman Tim Brown describing the circular economy as “this idea of, like, taking that line, and kind of bending it round into a circle”, and he accompanies his statement with the gesture of a strongman bending a heavy iron bar into a circle. The promise seems to be: if only the

beginning and the end of the so-called “value chain” could be welded together by a designerly feat of strength, materials could be used over and over again, and consumption could progress endlessly. One may not only be puzzled by how quickly the preachers of “human-centred design” have suddenly adopted a new text, but the whole promise makes us wonder: Do designers actually have the power to transform the whole economy towards circularity? Are we the strongman?

Countless graphic representations of the circular economy are circulating in the media, which may differ in detail, but are essentially all structured in similar ways. For the moment, we will therefore only focus on the most popular examples, such as the graphics recently published by the European Commission. And we will particularly take a look at how design is positioned in these graphs. The European Commission’s Circular Economy Action Plan (CEAP) depicts a loop of five steps:

1. Raw material extraction
2. Product design
3. Production and Remanufacturing
4. Consumption
5. Waste Management (from waste to secondary materials)

As flattering as this model may seem to us product designers at first glance, it is not quite clear why product design has been made part of the circle at all. The influence of product design is certainly not to be underestimated, however, product design seems to be out of place here as all other points actually represent direct stations of material flow. In short: material is taken from the environment, processed into products, used for a while and then either transformed again or disposed of. While product designers certainly have an influence on this flow of material resources, typically no materials flow directly through their hands. Either product design would have to be removed as an actor from this cycle, or numerous other forces and stakeholders, all of whom engage in and influence the “life” of products, would have to be brought into play here as well. Given that it is a circular *economy* model, the most striking questions that we have are: Where are the economists? How can market management measures contribute to sustainable development? Where are the legislators and politicians? How do rights and regulations affect the system? From a designer’s point of view, giving so much weight to product design in this model creates an image that is both flattering and skewed.

Product designers today are faced with the paradox of being expected to think systemically about their designs and interventions, even though

their strategic position is anything but detached from the system (Hill 2012). We are expected to be the strongman, while at the same time we are atoms of the iron bar that we are supposed to bend round. Design never happens unconditionally or independently (Till 2013). On the contrary, constraints and conditions open up the possibility for design. These conditions do not entirely determine the outcome, but they create a “space” for design to emerge; a space whose boundaries are explored and extended through designing. To what extent ecological issues can become part of design processes is a question to be renegotiated in every design project again and again.

Of course, product designers nowadays should help to increase the proportion of recyclates (Ressourcenkommission am Umweltbundesamt [KRU] 2019) in their products, and make sure that their products are designed in such a way that they can be easily repaired, reused and, in the last instance, recycled. However, as plausible as this demand may be, its hesitant implementation is less due to the unwillingness of product designers than to the socio-economic contexts in which design is practised as a profession. Leaving aside the fact that the current popularity of the concept of circular economy overshadows that tactics of *waste prevention should be given priority over recycling* (European Parliament and the Council 2008, § 4), to bring these demands to fruition in design processes requires a far better understanding of the dynamics of design, and far more complex relationships than those depicted in most circular economy graphics. To apply theories of transformational change – often referred to as “U-shaped” change (cf. Mahy and Carle 2012) – in corporations and communities poses fundamental challenges, as the ideas that emerge from these theories are not subject to the constraints of the existing system, but rather require the whole system to be transformed. There are, for instance, usually no depictions of immediate connections, dependencies and relationships between the actors who produce and those who recycle. How could the system be transformed, for example, so that the operator of a recycling plant has an actual say in the design of products and so that product designers have an influence on the design of a recycling plant? So, when we look at the diagrams on the circular economy, we cannot help but pose an almost childish question: what is going on inside the circle?

As designers, we are trained to see things from different angles, and a circle may also be perceived as a hole (Fig. 1). And indeed, the circular economy has a conceptual hole if it is understood to be “simply” about closing a loop. This in itself would certainly be an incredibly difficult task, but it also carries the risk of creating a system that is *as round as it is*

rigid. Everything that leaves the perfect curve of the circle falls victim to the black hole of capitalism.

To give hope and inspire the creation of a better future, the metaphor of the hole is certainly one to leave behind, but to *describe* the status quo, it is definitely a fitting image. We currently have a system in place that encourages us to dispose of products and materials in garbage cans, and eventually landfills. These suggest a seemingly consequence-free disposal, and all side effects are externalised. The German word for disposal is “Entsorgung” which means “to get rid of your worries”. That the idea of carefree disposal is a past dream can be well shown by the renaming of the corresponding German law. In the 1970s, the law was called the “waste disposal law”, today it is known as the “law on life cycle management”. Linguistically, a change has already taken place here: from the hole in which everything disappears to the cycle in which everything is supposed to be led. But the circle may still be too close to being a hole.

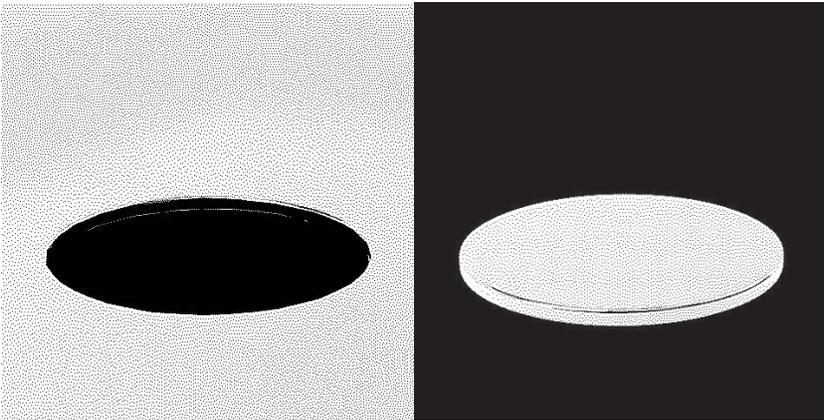


Fig. 1: The Hole; Fig. 2: The Plate

If we invert the image of the hole, we get a plate (*Fig. 2*). The plate marks a specific area where certain activities can or should take place. Every designer who has ever worked as a waiter knows that it is a big challenge not to let anything slide down from a plate. At the first mishap the (product) menu arranged flexibly on the plate is likely to fall down. If the metaphor of the plate encourages us to distribute resources evenly in order to maintain a balance, and not to consume too many resources in order to avoid collapsing under their weight, then this metaphor helps us

to gain an important perspective. A perspective that tends to be lost in circular thinking.

The circle describes the attempt to gain control over resources and territory. Some people try to protect what they hold dear by putting up a fence around their property. If one imagines the circle as a pasture (Fig. 3), the conservatism and protectionism inherent in the concept of the circular economy become more apparent. It seems illusory, though, to believe that material flows can be fenced off. Nowhere on Earth is there a neat separation between technosphere and ecosphere, between culture and nature – “we have never been modern” (Latour 2015). Thus, the pasture provides an ambivalent metaphor in that it remains open on which side we are dealing with culture and on which side we are dealing with nature. By reminding us that both culture and nature are human constructions, this metaphor raises a question that is just as ontological as it is political: who is limiting what for whom?

Just as viruses cannot be stopped by national borders, the climate crisis will not be stopped by traditional ideas of order. Nevertheless, when it comes to the global management of natural resources, we have to acknowledge the “limits to growth” (Meadows *et al.* 1972) and the “planetary boundaries” (Steffen *et al.* 2015) as limiting forces. How the global scarcity of resources translates into local limits, boundaries and regulations, however, remains a highly political question. Who builds the fences for whom, or for what? Who or what is fenced in, fenced out or can slip through? The metaphor of the pasture provides some thought provoking questions.

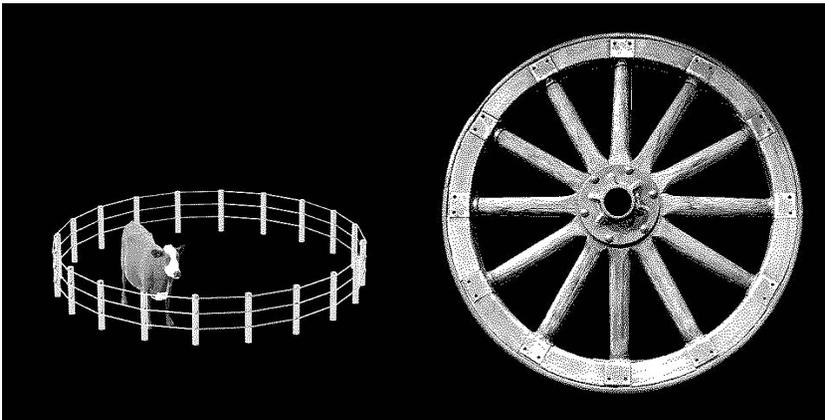


Fig. 3: The Pasture; Fig. 4: The Wheel

We hear it from many directions: we are facing big and difficult transformations, and we do not have too much time to act (cf. Schneidewind 2018; Göpel 2021; IPCC 2022). There is a long way to go. So would there be a more fitting metaphor for this journey than the image of the wheel (Fig. 4)? After all, the wheel is *the* invention for transporting goods, or getting from point A to point B.

And indeed, the wheel is already being used as an analogy in the scientific discussion on the circular economy. The so-called “Metal Wheel”, developed by Markus Reuter *et al.*, shows from a metallurgic perspective how products and materials are interlinked on an elementary level. The model includes the respective refining and alloying possibilities, and describes the losses that cannot be economically recovered (Reuter *et al.* 2019: 10). Reuter argues that we need a complete metallurgical infrastructure. Leaving out one sector – such as a ban on lead – would have catastrophic consequences, just as a wheel becomes unstable when a single spoke breaks.

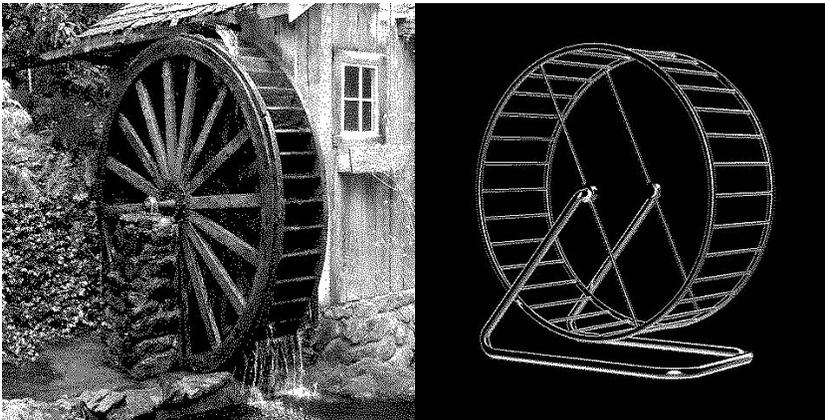


Fig. 5: *The Water Mill*; Fig. 6: *The Hamster Wheel*

However, the speed that the wheel allows us to cycle at should be chosen wisely. We can use it to quickly escape outdated structures and set out to find a new definition of prosperity. But we should resist the temptation to ride faster and riskier. “Matter feels, converses, suffers, desires, years and remembers” (Karen Barad, in Dolphijn and Tuin 2012: 59). A fast turning wheel develops high centrifugal forces that might throw out everything that is not properly attached to it, and can potentially destroy

itself. The wheel of the water mill (Fig. 5), slowly driven by the external natural force of flowing water, might provide a fitting image to remind us that the perpetual flow of material must be decelerated to a level that is sustained by nature. Otherwise the utopia of a circular economy, as a desired new economic system, bears the risk of ending up as a dystopian hamster wheel (Fig. 6).

If the efforts to realise a circular economy become the scene of an adventurous rat race, its goals would be fundamentally defeated, and fatal social consequences could emerge from it. It is therefore imperative that we discuss the speeds of circulation, as we will probably find that in many cases a speed limit for the flow of materials is of benefit for our social justice, safety and well-being (cf. Sachs 1993).

The claim that we can continue our current consumption unchecked if we let things circulate, as McDonough and Braungart have been propagating for some time now (McDonough and Braungart 2002: 179), probably makes a false promise. For thermodynamic reasons, a perfect circulation of material is neither possible (Schmidt-Bleek 1994: 162; Reuter, Ballester, and van Schaik 2018) nor does it necessarily make sense (Ressourcenkommission am Umweltbundesamt [KRU] 2019: 13). A vortex (Fig. 7) or downward spiral would be rather unattractive, certainly less “divine” (Munari 2012: 5), but maybe more suitable metaphors to describe current material flows. Reuter *et al.* have shown that if everything runs as optimally as possible, the Fairphone – as the most recyclable smartphone available on the market – currently achieves a recycling rate of around 31 % (Reuter, Ballester, and van Schaik 2018: 76). A recycling rate of 100 % seems to be delusional. Much more than the construction and material composition of products needs to change if this value is to be improved in the future.

The circle on its own fails to include all the strategies that keep our products usable. Thus, in many graphics about circular economy, the strategies of repair and reuse are illustrated by the so-called “inner circles” (European Environment Agency 2017: 8). But since the path for the material is inevitably downwards, the double helix (Fig. 8) that is connected with bridges seems a more fitting image to describe the cascade use (Walcher and Leube 2017).

Mechanisms such as reprocessing, reuse and repair (Stahel 2019) direct the material flow out of the downward spiral and place the material back a bit earlier in the life cycle – just like a glider that uses the thermals to fly higher. But the gain in altitude is always just a snapshot; at the end of the day, every aircraft has still come back down to earth.

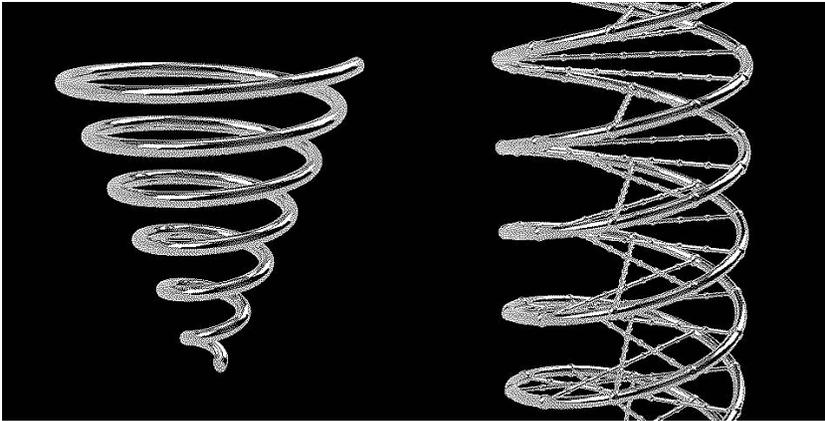


Fig. 7: The Vortex; Fig. 8: The Double Helix

The double helix is, of course, best known as the visual representation of the human DNA. What kind of actions would this metaphor lead us to? Just as DNA represents the human blueprint, we may need blueprints for environmentally friendly products. Regulations such as the EU Ecodesign Directive are measures that point in this direction. Just like the small building blocks of DNA, the Ecodesign Directive (DIN 2021) consists of numerous indicators like: lifetime, refurbishability, repairability, reusability, upgradeability, recyclability, recycled content, critical raw materials or information provision. These indicators might influence many properties of a product. Similar to human DNA, many characteristics are determined here, but how our life exactly unfolds is not written into it.

A product that has optimally mastered the process of negotiating between the above mentioned sustainability indicators is not yet immune from being used in ways that were unforeseen, or unforeseeable. In addition to the physically measurable properties, every product creates emotional and social connections; depending on the stories that are told, the interpretations that are offered, and the needs that are served (Ullrich 2011: 112). Products create an intricate net of connections with people and with themselves. In Bruno Latour's actor-network theory, these connections are described as follows: "It is an association between entities which are in no way recognizable as being social in the ordinary manner, except during the brief moment when they are reshuffled together" (Latour 2005). The spider web (*Fig. 9*) may function as a metaphor to remind us of the interconnectedness of the technical and the social. We should constantly and repeatedly consider that designing means to intervene purposefully in

our complex social, cultural and natural environments (Jonas 2018: 17). David Orr puts it like this: “Our science and technology are powerful beyond anything imagined by the confident founders of the modern world. But our sense of proportion and depth of purpose have not kept pace with our merely technical abilities” (Orr 2002: 3). The meaning of artefacts and the relationships between people and things are not given enough attention in the rather technocratic discussions about material flows, but they are essential if we want to understand them. How would we design if we were no longer heading towards a circular but a networked economy, whose socio-technical web needs to be constantly mended and re-knitted?

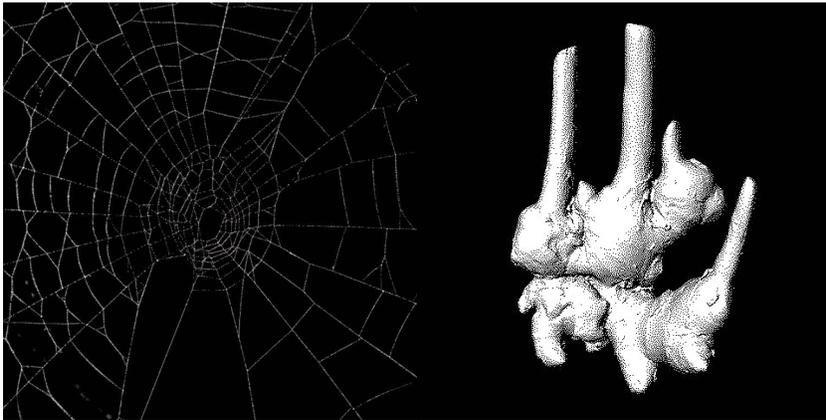


Fig. 9: The Spider Web; Fig. 10: The Rhizome

In everyday practice we are dealing with a complex network of countless, often subterranean, branches that cannot be described by a circle alone. The previous reflections have shown that none of the metaphors are able to reflect the complexity of reality completely, but each one brought with it another vital perspective. Eventually, the rhizome (Fig. 10) by Deleuze and Guattari comes to our minds (Deleuze and Guattari 1977). What would it mean to no longer pursue the goal of a circular economy, but to work on a rhizomatic economy? While we like the idea that we have abandoned the rigid construction of a circle and have now come to a living structure whose shape is in constant flux and cannot quite be described, the rhizome might undercut the level of abstraction to serve as a model that could help us in order to derive concrete actions towards sustainable development. Nevertheless, we think it is an important lesson not only to

strive for the ideal of the circle, but to imagine the world occasionally as a rhizome – even that is a simplification.

As much as we would end this article with a few concluding words, considerations such as those made here do not actually allow us to speak of a “conclusion”. We attempted to deconstruct the circle as an ideal, and we are now faced, as it were, with a pile of broken pieces. Some people may want to return to order after this deliberately created chaos and possibly end up with a circle again, but we want to encourage an openness towards alternative models. We would like to emphasise the contingency of the circular economy as a model. Models are not just tools for grasping reality, but they influence and change reality until they become a significant part of it (Shapiro 2014).

A core competence of designers is to “resolve [...] ideas in matter and form” (Chipperfield 2009: 11). However, this transformation process should not be imagined as a linear process in which an ingeniously conceived idea is just formalised/materialised, but as a constant “trial and error” process (Glanville 2007) that eventually makes the human human (Colomina and Wigley 2016). Falling in love with a form right at the beginning of a design process can be rather limiting, as hardly any alternatives will be considered, and all further decisions are subordinated to achieving the desired shape. So, have we fallen in love with the beauty of the circle too early in the “cultural project” (Schneidewind 2018) of the “great transformation”?

Even if we have our doubts about the concept of the circular economy, we see it as an expression of hope that we might be able to design a way out of an impending catastrophe. As diligent product designers that we would like to be, we have been concerned with the ecological consequences of our work for some time and so it happened that we recently visited a recycling plant. We wanted to find out how electronic products are processed after they are dumped, so that we could potentially incorporate our findings into the project we are currently working on. The manager of this recycling plant greeted us with the words: “Welcome to the end of the circle”.

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