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Dis/Assembling Value: Lessons from Waste Valuation Practices

Emma Greeson, Stefan Laser and Olli Pyyhtinen

Abstract

In this text, we offer a vision of waste as integral and immanent to valuation practices and argue that engaging with waste materials can thereby significantly contribute to the field of valuation studies. We lay special emphasis on the intertwined practices and processes of assembling and disassembling value and waste. Creating value is a process of joining together: classifying, grouping, combining, making, re-forming. Yet it is also a process where persons, things, parts of bodies, or landscapes are disentangled, abandoned, dismissed, or corrupted. The notion of disassembly attracts attention not only to the center of the action of valuation but also to its peripheries—to things and materials which are cast aside, to spaces which accommodate that which has been disassembled, and the ambiguities and potentialities opened up by processes of disassembly. Thinking with waste also pushes us to think about how various regimes of value are connected and how they coexist and/or compete. As such, waste is not a coherent thing, but rather one that gets displaced and transformed in valuing practices which coexist in various ways.

Keywords: assemblage; disassembly; valuation; waste

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Introduction

Waste is usually understood to be worthless, spoiled, or foul. However, following the diverse trajectories and afterlives of waste significantly complicates this common sense notion of discarded matter.[1] Rather than emerging as the reverse side of value or as an economic externality ensuing only after such economic actions as production, consumption, and distribution, waste is enacted as a fundamental part of all of them. In this special issue, we look at the co-emergence of waste and value from concrete practices and materials. Besides disrupting the linearity of the value-to-waste transformation, this reframing simultaneously recasts the work of valuing. We offer a vision of *waste as integral and immanent to valuation practices*. It is *integral* in the sense that valuation would not be possible without waste: systems that create value are also systems that create waste. And it is *immanent* in the sense that the logic and functioning of value production are inherently tied to the logic and functioning of waste production.

We propose that engaging with matters of waste can make a significant contribution to the field of valuation studies in three broad and interconnected ways:

First, we suggest an approach to understanding value that is informed by a theoretical consideration of waste. We insist on embracing "value as a verb" (Kjellberg and Mallard 2013: 20), while questioning the objects, infrastructures, and knowledge systems that are made predicate to the activity of valuing (see also Dewey 1939). This analytic move reminds us that waste is not necessarily something with no value, nor is it something that has been destroyed or discarded for good. What making something waste does is to *transform*, *deform*, *reform*, and in turn *open up space* for the *emergence of differences* and their mobilization in different practices and livelihoods.[2]

Second, the valuation of waste is a thoroughly *material* process. The shift from a binary opposition of value/waste to multiple and messy practices of generating value in our entanglements with waste (and to the boundary-making practices in which the very value/waste distinction is enacted) involves attending to the heterogeneous materials of waste, and the different ways in which they come to matter. Dealings with waste are material activities through and through, and the valuing that happens in them is grounded in the transformations and transubstantiations of waste, landscapes, people, and more-than-humans that are involved. And, when it comes to the

[1] Though we deal with matters of material waste here—what might also be called "discards"—we acknowledge that there are other conceptions of waste, such as waste of time, of energy, of space, or of resources, all of which, too, are worthy of studying from a perspective that emphasizes valuation as a social practice.

[2] We owe Justine Laurent and Filippo Bertoni for this idea.

re-appropriation of waste, discarded objects and materials must be reworked, manipulated, and transformed in order to be incorporated into further regimes of value, and these transformation processes involve sorting and categorization with corresponding infrastructures and tools.

Third, a focus on waste sheds light on how multiple modes and regimes of valuation are connected. On the one hand, this supports previous observations that economic valuation processes are entangled with (and difficult to unfold from) cultural, social, moral/normative, and other evaluative practices (Lamont 2012; Heuts and Mol 2013). Transformations that produce value require specialized knowledge, which can be technical and political, but equally "naïve" or "folk". On the other hand, these multiple modes of valuation are not simply co-present along the neat chains or circuits through which goods or materials travel. Multiple modes of valuation imply multiple forms of transformation, which refer sometimes to competing imaginaries.

Of course, we are not the first ones to challenge the common understanding of waste as the zero point of value. Waste studies scholarship has already done a lot of work to show that waste is a positivity in its own right, and to reconsider the relationship between value and waste (see e.g., Hawkins and Muecke 2002; Gille 2007, 2010; Herod et al. 2013; Alexander and Sanchez 2018; for extensive reviews see: Moore 2012; Gregson and Crang 2015; Reno 2015).[3] Our aim is to build on this body of work by stressing more explicitly the intertwined practices and processes of *assembling* and *disassembling* value and waste. While waste studies have established how waste is not simply the "theoretical derivative of the concept of value" (Gille 2010: 1049), thinking in terms of "assemblages" (Deleuze and Guattari 1987; Latour 2005; DeLanda 2006; Çalışkan and Callon 2010) provides a fine-grained account of the ways in which waste is enacted together with value. Crucially, the notion of *disassembly* is as important as assembly in the approach we propose. It attracts attention not only to the center of the action of valuation but also to its peripheries—to things and materials which are cast aside, to spaces which accommodate that which has been disassembled, and the ambiguities and potentialities opened up by processes of disassembly.

In this special issue, detailed accounts of the entanglements of waste and value are made possible by engaging with rich empirical data. These accounts shed light on the transitional moments and states both between and within the categories of waste and value; the connections and tensions between various valuing regimes; and the work and effort it takes to sort, extract, and manipulate materials and things in messy ad hoc practices to draw value from them. In the following section we review dominant conceptions of the relation of value and waste. We

[3] See also www. discardstudies.com.

then elaborate the notion of dis/assembling to engage with matters of valuation—in which processes of valuing are always interlinked with processes of wasting.

Imaginaries of value and waste

Frameworks for understanding waste shift over time. So, too, do proposed solutions for eliminating waste or making productive use of discarded materials, and the epistemes and political imaginaries invoked along the way to understand the sorts of systems of which waste is a part (see for instance Simmons 2006).

The perspective of neoclassical economics has long been influential in shaping thinking about the relationship between value and waste. In a neoclassical framing, waste is generally seen as something that has no value. Waste is irrelevant to the calculations of *homo economicus*: information about waste is external to the mechanisms of supply and demand. And when the rational economic actor buys or sells things that for outsiders may seem waste-like, what is bought or sold is considered as "resources" rather than waste. Waste, therefore, is never part of market exchange at all. Another way to approach waste in a neoclassical framework is by way of costs. Here, waste tends to be assigned a negative value. Environmental issues such as pollution are discussed in these terms in the neoclassical paradigm: negative costs that are not appreciated in a contract are externalities, which lead to "market failure" (Callon 1998). Waste has also been conceptualized as inefficiency, which makes it a cost (potential value not produced). In neoclassical economics, then, a clear hierarchy is established between the foundational concept of value and the derivative concept of waste, as waste is considered to be created by existing value-producing social structures and systems of knowledge (Gille 2010: 1050).

For political economy approaches, too, waste appears as a by-product. Marx distinguished two forms of waste or "excretions" in the economy: first, the by-products of production ("the waste products of industry and agriculture" Marx 1992: 195); and second, the leftovers of consumption ("both the excrement produced by man's natural metabolism and the form in which useful articles survive after use has been made of them" Marx 1992: 195). The so-called "excretions of production" could be re-input into the production process, as when iron filings return to the production of iron as raw material. The "excretions of consumption" could be collected, reprocessed, and reused, as in the case of wool shoddy: used wool could be remanufactured to make "shoddy", which in turn was used to make clothing that was of poor quality. Marx recognized that in order for excretions of production to be viable as a source of value, several conditions had to be fulfilled:

> the massive presence of this refuse, a thing which results only when labour is carried out on a large scale; the improvement of machines, so that materials that were previously unusable in their given form are converted into a form suitable for new production; and finally, scientific progress – especially in chemistry, which discovers the useful properties of such waste products. (Marx 1992: 196)

Waste, then, was for Marx a by-product, either of production or consumption, with the potential to once again be made valuable by recycling it through further production processes. The issue of waste's potential for value can also be framed in terms of "waste-based commodity frontiers" (Schindler and Demaria 2019), making property relations and conflicts transparent.

Other approaches understand waste as a positivity and center their inquiry on *excess* as a starting point. This is in stark contrast to neoclassical economics as well as to a Marxist approach. Neoclassical economics is premised on scarcity, as one can make profit on something only provided that it remains scarce. The emphasis on scarcity, however, presents a restricted conception of the economy, as has been argued by Georges Bataille, the classical theorist of excess par excellence. In his theory of "general economy", Bataille (1984) suggests that the fundamental economic problem is not scarcity but excess, whose presence is inescapable (see also Stoekl 2007). According to him, there are two basic impulses of living organisms: appropriation and excretion. While the first results in the homogeneity of the appropriating subject and the appropriated object, the latter results in heterogeneity. Living organisms tend to receive more energy than what is necessary for maintaining life, and the excess energy that they cannot absorb or use for their growth must necessarily be used, lost, consumed, and expended. Within the framework of Bataille's general economy, waste, too, is framed as a form of excess and expenditure that is primary, rather than derivative of production and consumption.

Many of the greatest problems of our era, such as environmental concerns like mass pollution and the ubiquity of plastic trash in the marine environment, are problems of excess (Abbott 2014). Along similar lines, in his book *The Enigma of Capital and the Crises of Capitalism* (2010), anthropologist and geographer David Harvey suggests that what is crucial to the destructive dynamics of global capitalism is not so much scarcity or the lack of resources, but the problem of overaccumulation. According to Harvey, it is precisely the lack of mechanisms to deal with excess that renders global capitalism so prone to crises. To place emphasis on excess is also to see waste as unavoidable. Processes of production, consumption, and use can never be perfectly cyclical; wastage and leakage here are considered part of the normal operation of the economy. Waste is the "other" of

capitalism's dynamics, its often invisible side. No matter how hard we work to obliterate it by binning it, flushing it down the drain, dumping it, or otherwise sending it away, it refuses to vanish. It has the capacity to return, haunt us, and play a role—often unexpectedly, often with unequal consequences—in unfolding social life.

The founding text in establishing the fundamental link between valuation and waste is arguably Michael Thompson's *Rubbish Theory: The Creation and Destruction of Value*, first published in 1979 and recently reprinted (2017). Thompson was a student of Mary Douglas, and he draws on her classical work *Purity and Danger* (1966) that casts dirt, or waste matter, as the symbolically constructed result of boundary creation and maintenance within society. Thompson insists that consumption does not always designate the end of an object's life: often objects continue to exist even if we no longer have any use for them, and discarding may even mark the beginning of a new cycle (2017: 134). Thompson describes how transient goods (ones with finite lifespans over the course of which they decrease in value) transform into durable goods (ones with infinite lifespans and whose value increases over time) (2017: 25). He suggests that there is a "vast and disregarded realm—Rubbish—that, it turns out, provides the one-way route from Transient to Durable" (2017: 10).[4] The cornerstone of Thompson's theory is his observation that the category of rubbish is "covert" and serves as a place for formerly transient goods to dwell in limbo before being plucked out by those with the social power to do so, for a new career as durable. This covert category is the basis for his observation that seeming paradoxes—in this case, contradictory value designations—are simply different arrangements within the same overarching system.

However, Thompson's *Rubbish Theory* is strikingly paradoxical in that it does not actually examine rubbish per se. The "rubbish" in the theory is merely a category of things in the world with no value, which allows for high-status people to increase the value of formerly less valuable things. Thompson is essentially interested in the social control and movement of goods between cultural categories/regimes of value, specifically the move "upwards" in the value hierarchy from transient to durable status. While he acknowledges things as part of our social world—arguing that in order to understand value hierarchies and the movement up and down them, we need to understand how our actions "depend on there being things 'out there' for us to push around (and be pushed around by) […] We need a theory of people *and* stuff" (Thompson 2017: 10)—he attends insufficiently to the activeness of things. He portrays objects as passive and inert, just waiting to be endowed with meaning and value, rather than in

[4] The oft-cited threefold division of cultural categories (durable, transient, and rubbish) are actually five categories, including also production and consumption (Thompson 2017: 122).

themselves active and effective, able to "*have a say* in what they become" (Hawkins 2013: 56).

Thompson's (2017: 10) general observation that "stuff matters" has been expanded in a meaningful way by a variety of more recent approaches across the social sciences which stress the need for direct engagement with matter and materials. Some of these do not trace their lineage from Thompson or matters of waste in particular (e.g. Latour 1992, 2000, 2005; Barad 2003; Bennett 2010; Coole and Frost 2010; Ingold 2011, 2013), but others are situated within the field of waste studies itself, which turns the focus onto waste matter as an object of study (e.g. Hawkins 2006; Gregson and Crang 2010; Lepawsky and Mather 2011; Hird 2012; Gille 2013). With the notion of dis/assembling we aim to capture the heart of this debate while also taking it one step further.

Assembling and disassembling

Understanding waste as part of assemblages helps us understand *how* waste acts, or is made to act.[5] Thinking in terms of dis/assembly is important if we are to fully understand waste and value as co-constitutive. Creating value is a process of joining together: classifying, grouping, combining, making, re-forming. Yet it is also a process where persons, things, parts of bodies, or landscapes are disentangled, abandoned, dismissed, or corrupted. This perspective helps us see, first, that waste is ubiquitous, and not just at the end of a value chain, production process, market transaction, or life cycle of an object. Second, waste and value are both socio-materially produced. Third, and relatedly, processes of assembly and disassembly are always connected. For something to be assembled, other things must be disassembled. Conversely, when something is disassembled, the constituent parts must go somewhere, and can be taken up into other assemblages.

A crucial move within the field of waste studies in the direction of assembly and disassembly was provided by the book *Culture and Waste* (2002). In their introduction to the volume, editors Gay

[5] This is also where our approach might have relevance to a broader understanding of waste beyond the notion of discards. The focus on assemblages draws attention to the way that materials are configured and reconfigured in an attempt to produce something, or to achieve a goal, or to bring a particular vision of the world into being. With Taylorism, for instance, the aim was to eradicate wasted time; Toyotism, on the other hand, can be understood as an attempt to eradicate wasted space and expenses (through the elimination of inventory). Each of these organizational principles was achieved by the meticulous assembling of production systems capable of reducing a particular type of waste. The development of progressively less "wasteful" modes of production, then, can be shown to be connected to the production of different sorts of waste, which can then, in turn, be the focus of innovative reassembling of production in the future.

Hawkins and Stephen Muecke (2002: x) propose that "[w]aste isn't just the uselessness that sustains utility, or the place where only the symbolic is in play; it has a complex role in formations of value". In their book, which shares with Thompson (2017) the subtitle *The Creation and Destruction of Value*, they consider this question in the context of "social" and "cultural" "strata". In *The Ethics of Waste,* Hawkins stresses the affective capacities of waste's materiality, arguing that "[t]o reduce waste to an effect of human action and classification is to ignore the materiality of waste, its role in making us act; the ways in which waste is *both* a provocation to action and itself a result of that action" (2006: 4–5). Hawkins is interested in interrogating the ways that encounters with waste matter and infrastructures move people to act, enlist people into relations of governance, or think about their relationship with the world. Though she does not use the concept of assemblage specifically, she presents humans and waste materials as co-constitutive elements of social worlds.

This is the first dimension of assemblage thinking that is of use to us: assemblages bring to light the more-than-human aspect of the emergence of value and waste. The relevant agents are not only human ones. In contrast to the social constructivism of much of the literature on waste, the more-than-human perspective foregrounds the socio-material underpinnings of waste (e.g. Gregson and Crang 2010; Lepawsky and Mather 2011; Gabrys et al. 2013). This does not mean that humans somehow vanish from the scene or that their actions are irrelevant. Instead, the focus shifts so that humans appear as "inextricably entangled with the nonhuman, no longer at the center of the action" (Pickering 1995: 26; see also Whatmore 2002; Manning 2013; Pyyhtinen 2015). Thinking in terms of assemblages sensitizes us to *both* the material *and* the expressive roles (DeLanda 2006: 12) that waste can play. In *The Mushroom at the End of the World*, Tsing (2015) emphasizes that "wasted" environments—such as landscapes devastated by atomic bombs or plantations whose soil no longer supports crops—provide both matsutake mushrooms and, in turn, those who pick them, resources to live. At the same time, the mushrooms reciprocally provide nutrients to the trees they grow under. Matsutake have become a valuable commodity, and are entangled in affective relationships with those who pick them, as well as those who purchase them or receive them as gifts. Ruins, then, are not simply the result of erasure or destruction, but are subject to processes of disassembly and reassembly that make alternative orderings of the world possible (Edensor 2005). Practices and processes of valuing and wasting are part of heterogeneous and at times surprising constellations of human and non-human or more-than-human doings.

Key to the formation of assemblages is not only the process of bringing things together but pushing out entities as well. Thinking of markets as assemblages, for instance, means recognizing that

"[m]arketization is about establishing *and* severing linkages, it is about incorporating *and* expelling people, places, and things" (Berndt and Boeckler 2010: 566). "Detaching" components of one assemblage and putting them to work in another is at the heart of assemblage theory (see for instance Delanda (2006: 18); Serres (1989) and Cochoy and co-authors (2017) also explore the nature of detachment). Assemblages are characterized by "relations of exteriority" which imply that "a component part of an assemblage may be detached and plugged into a different assemblage in which its interactions are different" (DeLanda 2006: 10). This is the second dimension of assemblage thinking that we wish to highlight: emergent entities are enacted not as a result of their situatedness in specific "contexts" (Woolgar and Lezaun 2013: 323) but through processes of assembly and disassembly of component elements. The fundamental indeterminacy of waste materials already points to a multitude of possible value setups (Alexander and Sanchez 2018). This approach implies that valuation practices cannot simply be understood by identifying their social contexts but requires us to take into account the realities that they bring into being. In other words, the question cannot only be what realities make valuation possible, but what realities are made possible by the dis/assembling processes of value and waste creation.

We are particularly keen on emphasizing the productive side of destructive action: the concrete and material disassembly of valuable entities. In other words, we suggest engaging explicitly with the "how" of disassembly. Gregson and Crang stress that it is important to understand not only how objects come into being, but also how they move out of their object form: "becoming waste is a means to break the focus on the object, to work with a politics of stuff, and to move beyond the identification of becoming and materiality with the affirmative, to insist that becoming is also un-becoming, literally and adjectivally as well as corporeally" (Gregson and Crang 2010: 1030 f.). Becoming refers, then, to the "affirmative" processes through which materials first become an object; it also refers to the processes whereby an object becomes waste through the disassembly of its component parts. Gregson and co-authors (2010) provide a picture of how unbecoming processes work in their research on the dismantling of end-of-life ships. Though the ships are coming apart, in doing so an entire scavenging and resale industry comes into being for materials and furniture that have un-become parts of the ships. The coupling of becoming and unbecoming makes clear that any object is merely a temporary congealment of various materials, forces, and relations and is therefore bound to disintegrate sooner or later, at which point its elements can become part of other assemblages.

Contributions to this special issue

The papers gathered in this special issue articulate the relations between and coexistence of different registers of practices. As such, waste is not a coherent thing, but rather one that gets displaced and transformed in valuing practices which coexist in various ways, as in the case of competing markets for used books (Greeson, in this issue). To assemble valuable entities entails practices of disassembly. Yet depending on the task at hand and the particular entities previously assembled, the material processes and "disassemblies" required to stabilize valuable entities can be quite different. Disassembly requires tools and infrastructures, which can be as specialized as industrial recycling equipment (Laser, in this issue) or as informal as the gloves and bags used by dumpster divers (Lehtonen and Pyyhtinen, in this issue). By empirically examining the practices of handling waste, the contributions to this special issue all bring to light how the specific affordances, capacities, and recalcitrances of waste figure in wasting/valuing processes.[6]

Because of the contingency of practices established to deal with waste matter, and because of the scales they produce, the papers in this special issue cover a wide scope: regimes of valuation which are both corporate and non-corporate, official and informal, capitalist and anti-capitalist; the papers address multiple scales from very local settings to global flows. We present particular case studies that deal in an intimate manner with places and things that previously have been mostly discussed from a distance (e.g. formal recycling of electronic waste, the resale of books on electronic platforms). Detailed investigations of them bring us closer to understanding the "unprecedented things […] being done with and to matter, nature, life, production, and reproduction" (Coole and Frost 2010: 4). Our investigations of the flow and evaluation of materials shed light on new (and not-so-new) industries, new solutions (ad hoc and formalized), and cumulative flows; we describe ways of relating to and dealing with (waste) matter; we take up the question of what people can proactively do with and to the discarded things and materials that surround them. The papers in this special issue deal with the question of how systems and imaginaries hold together *despite* their patent shortcomings, and how systems are sustained even though they *fail* to achieve their main goals of efficiency, control, and freedom from the limitations of human bodies and subjectivities.

In his contribution, Laser shows how a recycling company needs to de-form e-waste materials in various ways to calculate with them. He describes how electronic waste is forcefully dropped, rearranged, put through massive and sensitive shredders and (last but not least) heated to 1200°C to be reconstituted. All of these processes of material

[6] We are thankful to Justine Laurent and Filippo Bertoni for this idea.

deformation and disassembly are processes that the company's accounting system requires to be able to differentiate between different valuable entities. While processing e-waste, valuable materials called "scrap" are enacted, in contrast to valueless "waste". Laser emphasizes that the company's accounting system depends on the deformation of materials into new forms in order to be able to calculate and plan efficiently for making future purchases and adjusting future contracts. The successful valuation of the materials passing through the company turns out to be a fragile achievement, and one needs a perspective that is sensitive to material practices to perceive this fragility.

Greeson proposes an "ecological" view of valuation to understand the processes whereby used books are made valuable in England, through places from where books donated to charity are collected, to spaces of sorting and sale as various types of products, including, in the end, as waste paper. In her analysis, the concept of "subtractive production" characterizes the productive labor that accompanies the exchange of used books. This type of disassembly is not simply extractive, with valuable elements being removed from a material stream in order to be sold. Calling it "subtractive" turns this view inside out, focusing attention not only on the processes of excavation (which are only a fraction of the value-creation processes that are taking place) or on the goods being valued, but equally on the processes of ridding which direct materials to other spaces where they can be again recombined and reclassified in an ecology of connected moments of valuation.

Voluntary dumpster diving involves the valuation of discarded food in processes which undo the wastefulness of waste. Lehtonen and Pyyhtinen emphasize the creativity of the practices: they are not only about knowing what can be eaten but also making items good to eat by picking them out of waste containers, disentangling them from the waste infrastructure, and making them part of another assemblage of, say, bags used for carrying them home, kitchen utensils, and cooking. To transform food waste into edible food entails one creating something new out of what is given, something that is not yet there in the discards. And the actants entangled in this process of dis/assembly are explicitly both human/cultural (i.e., those who decided that food should end up in a dumpster and those who rescue it) as well as organic/biological (processes of decay which are halted when the food materials are made part of a new assemblage that uses a freezer, for example).

Focus on the assembly and disassembly of value and waste shared by all these papers contributes to the field of valuation studies in the three broad ways described at the beginning of this introduction. First, reconsidering value and valuation in terms of waste forces us to question taken-for-granted paradigms, subjects, and objects of valuation practices. The notion of dis/assembly allows for a

consideration of economic entities and processes that goes beyond markets, value chains, or other entities usually understood as economic. It shines light on various often overlooked actors, performances, and infrastructures and their (dis)entanglements. Various forms of so-called waste matter have been shown to be not simply at the end of their linear life spans. Instead, waste can be *potentiality* for the creation of new forms of value at every level of formality, from large-scale waste management to small enterprises and even informal or illegal activities organized in small social groups.

Second, thinking about value and waste together makes it clear that heterogeneous materials are part of valuation processes. In the papers in this special issue, waste is ubiquitous, appearing in various forms alongside value in processes of material reconfiguration as entities are assembled and disassembled. Waste does not lie outside of systems of value but is inseparable from them. Future research on valuation practices can therefore no longer ignore excess materials as an intellectual wasteland.

Third and finally, thinking about waste means that we cannot confine ourselves to thinking about single modes or regimes of value. Thinking with waste pushes us to think about how various regimes of value are connected and how they coexist and/or compete. Considering concrete processes of dis/assembly provides insight into what makes value production possible and into the realities enacted by the valuation practices themselves. It also invites us to reflect on systems in which certain values are dismantled—or were never set up in the first place. A focus on waste in studies of valuation thus provides a thoroughly grounded view of the politics of value.

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Ecologies of Valuation: Ridding as a Mechanism for Valuation of Used Goods

Emma Greeson

Abstract

When used consumer goods are exchanged, valuation proceeds differently than in markets for new goods. Many studies emphasize the social or socio-technical nature of valuation processes. This article outlines the difficulties inherent in these approaches when it comes to understanding valuation of used goods. These approaches, somewhat paradoxically, obscure the greater situatedness of contextualized "moments of valuation" in material flows and in relation to production processes. The ecological approach developed here shows that moments of valuation are never divorced from temporally and spatially prior and subsequent moments of valuation and waste production, and cannot be fully understood if not considered alongside the conditions in which the goods being valued are produced. The subtractive logic of ridding is crucial in the processes of production and valuation of used goods. This article draws on ethnographic and interview data from fourteen months of fieldwork in England to show how used books are valued in an ecology that stretches across connected moments and sites.

Keywords: valuation; waste; used goods; qualification; ecology

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Introduction

In 2016, IKEA's chief sustainability officer, Steve Howard, made headlines when he observed that "in the West, we have probably hit peak stuff" (Howard 2016). What happens to all our *stuff* when we decide we no longer want it? Not all of it gets loaded into attics and basements, or thrown into landfills, though much of it does. Used goods circulate, are exchanged, are bought and sold. This paper deals with the question of value in the exchange of used goods. What are the social processes whereby used consumer goods, discarded by their previous owners, are made once again valuable? And what does this question help us see about the ways that valuation is theorized?

It is now accepted within valuation studies that performances of value are highly situated, and that spatial, temporal, and social specificity are not incidental or trivial in the outcomes of valuation processes. Each instance of valuation takes place in a particular location—a concert hall, an art gallery, a point of sale—and has a beginning and an end point, lasting minutes or even years (Hutter and Stark 2015: 4). This observation is indeed the essential starting point for an account of valuation processes; "moments of valuation" (Antal et al. 2015) are always situated and contextual. These approaches to valuation as a situated practice provide a great deal of insight into the historical, social, symbolic, and technical factors which structure valuation processes. They tend, however, to abstract away from production processes, leaving intact an implicit linear sequence of production, then valuation, then consumption, then wasting.

Drawing on insights from waste studies, I present an alternative view of valuation as part of an ecology of interconnected spaces and material flows. The ecological approach shows that situated moments of valuation are never divorced from temporally and spatially prior and subsequent moments of valuation and waste production, and—crucially—cannot be fully understood if not considered alongside the conditions in which the goods being valued are produced. Following Hutter and Stark (2015: 5), I show that the moments before and after value is settled or agreed upon are characterized by dissonance and unsettledness: there is more than one possible framework for assessment, and more than a single value system for establishing worth. Departing from their approach, however, I will conceive of these moments not as located within one individual or judging entity who must reconcile dissonant orders of worth, but as distributed spatially and temporally and among contiguous spaces of exchange whose existence is mutually beneficial and contingent. Further, the dissonance is not only a matter of competing cognitive schema or abstract assessment frameworks. It is also a matter of a material reality which needs to be physically manipulated *in order to* deploy these schema and frameworks effectively. In this framing, a picture emerges of the importance of waste and wasting to processes of valuation.

Central to the ecological model is the practice of ridding. I use the term "ridding" in line with Gregson (2007), who describes it as a kind of divestment, but one which is firmly located within a larger system within which things and materials cycle. Gregson describes the ridding she observed in her anthropological work inside households:

> Ridding events were disclosed not as discrete events marking key moments in the social lives of things, their passage from one value regime to another. Rather, they occurred as part of a seamless flow of appropriation and divestment, storing, keeping and holding, involving an array of things in the domestic sphere. (2007: 20)

Ridding therefore refers to a kind of waste production, but one which does not conceive of waste as an endpoint. Further, it does not necessarily imply that the value of the things being "wasted" falls to zero (Thompson 2017) or becomes negative (Moore 2012). In fact, ridding is often characterized by attempts to dispose of items which are understood to still have use value or exchange value, by selling them or passing them to someone who can use them (Gregson et al. 2007: 3).

Many studies of valuation practices emphasize the need to qualify or frame objects as desirable goods (especially those which portray the work of qualification as marketing surrounding the moment of exchange; see for instance Hirschle in Beckert 2016: 191 or Callon et al. 2002). Quality is not intrinsic to a good but must be constructed; it is "the outcome of a collective process in which products become seen as possessing certain traits and occupying a specific position in relation to other products in the product space" (Beckert and Musselin 2013: 1). In this reading, qualification happens subsequent to production. This article, however, builds on observations that in the case of used goods, a supply of heterogeneous materials and things is more continuously *transformed* into value-able goods (Gregson et al. 2010). To understand how value is created, we must understand how goods are iteratively produced and re-produced through pragmatic, concrete processes of processing, sorting, categorizing, and/or (most crucially) ridding via various channels. I call this type of value production—which is material, spatially and temporally diffuse, and based on ridding—"subtractive production." Conceptualizing valuation as connected to production which is subtractive rather than additive brings into view the "residue" of valuation practices (see for instance Thompson 2017: 101).

If valuation studies, then, have demonstrated the situatedness of valuation practices, waste studies encourage us to think about the extent of their "ongoingness" (Herod et al. 2014). In other words, we should think about processes of valuation—and the goods being valued—as spread across time and space. By considering the question

of the valuation of used consumer goods first through the prism of value, and then through the prism of waste, I make a case for studying valuation with waste in mind. After these theoretical considerations, in the second half of the paper I illustrate this waste-minded approach with the case of used books in England. Drawing on ethnographic and interview data from 14 months of fieldwork, I trace the outlines of an ecology of used books through various spaces of collection, sorting, distribution, and exchange.

Valuation as a situated practice

How far do accounts of valuation as a situated practice go toward understanding the processes necessary for understanding valuation of used goods? Sociological and science and technology studies (STS) approaches have presented valuation as a social or a socio-technical process to explain how goods are assigned particular qualities and valued by market actors. These social and socio-technical explanations provide us considerable insights into understanding how goods are valued. There have been, however, relatively few attempts to understand what is specific about the functioning of markets for used consumer goods.

Sociological approaches have tended to stress the historical and cultural contexts that shape social conceptions of particular types of goods. The perceived value of particular items or types of items is contingent on broader social, cultural, political, and cognitive structures which reach beyond the moment of valuation. In other words, valuation processes are embedded in multiple dimensions of social life (Zukin and DiMaggio 1990). In her discussion of the market for Russian antiques, Bogdanova notes that valuation should be understood as "part of a process that reflects social, cultural, and political" factors of the society in which the valuation takes place, and as a cognitive process that requires specialized knowledge (2011: 2). In order for a market for antiques to emerge and operate, then, old furniture must be understood to be something attractive and desirable, and there must be people who have the knowledge necessary to recognize distinctions between eras, types of construction, styles, and so on. Crucially, the buyers and sellers of these things must occupy social positions which grant them legitimacy to make such claims about value.

When used goods are exchanged, an additional dimension of information asymmetry is introduced into the analysis: how does one know that one should trust the seller to sell as advertised (Akerlof 1970)? Questions of uncertainty and authenticity figure prominently in accounts of the valuation of antiques (Bogdanova 2011, 2013). Amazon.com is a platform that makes transactions between far-flung buyers and sellers possible, which means that uncertainty must be overcome in ways other than building direct interpersonal

relationships. When used books are bought and sold on Amazon, the standardized rating systems for both the material condition of the book and for the seller provide some assurance about the quality of the item being sold; Amazon also has a generous return policy that lends some security to the transaction. Used books are generally not high-priced items, except in rare cases of valuable and collectible editions. Despite the relatively low price and correspondingly low risk, however, it is still necessary to demonstrate the quality of the items with a reasonable degree of certainty.

STS approaches have contributed an added focus on the socio-technical dimension of value production. Economic value is not only socially produced, but is performed through the mediation of economic models (Callon 1998; Fourcade-Gourinchas 2003); economic ideas about how markets can or should function (Garcia-Parpet 2007; Rona-Tas and Guseva 2014); and infrastructures and tools (Preda 2006; MacKenzie et al. 2007; Pinch and Swedberg 2008). Karpik (2010) has drawn on this tradition to develop the concept of "judgment devices" like rating systems, rankings, guides, expert advice, and so on, which provide customers a sort of mental and technical scaffolding for forming judgments about the quality of products which do not have single, agreed-upon scales according to which their quality could be measured.

The socio-technical demonstration of quality and production of value is apparent when considering the sale of books online. Like the strawberry market in one of the pioneering texts on the "performativity of economics" (Garcia-Parpet 2007), exchange in the Amazon marketplace is shaped by various kinds of technical knowledge. On Amazon books are sold under a unified listing for a particular title, with options for purchasing the hardcover, paperback, or Kindle version. The content of the book is rated by high-prestige reviewers as well as customer reviews. If the interested party decides to buy a copy, s/he can scroll down a list of vendors offering copies of the book, used and new, at varying prices. The array of prices is clearly laid out to be evaluated by the potential buyer. Some of those prices are set by dynamic pricing algorithms which automatically adjust in response to competitors' prices and consumer demand (Chen et al. 2016). Each seller also has a rating that reflects customer satisfaction based on feedback over the past 12 months, so a potential buyer can evaluate his or her likelihood to feel positively about a transaction undertaken with a particular seller. On an Amazon page for a book listing, then, the "moment of valuation" is heavily scaffolded by multiple judgment devices.

The qualities of a used item are demonstrated by some of the same judgment devices as is the case with the new ones, as outlined above. But a new book is mainly valued according to content: has it been well reviewed? Does the potential reader know of the author and expect to

find the latest product entertaining, enlightening, or helpful? These are all dimensions that Karpik (2010) deals with in his discussion of the value of "singularities." For used items, however, there are significant material considerations which are not part of the qualification process as it is conceived of in the study of valuation of new items. Every used item has a unique wear pattern, making each item a "snowflake" (Rivoli 2006: 178). Will the copy be battered and worn or like new? Will the pages be heavily annotated? Will any pages be missing or torn? On Amazon, used books are sold with the use of a judgment device that is unnecessary in the case of new books. Each used copy available for purchase is ranked according to condition. Amazon's "Marketplace Items Condition Guidelines" standardize the material condition of the books so that a potential buyer can evaluate the options offered by the various sellers.

These material concerns may seem to be a self-evident and trivial dimension involved in the selling of used items. In fact, secondhand markets are often treated in economic analysis as a competitive alternative to the firsthand market (Fox 1957; Kim 2013) where the same products are offered in used form, and therefore at a discount. The qualities of books necessary for qualification when they are new, however, are connected to a particular type of production process: one in which the content is created once and distributed via a mass-production system. While they may choose between hardback, paperback, and Kindle versions, potential readers do not need to employ judgment devices that are sensitive to the quality differences between individual copies of the book, as quality is standardized across the supply of exemplars of the book, thanks to mass production.

In conceptualizing valuation as a phenomenon to be understood in its own right, discussions of qualification and valuation all too often leave aside supply-side—production—dynamics. The discussion above illustrates how modes of valuation which follow from processes of mass production are no longer exactly sufficient once goods have been altered through acquisition and use. The focus on how uncertainty is overcome and how quality is reliably demonstrated, through both social and socio-technical mechanisms, have been part of a program to focus on the "demand-side" aspects of exchange which have been left out of economic accounts (Beckert 2009: 253, 2016: 212). The result is that valuation and production are often not considered together.

Despite the insights gleaned from existing approaches to valuation of unique goods, understanding the valuation of used goods requires a shift in how we think about the relationship of valuation and production processes. When valuation is analytically detached from production, the "situated" moments of valuation explained by social and socio-technical approaches are actually circumscribed, detached from underlying material realities. I argue here that it is essential to

understand how these situated moments of valuation were constituted (see also Mintz's explanation of the preconditions of a consumer's choice (1985: 182)) in order to arrive at a more a complete story about valuation. If production is conceived of as something which always happens prior to valuation, valuation can be explained as a process that happens in the confines of a free-standing market, separate from production (albeit one embedded in society and culture). On the other hand, if production is understood as central to valuation processes, markets must always be explained in terms of larger systems of material flows, control of resources, and technological and organizational processes. Understanding the valuation of used goods, then, requires troubling underlying assumptions that the qualification of goods is part of an implicitly linear process, suggesting "a linear flow of objects and influences along the chain from production to consumption" (Entwistle 2009: 166).

Similar arguments have been made by other valuation scholars. Vatin has argued that the articulation between production/work (studied by sociologists, technicians, or managers) and exchange/market (studied by economists) should be reconsidered where viewing them as separate unconnected spheres obfuscates the debate about the genesis and transformation of value (2013: 40). While he does not prescribe their unification via a return to a Marxist labor theory of value, Vatin does observe that this artificial separation of domains, perpetuated in the sociology of conventions as well as in the new economic sociology, amounts to a "disconnection from reality" (2013: 41). More than leading us to the now-truism that valuation is work, his observation should prompt us to analytically link production and valuation. While disagreeing with Vatin's proposal to use two separate concepts for what happens during production and exchange, Heuts and Mol also argue that the "evaluation" of the market and the "valorising" of the production process are hard to separate and should be considered together (2013: 129).

The central role of production has also begun to appear in sociological discussions of the value of goods, though it is not necessarily explicitly recognized as such. Studies of how people are turned into commodities with economic value, like models (Mears 2011; Wissinger 2015) or Hooters waitresses (Newton-Francis and Young 2015), take pains to show that the making of these commodities is accomplished through human labor, including that of the models/waitresses themselves. The way that humbler commodities are produced is also relevant to valuation processes. In the market for timber, quality of the finished product is indeterminate at the moment of purchase, because sales are made long before the trees are actually mature (Aspers 2013: 75). Aspers observes that temporality is a relevant complicating factor in valuation in all markets, though in natural resource markets this problem is more pronounced. At the time

of exchange, it is often not clear what a good's quality is: "a good is being traded even as neither party has exact knowledge of what the economic result will be" (Aspers 2013: 75). He concludes that the temporality of qualification increases uncertainty in exchange, and trust between buyers and sellers is necessary to overcome this uncertainty. But rather than focusing on the temporality of *qualification*, we might recast his conclusion slightly in terms of the specifics of *production* of the goods in question. In the particular case of timber trading, Aspers says that "its long production time and its always singular tracts" (2013: 75) are what make the actual quality of timber indeterminate until long after the formal exchange has been made. By making this very slight shift, Aspers's findings about the importance of trust in overcoming uncertainty in the exchange of timber show us that the manner in which a good is produced has a central role in the ways that it can be qualified and thus valued.

In the next section I develop the concept of the ecological approach to valuation, and the related concept of subtractive production, and describe how it can help contextualize "situated" understandings of valuation. I then use the ecological approach to describe the valuation of used books in England.

Toward ecologies of valuation

A growing body of literature within anthropology and human geography on waste and recycling provides insight into social processes that surround the management of used things, from used clothing and textiles (Norris 2012) and other household possessions (Gregson et al. 2007) to e-waste (Lepawsky and McNabb 2010), mass landfill waste (Reno 2009; Woolgar and Neyland 2013), and industrial and toxic waste (Gille 2007). These studies largely draw on ethnographic engagement with valuation practices to show the labor necessary to accomplish actors' desired effects. Labor is always required to move materials from place to place, as well as to establish and maintain categories of cleanliness and pollution (Reno 2015: 561). Materials, goods, and infrastructures must be encountered and manipulated, rather than simply taken as given, in order for actors to derive value from them or to express a desired order of worth.

Many of these scholars have pointed out that mainstream global value chain and global production network approaches are insufficient for understanding how value is produced for used items. First, somewhat paradoxically, there is a lack of discussion within value chain analysis of "how and by what processes value is created" (Gibbon et al. 2008). Second, global production network analyses, focusing on how trade and production are coordinated, have overwhelmingly focused on production of new goods rather than the "back end" of the global economy (Brooks 2013). Furthermore, the conceptualizations of value production that have been elaborated in

these approaches are ill-fitted to the empirical reality of value chains of used goods and materials. The nature of the material stream constituting the supply of used goods means that value production cannot be additive as in the "value-added" chain conceptualization of international trade and industrial organization (Gereffi et al. 2005). Value creation for used things as they move from one site of value production to another is instead a matter of connecting different regimes of value to *extract* value from things which have lost their worth in one context (Norris 2012; Crang et al. 2013).

Identifying value extraction as a mode of value capture still does not specify the mechanisms whereby value is created at different sites along a value chain. In practice, it takes quite a bit of work to create a material stream that consists of used books or used clothing to the exclusion of other used things. The infrastructures of collection of used goods tend to generate a supply comprising different types of objects. Moreover, used goods are materially heterogeneous, having (usually) gone through (at least) one consumption cycle, rather than standardized through mass production processes. Valuation of used goods involves a type of production which I call s*ubtractive production*. Subtractive production involves the labor of ridding and displacing which creates sorted, aggregated, and classified goods from a heterogeneous material stream. This type of production is not a purely creative process whereby new things are created from abundant resources; it is, instead, contingent, messy, wasteful, and ad hoc. It is also not simply extractive, in the sense discussed by Crang and coauthors (2013). Although some high-value goods are extracted from the material stream, the lower-value items that remain are made valuable through rounds of sorting and ridding. This successive subtraction of items which are understood to be unsuitable in a variety of ways is the central mechanism for the valuation of used goods when considering the ecology in which these items move, from collection through various points of sale.

Understanding the work of ridding as a type of productive labor is at the center of understanding valuation of used goods. Very much in this spirit, Herod and coauthors (2014) have stressed the importance of considering the nature of labor processes in understanding value transformations of goods in recycling or secondhand networks. It is crucial not to think of goods as already produced and waiting to be valued. Valuation is not simply a process that previously produced, finished objects must undergo (see also Gregson et al. 2010). Markets for used goods are not simply the distribution mechanism for goods that were produced in distant processes. Rather than being analytically prior to valuation, production of the goods being valued—through physical manipulation of material components or displacement in space—is central to the valuation process.

A view of valuation which is able to encompass instances in which value is produced through ridding and subtractive processes requires what Jackson (2013) has called "broken world thinking." As Jackson suggests, this mode of thinking "asks what happens when we take erosion, breakdown, and decay, rather than novelty, growth, and progress, as our starting points" (Jackson 2013: 221). In so doing, broken world thinking focuses on the processes of "breakdown, dissolution, and change" as well as the accompanying, ongoing activities of repair and restoration that allow for the maintenance of stability of social worlds and systems (Jackson 2013: 222). While it was developed to understand information technology systems and the world they inhabit, broken world thinking provides an important orientation in thinking about market processes. Geographers Berndt and Boeckler observe that marketization is a "deeply ambivalent endeavour … about establishing *and* severing linkages … incorporating *and* expelling places, people and things" (2010: 566). This ambivalence of marketization is reflected in the ridding, categorizing, and sorting that makes it possible to create value in a market for used items.

Broken world thinking urges us to think beyond valuation processes that happen in a single market or in a single moment of valuation. Because value is created in part via heterogeneous processes of repair, recovery, and salvaging, and marketization is characterized by ongoing erosion, breakdown, and decay, wide-ranging actors and organizations are enlisted to deal with these various aspects of the process. We are obliged to think of the work of production as taking place in a "diverse economy" (Cameron and Gibson-Graham 2003) where practices officially recognized, counted, registered, and so on as "economic" are supplemented by other practices which, though not usually recognized as part of a legitimate account of economic activity, are essential to the functioning of markets and value chains. Following Hutter and Stark (2015), we might conceive of market valuation as a moment of stabilization within a greater context of unstabilized, often conflicting, processes. Broken world thinking helps us look at valuation differently by zooming out from the moment at which value is determined to the processes in which those moments are themselves situated. An ecological view allows us to see the overflow inherent to markets and to think in terms of excess rather than scarcity. We can think about how markets are connected to one another, and in a fundamental way about the conditions that make particular performances of value possible. The broken world thinking approach to valuation allows us to consider both production of value and production of excess within an ecology of materials, flows, and social structures.

Thinking ecologically with the broken world approach therefore helps contextualize existing sociological and socio-technical accounts

of valuation. While it is undoubtedly true that symbolic and technical mechanisms are at work, it is unavoidable that material processes of ridding, wasting, categorizing, and sorting not only contribute to, but often underpin those symbolic and technical mechanisms. The value of used items is only temporarily stabilized through a variety of sorting and classification processes which rely on a subtractive logic of ridding to qualify goods. These are the situated moments that valuation studies have largely been concerned with explaining.

The ecological approach demonstrates that trajectories of value are even more dynamic, iterative, and non-linear than as described by Thompson's (2017) rubbish theory. Ridding, as described in this article, is a practice which is done to items which fall within the realms of what Thompson has called "transients": consumer goods whose (exchange) value decreases over time and which have limited lifespans (2017: 25), as well as "rubbish": objects of zero and unchanging value which exist in a "timeless and valueless limbo" (Thompson 2017: 27). Thompson was more interested in explaining the phenomenon whereby kitschy or undesirable consumer goods become durables than he was in examining in any great detail the mechanisms at work within the categories of transients and rubbish. But there is not just dynamism *between* categories of transient, durable, and rubbish; there is a great deal of value transformation *within* categories. Looking closely at the dynamics of used goods makes it clear that the value of transient goods is not constantly decreasing. There can be peaks and increases in (exchange) value, even while goods never actually enter the category of "durables." Taking the pragmatics of ridding into account also problematizes his conception of "rubbish": far from being valueless, even the most mundane objects can be valued in multiple different ways as they travel through different spaces and encounter different judgment devices and evaluative schemes. An increase in (exchange) value does not make something a durable, and something does not ever necessarily need to have zero value or be "forgotten" in order to increase in value.

	Value	*Waste*
Heuristic	Market, value chain	Ecology
Location	Situated	Ongoing
Structure	Linear	Non-linear
Mechanisms	Social, socio-technical	Ridding, subtractive production
Aesthetic	Cult of the new	Broken world

Table 1. Value and waste paradigms for understanding valuation. Source: Author's own

In sum, the ecological approach presented here explains valuation as a process which is ongoing rather than situated; as non-linear rather than as part of a linear process from production through an endpoint of waste; as part of a broken world rather than in terms of a cult of the new that applies best in western capitalist contexts; and as intrinsically connected to particular methods of production. In the case of used goods, this is a process of *subtractive production*. Table 1 summarizes the distinctions between the value and waste paradigms for understanding valuation. In the sections that follow, I present the outlines of an ecological approach for understanding valuation of used goods by considering the case of used books in England.

Data and methods

The data for this discussion are drawn from a 14-month long qualitative study of the valuation of used clothing in England, wherein I traced flows of used clothing from points of collection through points of domestic resale or export. Using ethnographic (participant observation and observant participation) and interview data, the research was meant to investigate valuation of used clothing, but this is an article about used books. Early in the research, I realized that it is non-trivial that clothing is only one of the things exchanged in the spaces I was visiting. The infrastructures of collection mean that used clothing and used books (along with other types of used household items) occupy the same ecology.

My research was based in a medium-sized city in the South East of England. I volunteered in four charity shops in the city where I lived, totaling nearly 200 hours of participant observation. I conducted 26 formal interviews with a variety of actors involved in the buying, selling, and regulation of used clothing in England, as well as numerous informal (and not audio-recorded) interviews in the course of participant observation and observant participation which form part of the field note record. Formal interviews were with managers and employees from other charity shops, with representatives of local authorities (city and council authorities) responsible for the collection and management of waste, and with individuals involved in the collection and circulation of used clothing and other used goods as part of various local organizations. I interviewed owners or employees of six textile recycling companies, and traveled to visit five of these facilities. Taken together, these six textile recyclers covered most of the area of England, as their collection reach spanned the country from its northernmost to southernmost areas. During site visits I was shown the labor process, machinery, and warehouse spaces necessary for creating value from collected used clothing (and books, and other items).

The four shops I volunteered in represent different types of charity shop models present across England and the United Kingdom (UK).

Cat Charity is a local cat rescue charity with just one shop location, run by a small cadre of regular volunteers and no paid managers. I spent the most time volunteering in this shop, and I generally worked with the same two or three women each time I went in. Children's Charity is a regional charity with a few dozen shops and a highly professionalized managerial system, and a volunteer staff that was large enough for the managers to need to display a printed-out weekly schedule of who was scheduled to come in and for which hours. Health Charity is one of the UK's larger charities with hundreds of shop locations across the UK. In my time there I always worked with one of two managers and a fairly limited group of several regular volunteers. Pet Charity is a regional animal sanctuary with a few shop locations, each of which has one paid manager and a small handful of volunteers. The fifth charity included in the discussion below is Hospice Charity, a local charity with several shops spread around neighboring towns.[1] While I did not do participant observation here as a volunteer, I did spend a day shadowing the retail manager as she traveled around the region to visit her shops, and an additional day with the manager of one of Hospice Charity's shops as we traveled to meet with a textile recycler at his facility several hours away. I also visited Hospice Charity frequently as an "observant participant," taking field notes about discussions or conflicts among the employees and observing customer dynamics. This method of observant participation at dozens of other charities complements the participant observation data I was able to collect during my time as a volunteer over the course of 14 months at the four shops I mentioned above.

Used books in England

The "supply" of used goods is highly heterogeneous, as people discard various types of items with varying degrees of usage. As they travel through a variety of different spaces of exchange, used books can be sold alongside used other used goods or separated off into more specific niche markets. The social frameworks and socio-technical scaffolding that guide value judgments in markets for new things are

[1] All hospice charities are local, as their cause is always to support a specific (and thus always tied to a particular location) hospice's operations. While in practice they operate in the same way as other local charities with just a single or several shop locations (in contrast to those charities with a larger regional or even national presence, which tend to use centralized warehousing and because of the greater volume of goods flowing through their stores can support more targeted retail operations, such as "vintage" shops with collected items), hospice charity retail is treated by the Charity Retail Association as a separate category when data about sales are aggregated and reported. This is because hospice shops often do very well due to the emotional connection people are thought to have to their local hospice, meaning that hospice charities do not usually face the same difficulties soliciting donations that other charities complain of.

secondary to the mundane and everyday ways in which used books are sorted, classified, and moved into different spaces to be made part of different material flows. Used books are remade through sorting and classification as certain types of goods, which are evaluated with various modes of valuation. The ecology of used book exchange stretches across sites from charity shops to waste paper recyclers, with a number of different intermediaries and multiple modes of valuation.

Before the shop floor: rejection

When charities collect goods, they are taking advantage of people's desire to downsize and rid themselves of excess or unwanted items. As a result, used books and used clothing are very often collected in the same infrastructures of charity shops or collection banks (the large metal bins that are often located in the parking lots of grocery stores alongside other bins for recycling other types of goods or materials). These material streams are often not only full of clothes and books but a great variety of other household items, including toys, games, crockery, decorative items, small electronic devices, furniture, gardening supplies, and so on. Used goods must be excavated, carved out of these material streams which consist of a great variety of unique items, and aggregated; only then can they be known in particular ways as having particular qualities which position them in particular value regimes. This is done through multiple rounds of ridding and expelling from the "calculative space" (Callon and Muniesa 2005: 1231).

The first of these rounds is at the moment of collection. A lack of space is quite often the biggest factor determining what, and how much, needs to be rejected. At Cat Charity, where the shop location consisted of one room for display and a curtained-off storage and sorting area, plus a storage garage out back, officially books were not sold because they take up too much space. The exception to this rule was children's books, which were displayed for sale on one shelf among other children's toys and games, and stored in the stockroom on one shelf. The policy prohibiting sales of books did not, however, prevent people coming in often with boxes of books which they wanted to leave, or with books which were discovered only later when bags were opened, and which therefore could not be refused. The workaround at Cat Charity, then, was that when books were received they were displayed on the counter to be given away or taken for a donation. I was told that it is better to get 20p for a book than nothing at all.

It is not only space constraints that motivate ridding processes; ridding also helps charities cultivate a particular image. Given the strong culture and infrastructure of charity shops in the UK, there is a great deal of competition among the charities as people have a number of choices as to where they can bring their used items. It is therefore important for charities to strike a balance in their message to potential

donors, encouraging them to bring everything they have to give away, but not causing the volunteers to get bogged down in poor-quality items that they will spend hours sorting and then will not be able to sell. Volunteers often discuss the difficulty of encouraging the "right" kinds of donations: "good" things which will sell, raise money for the charity, and which in the process will make the shop attractive. In this sense the production of value begins with the cultivation of supply. Even in the shops that attract the "best" goods (those with the highest resale value), most of what is brought in as a donation is rejected. In most cases, if not all, only a fraction of what is brought in as donations is ever set out for sale.

When items, desired or not, have been accepted, another set of rejection criteria is employed in sorting processes. At Cat Charity, when books were damaged or written in, whether they were children's books and therefore suitable for official sale, or books that were not to be sold officially (novels, cookbooks, travel guides, curiosities of all kinds), I was instructed to "bin them" and told that we should not sell things that are soiled—and apparently we could not give them away for free, either. Books that were set out to be taken, like other items that were for sale, were not only meant to raise money for the charity but were also used to convey a sense of propriety and attractiveness.

At Children's Charity, a larger shop, books are given their own section of the sale floor. Before they are set out for sale, however, they get subjected to a physical test similar to that employed at Cat Charity, which ensures that the stock on the sales floor is relatively uniformly decent-looking. If books are worn (for instance if the outer edge of the pages are dirty or if the cover is tattered or damaged) or if they have writing or a stamp in them (from, for instance, a school library to whose collection a book used to belong), they are set aside into the plastic bag that will be passed along to a book recycler. This store has a vintage section, which in turn has a separate section for vintage books, but even for a book to qualify to be displayed there, the book should not be falling apart, and it should be a first edition. If they pass the physical test, books are set out in their own special area. Volunteers are not required to make any sort of evaluation of a book based on its content, or its potential to appeal to customers.

Before the shop floor: extraction of high-value items

Alongside subtractive ridding processes to eliminate undesirable items from the material stream, potentially high-value items are also being extracted out of the material stream to be qualified in different ways. Shop managers must either have the knowledge themselves to evaluate potentially higher-ticket items, or they outsource this task to specialists or to technical support like software. I observed both of these strategies at Hospice Charity, a local charity with several shops spread

around neighboring towns. On a day when I visited several Hospice Charity shop locations with Sandra, the manager of the charity's retail operations, she spent some time instructing the shop managers what they should be setting aside for a special event that she is going to have for the moneyed, high-class hunting crowd that lives in the countryside near this shop. She called it her "hunting sale" and told her managers to set aside large coffee table books for this event. Though she knows that these people "won't walk into a charity shop," through a friend who is involved in hunting in the region, she knows that these people will attend a glamorous charity event to buy hunting memorabilia, furs, and nice coffee table books. This event was a chance for Sandra not only to raise money for the charity but also to find the "right market" for things that she could not sell in her shops otherwise, like fur.

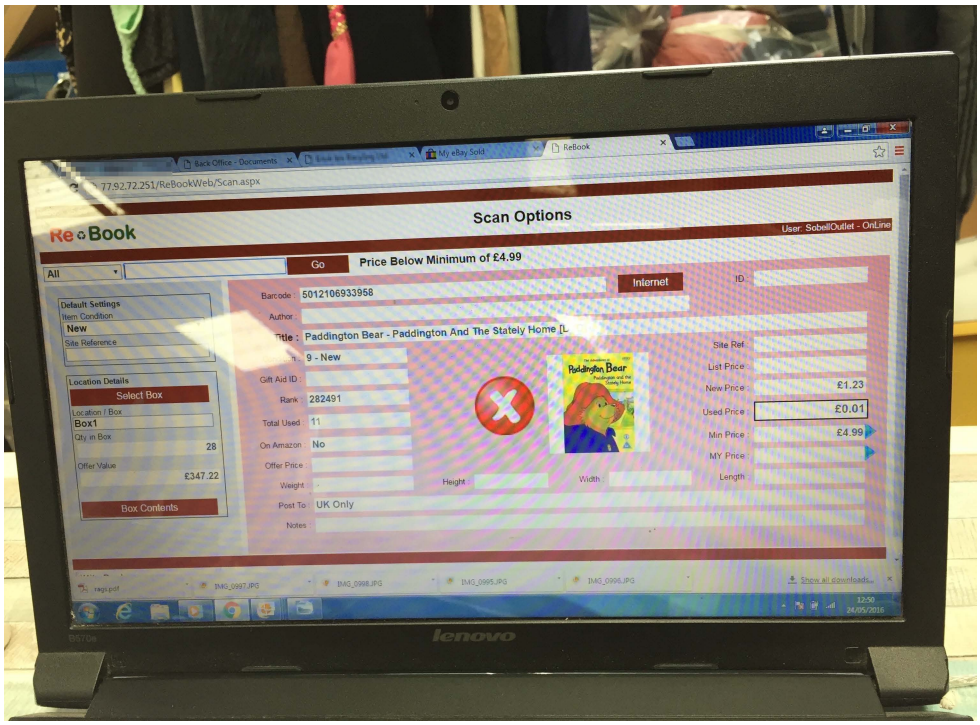

Figure 1. Hospice Charity's book-scanning software rejects a candidate for online sales.
Source: Photo by author.

As another part of their extractive production process, Hospice Charity scans the barcodes of books to determine which ones should be sold online for a higher price than could be asked in the shop. This business model is designed to extract the highest amount of value as possible from the books that come in as donations. Tucked away in the sorting room of her shop, a shop manager demonstrated to me how the software for scanning and selling books works. She showed me

stacks of books under the desk holding the computer and pointed to additional stacks of books on the floor in the stockroom a couple of meters away, covered with a sheet. All these books were waiting to have their barcodes scanned. If the software tells them that the profit for that book, taking into account shipping costs (which the software can calculate based on the information gathered from the ISBN code[2]), is greater than £5 (the limit that this charity has chosen to set), that book will be listed to be sold online (see Figure 1). The books listed online are set aside in a large plastic tub, on top of some shelves, to wait. When the book sells on Amazon, the software sends them an email and even generates a shipping label. If the software determines that a book will generate less than their £5 profit limit, it goes out onto the sales floor in the shop. The manager showed me how to scan in a boxed set of children's books as an example. Although the item cost over £8, the profit threshold of £5 takes into account shipping price. In this case the item's weight meant that the shipping costs were too high to bother selling it online.

On the shop floor: qualification at point of sale

Their heavy culling strategies, based on material qualities, meant that Children's Charity could price books by using a "scaffolding" device borrowed from the items' first life as a new book: by checking the suggested price on the cover and charging about 25 percent of that amount. But after passing the first rounds of inspection, books are not just sent out to the shop floor and left there until they are sold. Most charity shops have a "culling" system that allows them to systematically employ periodic ridding mechanisms that ensure that no items linger unsold on the shelves too long. For the purposes of keeping track of how long stock has been out on the floor, all items are marked with the date of their eventual culling on their price sticker before they are set out on the shop floor. Shops with a higher volume of turnover[3] had shorter "cull-by" periods, usually two or three weeks; smaller shops tended to use a cull-by period that allows goods to sit out for a month or more. When I was being given my introduction to a Children's Charity shop, one of the managers pulled out a book to show me the date written on the price sticker, which is always two weeks from the day the book is set out on the shop floor. In this case the date on the book she pulled at random off the shelf was long past. She explained to me that though this one should have been long gone,

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[2] The International Standard Book Number, a book's unique numeric commercial identifier.

[3] Turnover is not just a function of the volume of donations a shop gets; charities with a network of shops often employ stock rotation systems, where unsold goods are sent to other shop locations according to a predetermined schedule. In this way shops can display "new" stock, even if the items are not "new" donations.

sometimes you can leave it longer because it is better to have things that are overdue for culling than to have bare shelves. When there is more supply, however, books should not sit for more than a couple of weeks unsold.

It should by now be clear that multiple previous rounds of ridding allow for the use of qualification strategies that resemble those in the market for new goods. It is at this point that valuation processes for used books also resemble processes described for higher-value used goods, like antiques or vintage clothing. As with antiques, cues that indicate an item's provenance help make it appear valuable (Bogdanova 2011). Sandra at Hospice Charity tells me that she has an arrangement with a local auction house whereby items that are neither sold nor collected by the people who put them up for auction are given to the charity. She playfully tells me that auction tickets help items sell, and we laugh when she describes how "old books that aren't worth much really" that were not bought by collectors on auction are attractive to people in the shop simply because they have the auction tickets on them! The ticket conveys a sense of the quality of the book, whether or not this quality reflects its actually attainable economic value (similar to Thompson's example of a low-status fireplace raising the appeal and market value of a renovated house [2017: 67]).

Beyond the shop floor: parallel exchange

Alongside the official sale of donated goods, charity shops tend to be places of many kinds of informal exchange and multiple channels of circulation which extend outside of the space of the charity shop. Many studies of used goods use a value chain approach as a heuristic for tracking the flow of objects, but the ecological approach shows that value production is more diffuse—iterative, circular, spread out—than linear. One common practice among charity shop workers was to speak of the shop's stock of books as a library. One of the managers at Health Charity told me that I could borrow books from the shop and bring them back once I'd read them, or at a pound or two apiece, I could "just buy them and re-donate them, they're so cheap!" At Cat Charity, books were also often quite freely distributed among volunteers, who were encouraged to take them away and bring them back at will. At Pet Charity, the manager explained to me that children's books are some of their best sellers, because it's the type of thing that people always need more of. Some people even buy them and then donate them back when they've finished. It's like a library, she said, just without the late fees. In this way, books move through multiple cycles of exchange which are temporary displacements rather than linear transfers from buyer to seller.

In addition to this library-like exchange with the shop itself as a hub, used items that come in as donations to charity shops are sometimes sold or exchanged in settings outside the shop. At Cat

Charity, though books were not sold officially in the shop, books were nonetheless sometimes collected and sold via alternative channels. A local fair in the springtime proved an opportunity to sell some things which were not usually sold in the shop, books included. In other instances, amassed books were sold by the box to local auction houses (usually ones that had agreed to waive the fees for putting goods up for auction). Auctions—both online auctions like eBay or local auction houses—were sites for selling both high-value items as well as low-value items that had collected in significant numbers and not sold: boxes of books, boxes of plates, boxes of stuffed animals, anything that had accumulated. After items had been displayed in the shop for some time without being sold, they were often taken out to the garage out back to be stored until enough of that type of thing collected and they could be taken to auction and sold off. Through these processes of storage and aggregation, items unsold in the shops did not become zero- or negative-value waste, but were instead re-qualified in other contexts.

Beyond the shop floor: professional recycling

Moving beyond the space of the charity shop, an ecology of markets emerges. Individual moments of valuation are sustained by the existence of contiguous markets and spaces into which unwanted materials or goods can be offloaded. If a used book is rejected first by its original owner, and then by charities, it either ends up as waste—going directly into the garbage as at Cat Charity—or is sold onward to a book recycler. Smaller charities can get away with putting unwanted items, like damaged books, into the garbage, because they generate smaller amounts of waste in general. For instance, they may pay per tip that they fill per month, and even higher rates of ridding would not cause them to fill up more than one tip. Their costs associated with generating waste are in this sense not prohibitive. At larger charities, however, larger volumes of stock meant larger volumes of waste generated and paid for. I was told to try to put as much in the recycling bags as possible (for cardboard, paper, etc.) because it costs less to dispose of those than a bag of rubbish. It is a better solution to avoid the cost altogether, by segregating books and selling them onward to recyclers. When books are unsold after their designated time period in charity shops, they are taken off the shelves, bagged, and sold onward, together with books which did not make the cut to be displayed on the shop floor. Unsold books can be bought by the textile recycler who buys unsold clothing from the shop, or sold to a specialized book recycler.

Textile recyclers often collect books from charities along with clothes, and sell them on to book recyclers. Books can accumulate in huge amounts, even as a by-product of the main activity of used

clothing collection. A London-area textile recycler who collects from charities within a 100-mile radius of his warehouse told me that he collects and processes about 40 tons of books a week (alongside their main business of clothing—180 tons per week—and 30 tons of shoes, 12 tons of bric-a-brac, and 2 tons of cardboard). The textile recycler can take on pre-scanned batches of books because the book recycler that he works with sells all books, even those that can only be listed for a penny. The value production model employed by the book recycler for selling books therefore has an effect earlier, at the point of collection, on the decision of the textile recycler with regard to what "sorts" of books he can collect. It should be noted that the "sort" of books is quite literal here: the sorting processes employed on a material stream have the effect of making it a particular type of product. Sandra at Hospice Charity tells me that the only problem with her value-extraction sales model, relying on her Amazon barcode scanner, is that she can't get much at all—only about 5p for a bag of 30 books—for the books that she sells on to a book recycler because they know they have been scanned. Health Charity gets more, selling their unsold books to a firm that buys them for 5p per kilo.

Sometimes book recyclers work independently as opposed to on a contract basis with charities. One day when I was working at the till at Children's Charity, a man in his late 20s or early 30s came in with a rolling shopping bag. He introduced himself as a book reseller and asked us if it was okay if he scanned the barcodes of books. The manager allowed him to do it. After a while he came back around the corner from the book area with a stack of about ten books. When I asked, he explained to me that his barcode scanner was connected to the Amazon product database and shows him the price on Amazon—a mobile version of the software that I saw Sandra's managers using at Hospice Charity. He said that he spends most of his time buying books, traveling from one area to another. He told me that he is surprised that I don't see more people doing the same, because there is quite a lot of money in it. It was worth it for him to buy books at the prices we were selling them for at Children's Charity (£1 to £2.50) but at the charity down the street, the books are £5 each and it's not worth it. Thanks to his socio-technical device, this book reseller does not have to have specialized knowledge about the desirability of individual books; he can instead rely on price data to calculate whether he can make a profit on particular items. When I mentioned this incident to Sandra, she said: "Naughty! He wouldn't get anything out of us! We scan them all first." Her stores' extractive methods for books would likely mean that such an entrepreneur would come out empty-handed, but where other shops do not use this extractive method, there is room for such business opportunities.

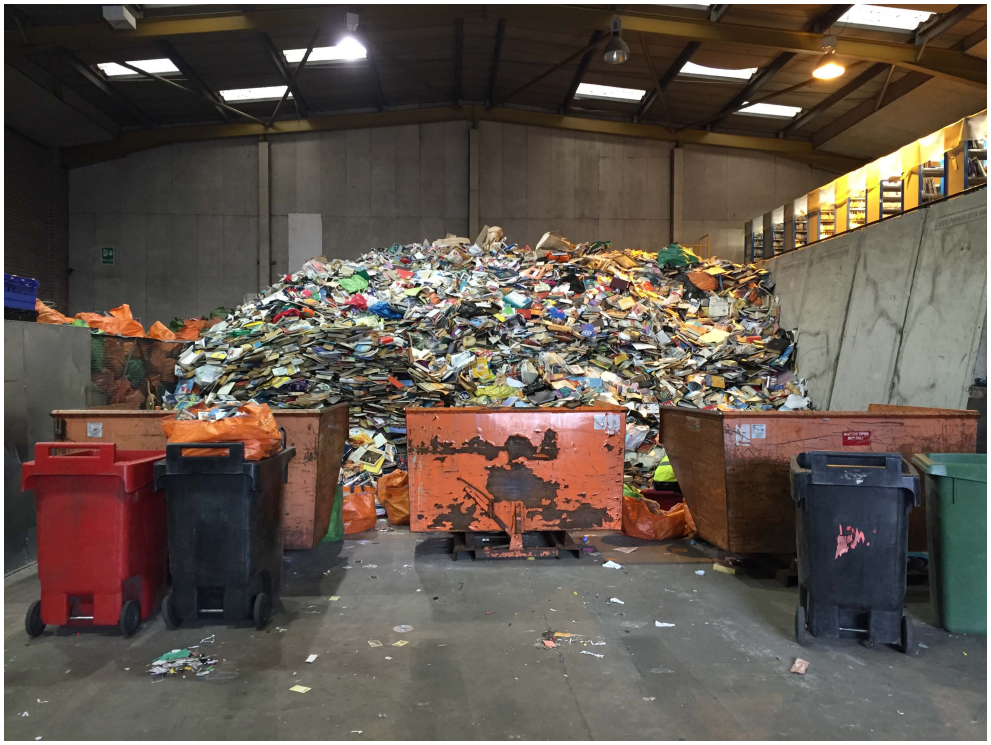

Figure 2. Books await sorting, workers crouching in high visibility vests at the base of the pile (one can be seen behind the tip on the right). Rejected books go into the orange tips. Shelves of books awaiting sale can be seen at upper right.
Source: Photo by the author.

One of the UK's largest textile recyclers also collects books (independently via collection banks, not from charities) and sells them themselves on a massive scale to Amazon. At their warehouse, I witnessed the high-value model of value production for book sales in action. In this model, the first culling is aggressive. In a warehouse separate from the one where clothing is processed, three workers in high visibility vests crouch at the base of a pile of books that is about 5 meters high, tossing books into the tip behind them—each worker has his/her own tip behind her—that do not meet cosmetic criteria for resale (see Figure 2).

The books that pass the first, cosmetic, test are placed into a sack (like an IKEA bag) and transported across the warehouse to the staging area for the rational/technical stage of the sorting process. Here, as at the charity shops, workers use software that calculates the books' sale prices on Amazon. Then the books will go into dozens of rows of shelves, stretching across two stories of the warehouse, and wait to be sold. This is the physical bookstore behind the virtual bookstore on the Amazon marketplace, just like the plastic boxes atop

the shelves at Hospice Charity, or the books inside the rolling bag pulled by the lone book reseller who searched the bookshelves at Children's Charity.

2017 UK domestic mill £ per tonne ex works	January	February	March	April	May	June
Mixed papers	69 - 79	76 - 85	80 - 105	40 - 52	45 - 60	55 - 75
Old KLS (cardboard)	80 - 95	88 - 100	98 - 110	80 - 90	90 - 110	115 - 130
News and pams	80 - 90	90 - 100	100 - 108	80 - 95	82 - 95	88 - 98
Over-issue news	115 - 122	120 - 127	125 - 135	112 - 122	115 - 122	120 - 128
Sorted office waste	162 - 168	164 - 169	165 - 174	166 - 175	166 - 175	165 - 175
Multigrade	160 - 165	160 - 165	163 - 168	164 - 170	163 - 170	160 - 168
Light letter	165 - 175	170 - 177	175 - 180	175 - 180	175 - 181	175 - 180
White letter	225 - 230	225 - 230	225 - 230	220 - 230	225 - 233	225 - 235

Figure 3. Waste paper prices for the first half of 2017. Source: https://www.letsrecycle.com/prices/waste-paper/, accessed May 5, 2017.

Book recyclers buy unwanted books from charities or collect them in special collection containers at Household Waste Recycling Centres or in recycling banks (for instance, in the parking lots of grocery stores or on property owned by local authorities). World of Books is one book recycler that specifically works with charities to collect books that they cannot or do not want to sell. On their website, World of Books reports that they "recycle 2.3 million books a month" (World of Books 2017). This is the equivalent of 12,500 metric tonnes per year. The books get sold on Amazon (or similar marketplaces like AbeBooks or eBay), exported as books, or sold as paper of various grades.

If a book cannot be sold as a book by a book recycler, it then ends up on the commodity/recycling market. Book recyclers must also deal

with their own waste from their sales processes, and World of Books is no exception, reporting on their website that what they cannot sell on their various online marketplaces or export "to developing countries to assist in education and enjoyment," gets "recycled into low grade cardboard and other materials to be re-used" (World of Books 2017). That market is itself specialized, with different prices for different types of paper. According to the index of prices maintained at letsrecycle.com, white letter paper is the most valuable grade of waste paper, and consistently fetches about 3 to 5 times more per tonne as does the least valuable grade of waste paper, "mixed papers" (see for example recent statistics in Figure 3). Thus there are multiple routes via which used books end up on the commodity recycling market to be sold as waste paper. Even then, the type of waste paper that a certain item can become—or whether it can be recycled or reused at all—is dependent upon the material parameters of the particular item (what kind of paper it is, whether it is wet or soiled) and inherent limitations of paper fibers which constrain the "ongoingness" of a used book as a re-produced commodity (Herod et al. 2014: 428).

Discussion and conclusion

Considering ridding as a fundamental mechanism of a used-goods economy brings valuation into focus as a part of ongoing flows and processes. While individual moments are indeed situated in particular places and spaces and embedded in particular social realities, this is not the entire story. The ecological approach compels researchers to think about access to resources and about the conditions that allow certain actors to manipulate resources in particular ways in temporally and spatially adjacent and overlapping valuation processes. Furthermore, I have urged for a focus on production in studies of valuation. In this case I have discussed subtractive production, but the approach could be extended to all types of production (industrial, lean, or just-in-time, for instance). By way of conclusion, I propose that this article has demonstrated how valuation is ongoing as well as situated; that studies of valuation should not only be attuned to waste but to multiple forms of waste; and that studies of market making, like this one, are important counterparts to studies of market functioning.

Ongoingness of valuation

Beckert and Aspers (2011) note that most studies of valuation in markets to date have been empirical studies of wine, art, and finance. With an eye to developing a "general sociological theory of valuation and pricing of goods," they ask if the findings of the studies are generalizable, or if "valuation processes differ systematically in different types of markets, and if so, how?" (Beckert and Aspers 2011: 31). The answer proposed in this article is that moments of valuation

are themselves situated in larger ecologies, which expand beyond single instances of valuation in particular markets. Part of telling this story means considering the realities of production which make the moments of valuation possible. The ecological approach sheds light on a number of questions that are more difficult to answer when valuation is conceived of as a process that happens when production is already complete. Accounts which seek to situate "moments of valuation" by describing the social or socio-technical processes through which the value of goods can be agreed upon tend to abstract away from production processes, and take for granted the existence of the "x" in "a market for x."

With this in mind, we can situate economic sociological knowledge about valuation of spectacular and expensive goods, like wine, contemporary art, antiques, or financial derivatives. Before impressive profits can be derived from the exchange of these goods, they must be turned into knowable and standardized goods not only through the work of material infrastructures but also through the work of a great deal of human actors whose job it is to do the preliminary sorting, categorizing, and arranging of materials and things that make the astronomical profits from the exchange of objects possible elsewhere. Creation of those things that are attractive, desirable, or even just knowable involves a lot of moving around of unchosen, unwanted things and materials. Wherever it is possible to exchange highly standardized objects—used goods or new goods—there is a rich infrastructure that refers not only to the immediate environment of exchange but also to one that spans the globe and reaches back to primary production markets.[4]

Multiplicity of waste

Focusing on ridding adds nuance to Thompson's (2017) hypothesis that the exchange value of transient goods decreases over time and that so-called "rubbish goods" have zero value. Within these categories there is a great deal of value fluctuation. Thompson is more interested in the social control of value and the ability of individuals and groups with the most power and capital to determine which goods have the most (economic) value, than in the value of rubbish per se. Despite recognizing the variety of evaluative schemes or tastes (the multiplicity of "blinkers" (2017: 144)) operating within one society, Thompson insists that "there is only one market" (2017: 65). The case of used books has shown this to be not entirely true. It is true that there are higher-value markets for antiques or collectibles—the more durable

[4] This is true even in the case of financial markets. See for instance Çalişkan's (2010) ethnography of the global cotton market for an ecologically-spirited account of how the farming of cotton is connected to the trading of cotton futures in global stock exchanges.

types of used goods—but the operation of these markets depends on the operation of an ecology of neighboring markets. These flows are not infinitely realizable: there are limits to the "ongoingness" of waste which derive both from material limitations of remaking goods and from the logic of profitability under capitalism (Herod et al. 2014). In this article the logic of profitability has been shown to be not just a single, overarching logic, but a multitude of localized logics which are contingent upon the ways in which the "rubbish" from one situation of valuation will be used in the next one.

Making markets and valuation possible

Finally, the ecological approach brings into focus certain fundamental questions relating to the study of markets. One of these is: "what should economic sociologists explain when they study markets?" (Gemici 2012: 107). The most common focus of explanations has been the question of how markets work, and specifically how it is that the value of goods is agreed upon through the coordination of disparate market actors. As I have described throughout this article, explanations have tended to be social (overcoming of uncertainty; building relations of trust) and socio-technical (economic ideas help shape, not just explain, markets; the role of infrastructures and judgment devices is key).

This paper contributes to a body of literature concerned with the preconditions for the functioning of market exchange rather than solely explanations about how certain markets work (see for example Kjellberg and Helgesson 2006, 2007; Vatin 2013; Rona-Tas and Guseva 2014). Rather than asking how a market for a certain type of good works, I have argued that in order to avoid obscuring essential features of the world, it is equally necessary to ask what conditions are necessary for the market to operate in the way it does. This is not a metaphysical issue, but rather one that seems almost too simplistic to include in a serious study of valuation and markets. We might ask questions such as: What is the market in question made of? How did those elements get there? In the case of Amazon.com: How do all these books end up in an online marketplace? In the case of the global cotton market (Çalişkan 2010): How is cotton made into a global commodity, traded on the stock exchange? These are supply-side questions which have been obscured by the demand-side explanations of valuation produced in recent decades, but they are an essential part of the story.

By asking these questions about markets in which we have assumed production processes as prior to valuation, economic sociologists will be able to gain greater insight into the way in which markets are created and sustained. For instance, with regard to the market for apparel, the relevant question for economic sociology has been: if all

goods are created equal, why is one sweater worth more than another? The widely accepted answer is that one sweater has greater symbolic value than the other due to the status of the people who produce and consume it (Aspers 2009). But this, in part at least, inverts reality. To take the example of two mass-market clothing stores, it is the organization of production (just-in-time stocking, mid-season production of apparel, responding to the latest trends, and customers' actual buying patterns) that allows Zara to maintain a higher-fashion status, and attract higher-status customers, whereas Gap, producing most of its clothes before the season starts and less able to create apparel in response to observed demand, currently cannot (Fraiman et al. 2002). Retailers have figured out the importance of process innovation, and it is time for us to adjust our thinking as well. The lesson of ecological thinking is that sociologists who want to understand value should stop assuming that all goods are created equal, concentrating only on symbolic value, and start asking how goods are created differently. In this way we will better understand how material production processes make particular social and economic outcomes possible.

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From Trash to Treasure: Valuing Waste in Dumpster Diving

Turo-Kimmo Lehtonen and Olli Pyyhtinen

Abstract

The paper, based on an ongoing research project conducted in Finland, examines voluntary dumpster diving as a practice of valuation. Its main questions are: How is voluntary dumpster diving intertwined with the question of value? And, conversely, what can dumpster diving teach us about practices of valuation more generally? The article proceeds via three steps. First, in order to emphasize the creative side of dumpster diving as a practice of valuation, we draw on Georg Simmel's theory of value, supplementing it with the concepts of actuality and virtuality, as elaborated by Gilles Deleuze. Second, we look more closely into the practicalities of valuation evident in dumpster diving. It involves a particular orientation to the urban environment that we call *the scavenger gaze*. Third, the informants also value the practice itself in relation to its societal relevance. They think about dumpster diving as a way of doing good and as part of an ecologically sound form of life. All in all, as value does not reside inherently in waste or would simply be merely the product of subjective judgment, the analyst must attend to multiple modes of valuation evident in the practice, among which there is no self-evident hierarchy.

Keywords: dumpster diving; valuation; food waste; scavenger gaze; waste; virtual value

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Introduction

In this article, we explore the connections between value and waste matter by considering voluntary dumpster diving for food. The practice implies recovering discarded items from trash bins, often those placed in supermarket backyards or in the vicinity of other commercial establishments. Reminiscent of Hermes in Greek mythology, dumpster divers cross the boundary from our world into that of the afterlife (of rubbish) and back—carrying plenty of delicacies. The study offers a double exposure on the topic of dumpster diving. On the one hand, we examine how this practice is intimately intertwined with the question of value, as it involves the transformation of trash into treasure in hands-on practices of valuation; on the other hand we ask what can dumpster diving teach us about valuation, more generally?

Despite its seemingly marginal nature, dumpster diving is a highly relevant and fruitful topic for valuation studies for the following reasons. First, practices related to waste and waste management are in general fertile ground for cultivating an understanding of the emergence and loss of value. Of course, classifying something as waste in itself involves valuation. Things become waste as a result of the separation of the valuable from the worthless. However, as, for example, Josh Lepawsky and Chris McNabb (2010: 186) have argued, materials do not simply follow a 'one way transformation of value-to-waste along a linear chain of production-consumption-disposal'. Accordingly, recent waste scholarship has stressed that disposal does not inevitably lead to the annihilation of value (e.g. Gutberlet 2008; Reno 2009; Gille 2010; Lepawsky and McNabb 2010). For example, it is well known that the ideology of circular economy and the growing waste market in the Global North are rapidly changing the classification of rubbish from something unwanted and worthless into a source of value and profit. Further, scholars interested in scavenging have suggested that harvesting waste materials is a key economic activity in lower income countries in the Global South (e.g. Gregson and Crang 2015; Carenzo 2016a, 2016b). Because waste flows are rarely simply linear or even cyclical, following them calls for a close examination of the concrete ways in which things become waste, how waste is transformed into value, and also how other disposed materials fail to regain value (Gille 2010: 1054; Lepawsky and McNabb 2010: 186). We suggest that the transubstantiation and reclassification from waste to value is not simply a cognitive exercise but also involves lots of hands-on work, bodily practices, and heterogeneous techniques. This concrete activity of valuation in the borderline of purity and danger makes the practices of dumpster diving a fruitful research site. Thus, dumpster diving inevitably sensitizes the analyst to the dynamic nature of the category of waste; its contingency becomes especially clear when the 'wasteness' of waste is problematized or undone, as is

the case in the practices that we study.[1] When refused objects are recovered and gain new value they cease to be waste.

Second, dumpster diving provides a good case in point regarding how re-commodification is not the only way for discarded and assumedly dead matter to be resurrected. Instead of becoming reintegrated into capitalist commodity chains, rejected food items, for example, may also be discovered by someone diving into the waste container and make their way, in a plastic bag, to that person's home to be cooked as a meal, given as a gift, or placed in a freezer for later use. Whereas discussions on waste management often, at least implicitly, draw on a rather simplistic duality between use value and exchange value, our case shows that it is far too vague to rely on a general notion of 'use' when describing the multiple ways in which valuation is about more than just exchange value.

Third, dumpster diving also illuminates how the valuation of rubbish is intimately intertwined with other values and valuations of not only other things but also other practices, people, and even forms of life. By rescuing devalued or discarded matter, the divers judge the wastefulness of consumer capitalism and place value on the practice itself as a way of doing good.

The article is organized into four main sections. After briefly describing our research materials and how we use them, in the next section, we explicate the multifaceted and complex connections between dumpster diving and value. We draw our theoretical understanding of the practice of valuation from two sources. The first is the work of the sociologist and philosopher Georg Simmel, while the second is actual–virtual conceptual pairing as developed by the philosopher Gilles Deleuze. The latter we find helpful in coming to grips with the actualization of value in and by dumpster diving. After that, we look more closely into how valuing takes place through sorting out. We suggest that finding edible food in dumpsters requires a specific orientation toward the townscape that we call the *scavenger gaze*, inspired by the concept of the 'tourist gaze' introduced by John Urry (1990). The gaze always implicates the craft of scavenging, and both the gaze and the craft, in turn, rely on the use of various objects as technological prostheses. In the following section, we move from the practicalities of dumpster diving to examining how dumpster divers value not only waste matter but also the practice itself in a way that is different from the way surrounding society does. They take pride in doing good and see themselves as accomplishing something respectable and significant. Finally, we conclude the article by summing up the several modes of valuation involved in dumpster diving.

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[1] On the indeterminacy of waste in relation to valuation, see also for example Strasser (1999), Hird (2012), and Liboiron (2012).

Research aims and materials

This article is based on ongoing empirical research conducted in Finland. The aim of the overall project is to understand the role of waste in contemporary life. For us, dumpster diving is an especially interesting case for the three reasons mentioned in the Introduction. In addition to wanting to describe the practice, our aim is to develop apt conceptualizations of the complex of relevant issues. The data that we have collected up until now include interviews and media materials. The latter contain all the articles mentioning dumpster diving published in Finland in Alma Media corporation-owned newspapers between 1990 and 2014 (44 articles in total); documentary films on dumpster diving; and social media data.[2] The materials that we have gathered thus far provide a rich background understanding of the phenomenon and its recent history in Finland and elsewhere, especially in Europe. One striking feature of the data is how vividly the practices of dumpster diving are portrayed. These research materials are useful for our present methodological aims which are twofold: we *describe* the practices of dumpster diving as they come forth in the interviews conducted thus far and we also *conceptualize* these practices from the point of view of valuation studies. For these purposes, we have gone through the interview materials by way of thematic coding, highlighting the core findings relevant for our present aims. Especially, we have looked for narratives that detail the practical action and thus also provide us with important material that can be used in conceptualization.

We interviewed 14 people who had been actively engaged in the practice of voluntary dumpster diving for food, plus we conducted one interview with a shopkeeper. At the time of the interviews, the informants were between 23 and 43 years of age, but only four were older than 34. Eight were women, and six were male. The informants were recruited through various channels. First connections have typically been made through acquaintances who mentioned that they themselves or their friends dumpster dive, or have previously done so. Then, others were found through snowballing. New contacts have been gained not only through those already interviewed, but also via our conversations with students and colleagues who have practiced dumpster diving themselves or who know others who have done so. We met with these people in southern Finland, in the cities of Helsinki, Tampere, and Turku, between 2012 and 2017. However, some of the activities and experiences recounted by the interviewees took place either in other, smaller towns in Finland or abroad, elsewhere in

[2] Alma Media is a media and service company focused on publishing, printing, and distributing as well as on providing digital services mostly in Finland but also in Sweden, the Baltic countries, and Eastern Central Europe. We have chosen the corporation's newspapers for reasons of access and their wide coverage of major regional newspapers in Finland.

Europe. And although most of our interviewees are active dumpster divers today, two informants talked about activities that took place in the past because they did not feel that they could practice dumpster diving given their current life situations.

Despite the fact that dumpster diving can seem very radical from the point of view of other consumers' daily lives, it is noteworthy that our informants are, on the whole, rather middle-class in terms of their appearances and lifestyles. While they do not present a homogenous group,[3] most are relatively highly educated professionals, with university degrees or other tertiary education. They are also privileged in that they practice dumpster diving voluntarily, which distinguishes them from the marginalized people who scrounge out of necessity. Our informants could afford to buy their food, but they chose to scavenge mainly for ideological reasons: they are critical of overconsumption, the ethos of disposal, and the wasting of resources in capitalist production.

Virtual and actual value: How does food waste become desirable?

One of the key points we want to make in this article is that what emerges from attending the practices of dumpster diving is an understanding of value as a *pragmatic* matter. Instead of residing inherently in the object or being simply a product of a subjective judgment, value is created and enacted in practical relations, as a result of valuation. Of course, approaches treating the emergence of value as related to practices have recently become commonplace in the field of valuation studies (Fourcade 2011; Lamont 2012; Muniesa 2012; Helgesson and Muniesa 2013). Such approaches have often found their key inspiration in John Dewey's *Theory of Valuation* (1939). However, in this article, we draw our understanding of valuation as a practice from another author, the German sociologist and philosopher Georg Simmel, who was a contemporary of Dewey. In the context of the present paper, there is not sufficient space for systematically studying the similarities and differences between Dewey's and Simmel's conceptions of value and valuation. In drawing on Simmel, for us the point is not so much to say, for instance, that Simmel would offer a significantly 'better' understanding related to these concepts than does Dewey. Rather, Simmel allows us to make similar kinds of points that have recently been made by relying on Dewey's writings. In this way we underline the possibility of drawing on multiple theoretical sources and thereby enriching our understanding of valuation. In addition and perhaps more importantly for our purposes, as we will show, we find

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[3] See also Alex V. Barnard (2016b: 1019), who observes the New York City based freegan dumpster divers studied by him to be 'ideologically heterogeneous'.

Simmel's concept of *desire*, which is a notion that is not as central for Dewey, especially useful for us in this context.

For Simmel, values are integral to what it is to be human. It is a psychological necessity that human life runs in 'experiencing and judging values' (Simmel 2004 [1900/07]: 60). Without valuations, reality would lack all sense and significance (*Sinn*). According to the approach Simmel develops in *The Philosophy of Money* (2004 [1900/07]), nothing is valuable in itself, but neither can value be understood as simply a projection onto the world that is assumed to be passive and indifferent to human action. Instead of starting from either the subjective or the objective pole as pre-constituted, Simmel starts in the middle, in the act of valuation. He proposes that value 'appears at the same time and in the same process of differentiation as the desiring Ego and as its correlate' (ibid.: 68). In other words, according to him, the distinction between what is 'objective' and 'subjective' is *generated* in and by the act of valuation. It is through valuation that a subject comes to understand itself as separate from an object. Thus, Simmel detects a dynamic *in-between* through which something that we call 'objective' and 'subjective' can emerge.

Interestingly, Simmel sees the concept of value as corresponding to the concept of *desire*. He maintains that value and desire are one another's reverse sides. In other words, the relationship between a subject and an object is the same whether one says that a subject 'desires' or that an object has 'value'. The only difference lies in the perspective. Once a relationship of valuation is constituted, it can be seen either from the point of view of the subject or the object. The act of valuation simultaneously implies the emergence of the *distance*, or the space in between, that separates us from the objects of our desire. This distance, then, is also the constitutive element of desire and value. According to Simmel, we desire objects only insofar as and as long as they are not in our immediate use and enjoyment (ibid.: 66). We see as valuable those things that we must struggle to obtain. Therefore, to value something is to assess the distance between oneself and the thing to be enjoyed, and to assess the obstacles one must face when covering the distance. To sum up, Simmel leads us to think about 'value' and 'desire' as names given to the practical in-between space that helps to constitute the subject and the object as separate. It is this in-between space that also makes present the desired and valued object as something that is *not* completely under the subject's control.

How is the Simmelian idea of valuation applicable to waste, then? Evidently, if positive valuation is about apprehending and attempting to overcome a distance, ultimately fuse the one who desires and the object of desire, the production of waste is rather about *increasing the distance* between oneself and what is thrown away, thus resulting in heterogeneity instead of homogeneity. It is to exclude and abandon, to separate the self from what is considered not to be a part of the self.

Indeed, the etymology of the term 'object', with the Latin root *ob-iacere*, indicates that objectification has to do with something being thrown before one's mind or senses. Thereby, one is tempted to claim that the object being thrown away is also the primordial object.

Hence, much like valuation, *de-valuation* is a practical matter. This conclusion is in accordance with the key premise of social scientific research on waste, which often draws inspiration from Mary Douglas's *Purity and Danger* (1966): just as value does not reside in objects themselves, nothing is rubbish inherently and in essence. On the contrary, things become rubbish depending on how they are perceived and valued by human subjects. Whereas Simmel does not overtly discuss rubbish in *The Philosophy of Money*, Michael Thompson considers the creation and destruction of value very explicitly in his book *Rubbish Theory* (1979). According to Thompson, objects do not simply vanish and cease to be once they have lost their value to us. Rather, they persist even though we may no longer have any use for them. He refers to such objects with the term 'rubbish'. For him, rubbish presents the zero point of value. It forms the third category of objects between transient objects (which have a limited life span and the value of which decreases over time) and durable objects (which are more permanent and the value of which tends to increase over time).

While we have referenced in the Introduction more recent scholarship within the field of discard studies relating to the ambiguity of waste and valuation, we feel that it is especially by elaborating how our approach departs from Thompson's that we are best able to outline our own take. First, whereas Thompson has his eye principally on the social control of value and on the creation of durables, in our study rediscovered objects have an afterlife quite different from that of the durable items examined by Thompson. Our informants most often recover the value of discarded objects literally to *consume* them, that is, to finish them off. In their case, valuing thus leads to destruction (see also Heuts and Mol 2013).

Second, we do not treat rubbish or waste as the negation or 'the degree zero of value', as Thompson does, or as 'the opposite of value' (cf. Frow 2003: 25). Rather, our research on dumpster diving shows that when extracted appropriately, waste itself may turn out to have a capacity for value (see also e.g. Gutberlet 2008; Lepawsky and McNabb 2010; Gregson and Crang 2015; Carenzo 2016a, 2016b; Abrahamsson 2019; and other contributions to this Special Issue). Even when waste is unwanted by some, discarded items may be reassessed and re-categorized as usable and valuable by others. This is in accordance with Simmel's theory of value, which when applied to the case of waste, leads one to consider the 'wasteness' of waste not as a question of either/or. Rather, it has to do with the dynamics of distance and proximity that involves the affect of desire; thus, instead of not having value at all, waste items can have negative value for

some. That is, these people can desire to have more distance between themselves and waste items, but still, for dumpster divers, these waste items may possess value.

Third, unlike Thompson, we pay close attention to matter and the world of materials (see also e.g. Gille 2010; Hird 2012). Dealing with rubbish means dealing with heaps and piles of stuff that rots, tarnishes, grows mouldy, decomposes, and may be sticky and smelly. Dumpster divers not only intervene in the various trajectories of waste and processes of decay, but also sort things out, extract them, and process them. Thus, for us, studying waste and dumpster diving has to do with *becoming*, that is, with the historicity of matter.

By emphasizing that the materials that make up waste are heterogeneous, and that waste is not simply the opposite of value, we put a finger on something that seems to be a common problem for Douglas and Thompson, as well as many others who emphasize the pragmatics of categorization, including potentially Simmel as well. Their work is important in establishing the in-between as the sphere of valuation and to achieve this, they busily dismantle claims that things have inherent or substantive value. The cost of this move, however, is that they easily turn a blind eye to the positivity of the stuff desired or devalued. Subsequently, it remains unclear what in the waste matter is the *given* that allows it to become either waste or food. In the process of making the discarded foodstuffs edible, the materials are not merely inert and passive matter. Their morphogenetic capacities are not imposed from the outside. Rather, the materials themselves have a say in their becoming—in what may and may not come out of them (see DeLanda 2005; Hawkins 2017: 56).

So what is given in the waste matter? We feel that in order to begin to answer this question, it is useful to follow the dumpster divers to understand how they *generate value*. This practice can be portrayed as a sort of 'alchemy […] of turning trash into treasure', as Jeff Ferrell (2005: 25) describes scrounging. In waste items, the dumpster divers see and actualize something that is neglected or overlooked by others. In contrast to the rest of the population, they do not share the consumer ethos that only the best quality suffices. For them, foodstuffs do not need to be presented in shiny and inviting packages. Nevertheless, the goods that they rescue from the dumpsters do not look much like waste at all and are perfectly edible. And there is lots of the stuff, too. Our informants tell us that often there is much more food available in the trash bins than they can take home with them and make good use of. In addition to bananas and white bread, there are plenty of vegetables, yoghurt, cheese, cakes, and sometimes even chocolate, not to mention ice cream, the odd tenderloin, or vacuum packed salmon. Only dry foodstuffs, such as pasta and flour, are harder to find, and cooking oil is almost impossible.

When making their rounds across the urban streetscape to make discoveries, dumpster divers approach discarded materials as *perhaps* containing more value, or a different kind of value, than what shopkeepers and other consumers see in them: the practice is all about seeing uncertain, un-actualized value in waste and *making* something out of waste. There are two reasons for emphasizing the words 'perhaps' and 'making' here. First, when one follows the minute gestures with which dumpster divers evaluate items, it becomes clear that they cannot be certain that the materials they encounter are eatable as well as edible, and worth taking home. Perhaps some of them are. Perhaps others are not. In order to find out, dumpster divers must use all their senses to assess and evaluate the condition of the product. Indeed, when leaving for a dumpster diving tour, one can never be quite certain whether one will find something edible and, if so, precisely what this will be (although white bread and bananas are a sound bet). This stands in stark contrast to mundane shopping that is structured by the expectation that one will get exactly those products one is looking for, and one knows exactly where and when to get them. Nothing in this process is likely to cause a surprise; in principle there is no 'perhaps' involved.[4]

Second, there would be no value in rubbish if that value was not generated and *made*. As will be seen in the following sections, there are many stages in which food materials are trialled before they finally end up on the plate as edible things. A range of activities is involved in extracting the good nutritional value or culinary pleasure out of what the shopkeepers and other consumers consider as only waste. However, before going into more detail regarding the techniques and skills involved in dumpster diving as a valuing practice, let us still slow down our analysis slightly to conceptualize clearly what is given in waste.

One may be tempted to say that dumpster divers see possibilities or capacity where others do not. While this idea rightly draws attention to the contingency involved, it also leads the analysis astray in terms of bypassing the practical side of dumpster diving. It is as if the possibilities lay dormant in waste and one only had to spot and discover these possibilities and give them reality, as it were, in order to extract the edible mass from the non-edible mass, the assumption here being that nothing in the item itself changes during the manoeuvre.

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[4] Of course, this is a limited description of factual shopping practices in which the element of surprise is constantly present, both as something with which the shopkeeper and the brand manager try to seduce the customer and in the form of the 'impulse buy', which for the customer, can be the source of a pleasant thrill. However, the possibility of such a thrill depends on the confidence one has that the shopping environment will provide the things that one had originally come to look for; impulse buys are only an extra layer added to this basic expectation. In contrast, in the case of dumpster diving the sense of uncertainty is constitutive and primordial.

Instead of such vocabulary, we draw from Gilles Deleuze's elaborations on Henri Bergson's notion of the *virtual* (Deleuze 1966, 1968) to articulate how that which is given as trash quite literally must be *transformed* into treasure. Deleuze's pair of terms, the 'virtual' and the 'actual', is a way of conceptualizing change and dynamism in terms of the creation of difference. Deleuze elaborates on the notion of the virtual by distinguishing it from the 'possible'. Whereas the possible is the opposite of the real, virtuality is, according to Deleuze, real through and through; it lacks nothing. According to Deleuze, the actualization of the virtual is always creative. Instead of merely making real something possible by adding existence to it, it is an act of invention. To actualize something thus means that one *creates* something new out of what is present in the thing in a virtual manner. Deleuze insists that things are never only actual. Rather, they have a virtual side to them as well. The virtual in a thing is related to lines of becoming that are not yet actualized (and, if so happens, might as well never become actualized), and the differentiation that it is capable of.

For us, Deleuze's conception is helpful in stressing the dynamics of waste. If we want to understand the potential value of waste, we must go beyond its actual elements. The transformation from trash to treasure depends on waste having a virtual dimension, a capacity to be enacted in various actualities as edibles. The potential of the materials to become edible is folded as virtuality. What is more, we consider the idea of the actualization of the virtual also to be helpful in underlining the practical side of valuation. The refused materials placed behind a supermarket will not become actualized as food again without the concrete practices of valuation through which these items are first tried out and then *made* edible by being processed and prepared into a meal. The practices thus create difference. It is only because the found items have the prospect of perhaps being edible and delicious that they are worth all the trouble that goes into diving into and sorting things out in waste containers, transporting the catch home, cleaning it, preserving it, and cooking it.

All in all, the shift from the virtual to the actual is a very different way of conceptualizing the potential of discarded foodstuffs to become edible as compared to seeing it as residing statically in the materials. To depict the potential as intrinsic to the items would to be to ignore completely the concrete work of dumpster divers, which is necessary in ensuring that something valuable is generated from the items found. Dumpster divers do not simply go about recognizing some presumably static possibilities in items waiting to be rediscovered in waste management areas. Rather, the practice of valuation implies making something *new* out of what is given, allowing something novel to emerge, something that is not yet there in an actual form. The capacities and the potential value of the items must be enacted via specific practices and arrangements. This is the virtual side of food

waste: some parts of the material have virtually what it takes to the material to be actualizable as food, but not all of it has this property. What we want to emphasize with this terminology is the creative and practical side of dumpster diving as an act of valuation. The in-between space detected by Simmel is the practical sphere of value/desire, where the virtualities of the discarded foodstuffs are (re)assessed and where these foodstuffs are allowed and then made to become something else, something valuable and desirable.

Actualizing value: the scavenger gaze, dumpster diving skills, and the proper gear

How do dumpster divers concretely go about actualizing value in the foodstuffs they find in waste containers? In this section we will investigate the practices of valuation by discussing the modes of perception, skills, and tools demanded by the activity.

To begin with, in order to have any chance of finding things to eat among waste, one needs a special *orientation* to the surroundings. Our informants told us that, over time, one comes to develop a particular manner of perceiving the townscape with the aim of finding abundant containers. By drawing on the notion of the 'tourist gaze', as coined by John Urry (1990), we call this perceptual orientation the *scavenger gaze*. Both gazes imply an increased sensitivity and attention to the townscape and its visual elements. Similarly to the tourist, the dumpster diver observes the features of townscape as signs standing for something else. However, while the tourist craves experiences and sensuous pleasure, the scavenger scans the urban environment to find a good catch.

Importantly, however, the valuation of the urban environment and discarded matter in dumpster diving not only involves the gaze but other senses as well. It mixes cognitive evaluation with bodily operations.[5] This is evident for example in the quality control that the dumpster divers perform on site. This involves not only deciphering the information provided by the texts and best-by dates on packages or the material conditions of objects, but also sensuous evaluation, using the senses as epistemic devices to judge whether a product is still usable or has gone off. One inspects the items by eye, feels them, smells them, and may even taste them there by the containers, though more often than not one takes a bite only when the food has been cleansed and put on the plate. Even the sense of hearing is important, although mostly to allow the dumpster diver to stay alert to the potentiality of anyone approaching and interrupting the action.

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[5] Soile Veijola and Eeva Jokinen (1994) aptly criticize the notion of the tourist gaze as focusing too heavily on the visual dimension and ignoring the *body*; according to them it is not just the gaze that is engaged in touristic activities but the body as well.

Analogously to the tourist gaze, the scavenger gaze presents us a mirror, as it were, for making sense of the 'normal' ways of being in and experiencing the townscape, with which it is contrasted. However, whereas the tourist gaze involves a departure from everyday surroundings, a limited break with the established routines and practices of everyday life, according to our interviewees dumpster diving can dramatically change the everyday ways of looking at the townscape, as well as being in and moving across and around it. It also becomes part of the practitioners' mundane, habitual life. Similarly, when observing dumpster divers in New York City, Sharon Cornelissen (2016) observed that their ways of seeing and orientations in the urban space acquire a commonsensical character, rather than representing disparate elements of a cultural repertoire. Alex V. Barnard (2016b), too, suggests that for freegans living in New York City, navigating its streets and combing the curbs in search of useful waste are something like 'second nature'. Thus, the scavenger gaze does not primarily stand in contrast with the mundane. Instead, it is different from others' orientation to the urban environment. It is also obvious that the scavenger gaze ultimately maps the city quite differently than the tourist gaze: instead of focusing on spectacular sights, it explores the barely visible city, paying attention to the backyards, smutty waste containers, and no-go areas that usually remain out of sight and are not displayed in postcards, travel guides, glossy books, and tourist snapshots. From the point of view of our general argument, it is significant that the scavenger gaze is also a way of *valuing* the urban environment. Whereas the tourist examines the cityscape for sites to visit and photograph, the dumpster diver looks for places that could be hiding a good catch.

For someone equipped with the scavenger gaze, the cityscape becomes an urban hunting ground. Or, to be more exact, the scavenger gaze is not a property of people, but a relation of the subject and one's environment, of a sensory medium and a sensitive world. It is a particular way of engaging with the urban environment. This means that it is also partly up to the cityscape to attribute the scavenger gaze to the subject by rendering the self alert and making it sensitive to differences. To acquire the scavenger gaze and inhabit a cityscape hiding plenty of good catches, one must 'learn[…] to be affected' (Latour 2004: 206) by the urban environment. A good hunter develops an alertness to opportunities whenever they present themselves. In the same way, becoming a skilful dumpster diver implies that one learns to know the environment and its material flows, including the changes in the spatio-temporal structure of the townscape during the day. Hence, correct timing is part of the dumpster diver's craft. One must hit the supermarkets' or grocery stores' bins at the right moment. Usually, dumpster divers make their rounds after closing time, when night falls, taking advantage of

darkness. This is to avoid receiving attention. Few want to be caught digging through the leftovers of others. What is more, encountering supermarket clerks would expose dumpster divers, and thus they might not be able to continue their practice on the premises in the future. Supermarket and store managers tend not to prefer that people scrounge around their waste. In addition, the after-closing hours are also the most convenient time to go diving, because the bins are typically filled. Therefore, in terms of circadian rhythm, dumpster diving can be difficult for people with small children and regular nine-to-five jobs because one must stay up late not only to obtain the food after supermarkets' closing times, but one also needs to process the catch afterwards at home.

In addition to knowing the best time to go scrounging, dumpster diving also requires spatial knowledge regarding where one can find a good catch. Our informants told us that to some extent this information is shared within the community. As Aaro, a 32-year-old male student who lives together with five friends told us, sharing the information is an expression of solidarity:

> Of course I reveal [the right places] to everybody I know to dumpster dive because they are all in the same situation as I am, with likely no other sources of income than student allowance or social benefits; if one for example, lives on a disability pension or something like that, it would be awful if I kept it all to myself.

It is not, however, that the information circulates freely. On the contrary, one chooses quite carefully the persons with whom one shares it. For instance, in the Finnish Facebook group *Dyykkaus* (literally, 'Diving')—which at the point of this writing, in June 2017, had over 5,200 members—people who have moved write frequently on the wall to ask for tips regarding places to dive in their new hometowns, but these queries always remain unanswered publicly. In fact, it is against the rules of the group to share this information otherwise than via private messages. It is feared that if managers or staff members realize that people rummage through the shops' containers, stores and supermarkets may attempt to implement measures to prevent dumpster diving. In Finland supermarkets increasingly either lock up their dumpsters or house them inside sheds that have locks.

Obviously, it is not enough to say that a crafty dumpster diver must have the right orientation, if by that word one refers only to an 'attitude'. Rather, talking about the scavenger gaze, for us, implies both cognitive, bodily, and prosthetic aspects. Indeed, the cognitive and hands-on valuation practice of scavenging also relies heavily on

various objects and tools.[6] Finding enough cast-off bounty to live on it and also managing the excess one finds, requires the use of proper gear including gloves; thick-soled footwear such as hiking shoes because the area around containers may be littered with glass; durable clothing that is not so distinctive as to raise unwanted attention but can get a bit soiled (though our interviewees reported that dumpster diving is a lot cleaner than people seem to think it is; unless one digs through meat or fish, one can simply wear regular clothes); and a backpack, for instance, for collecting and transporting the catch. Plastic bags may also come in handy. If some of the food items are slimy, they can be placed in plastic bags so that they will not soil the rest of the catch. Also, a flashlight or a forehead lamp is useful, though inside a well-lit shed one may do without. Additionally, if the site is not close to home, a dumpster diver will also have to take into consideration the means of transport, be it a bike, car, or bus. All these tools are employed in the concrete work of valuing and sorting out what is potentially edible and what is not. Without such technological prostheses, the valuation practice would be difficult.

For our informants the fundamental problem with regard to food is not scarcity but excess. A successful hunt will produce an overflow of edibles. And yet, because the specific catch produced by a hunting trip cannot be predicted, one core skill for a dumpster diver is to know how to handle surplus and use it to fend off the potential for scarcity. This sets requirements for kitchen facilities and utensils, too, as after one has arrived home another round of quality control needs to be performed. One must have enough space to deal with the materials, pick what is good, clean it, peel it, cook it, and preserve it. An especially useful device in dealing with an abundance of food is the freezer. The freezer is a means with which to defeat the forces of decay and decomposition, yet it is worth noting that none of the individual tools mentioned seems to be *essential* for dumpster diving. Rather, while *some* tools are inevitably required, the totality of the equipment used can vary, and also new prosthetic parts of practical valuation can become core instruments for the activity. For example, one of our informants—Milla, a female doctoral student in her late twenties—discussed the significance of the blender in these terms. Because of the constant availability of cast-off fruit, especially bananas and lemons but often also kinds that the interviewee describes as 'exotic', a blender is handy for turning an abundance of slightly old fruit into smoothies. The point here is that the valuation of lemon, especially, becomes different because of the usage of the blender, which thus becomes, for Milla, an essential tool for the activity.

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[6] The literature on the techniques of dumpster diving includes, for instance, the dumpster diving manual by John Hoffman 1993; for more academic points of view, see Ferrell 2005; Barnard 2016a.

In sum, the valuation of food waste in dumpster diving involves three intimately intertwined dimensions. First, there is the *orientation* to and *relation* with the urban environment we called the scavenger gaze. Second, the scavenger gaze is not separate from the various *skills* involved in dumpster diving or from the multisensory practical expertise that comes with the craft. Finally, third, one could not begin to understand these bodily skills unless one understood how deeply they are dependent on a range of *tools* and technologies that only make the valuation activity involved in dumpster diving possible. Importantly, then, the valuations that our informants perform are not merely cognitive operations concerned with *knowing* what can be eaten but also multisensory, distributed activities that are dependent on various non-human or more-than-human objects and materials, enact value, and perform the foodstuffs as edible. The techniques and tools used in recovering food are all means of evaluating and sorting the items that may have an affordance of value from those that do not. All of this has repercussions in terms of the previous section's Simmelian examination of value. Namely, the tripartite analyses of orientation, skills and tools suggest that the core of valuation, the *in-between space,* does not bluntly refer to just one sphere of valuation. Rather, in practice valuation consists of a dynamic interplay between activities in multiple scales and modes.

Doing good—and undoing the stigma of scrounging

Scavenging the discarded materials of others tends to be associated with marginalized people. In the international news media, for example, scavenging is often perceived as an index of global inequality. The salvaging of waste is portrayed as something done out of necessity and desperation as a result of extreme poverty (Reno 2009: 32). It also bears a stigma: it is regarded as dirty and degrading and as marked by indignity and shame. In his article examining workers at a large Michigan landfill practicing scavenging, Joshua Reno (2009: 40) observes that it is as if the workers were contaminated by waste, so much so that they have exchanged properties with the materials with which they work and, in a sense, 'become waste themselves—worthless and without potential'. To avoid some of this contamination, the landfill workers, according to Reno, engage in various rituals of purification, such as throwing out their work gloves, washing their hands and arms, changing their uniforms and boots at the end of the shift, and keeping them at work in the locker room instead of taking them home. Nevertheless, the smell simply does not wear away, and the workers' partners and children occasionally complain of landfill odours and recoil in their presence (ibid.: 40).

Our informants, too, are fully aware of the disgust that people tend to feel when in contact with rubbish and the anxiety that dumpster

diving therefore creates. Milla, who started dumpster diving when she was 16 years old, talks about the repulsion her parents felt when she brought scavenged food home back then: 'They yelled at me and said that this food would not be eaten, and they were ready to throw it away immediately.' Her mother also carefully placed the foodstuffs recovered by Milla from waste containers in isolation in the fridge to prevent them from mixing with their purchased groceries. Further, Tommi, a 35-year-old male academic with two children, explains that while he himself does not mind the dirtiness, because he has had a fascination for finding things and also has practiced scavenging in some form or another as long as he can remember, people in general do not feel this away. On the contrary, he feels that when they think of dumpster diving, 'there is a genuine unpleasantness to it that people have at the back of their minds, precisely the dirtiness associated with rubbish'. According to Tommi, frequenting dumpsters is also stigmatizing; people assume that 'it is [only] the outcasts of society who hang around there'.

Nevertheless, our informants tell us that it is very rare that one encounters marginalized people, such as homeless alcoholics, at waste containers in Finland. 'Most often you bump into mates from your circle of friends who happen to live nearby the place where you go diving', Aaro mentions. Also, voluntary dumpster divers actively reject the indignity and negative stigma associated with digging in other people's garbage. Thus, while they re-value waste matter they also *trans-value the value of the practice itself*.

For one thing, our informants see dumpster diving as profitable. It is not their last resort, but they choose to do it because it benefits them and works to their advantage; if one can obtain food for free, then why not do it. Tommi says that occasionally he calculates how much money he has saved by diving: 'Sometimes when you assess the worth of what you have found on a one-hour dive, for example, it sums up to over a hundred euros easily.' In a similar vein, a freegan[7] interviewed for the *Turun Sanomat* newspaper stated that dumpster diving enabled him and his friends to have a lifestyle that would otherwise be unattainable. 'We eat like kings', he bragged, and continued as follows: 'Judging solely by income I belong to the section of the population who earn the least, I mean, to the very bottom. But we get by really

[7] The term 'freegan' is a combination of the words 'free' and 'vegan'. Only few of our informants identify themselves as freegans. The main reason for this is that although they, like freegans, are systematic in seeing dumpster diving as an ethical and political choice and voluntary practice, among our informants the kind of rigid stance towards animals products involved in some definitions of freeganism—i.e., an absolute refusal to eat any animal products, not only meat but also dairy products such as cheese—is rare. In addition, freeganism, as described by Barnard (2016a), can be related to an endeavor to form an organized social movement. For our interviewees, by contrast, dumpster diving is more of a personal matter and represents a form of less visible resistance.

well. I really don't need much money' (*Turun Sanomat* Sept 14, 2014). Aaro, too, says that thanks to dumpster diving he and his flatmates are able to live in abundance: 'It is great when you don't have to worry about whether you can afford to eat. We always have salad, and there are always fruits and veggies. It is so fantastic. For a student that is magnificent.' He says that they buy basically nothing but dried foods such as macaroni and rice; all the other foodstuffs they get from the dumpster. Notably, there is plenty of bread:

> In our commune we have on the kitchen hood a post-it note that reads 'Never buy bread'. You know that things are really bad when you reach the point that you have to buy bread from a store (laughs) because you can always find bread in basically every dumpster.

Dumpster diving also enables one to work less and spend more time in the pursuit of more pleasant tasks (see also Hoffman 1993: 5). One of our interviewees, Jaakko, says that to him, dumpster diving 'makes possible the fact that I do not have to work so much. In any case you do not spend much money; it is exactly because you can dive that […] I think we manage with a ridiculously small sum of money'. By 'we' he means himself and his partner Alisa, who adds the following:

> Yeah, our household income is smaller than it would be if we lived on benefits. […] I mean that, for us, social welfare which people have complained of being too small—we would probably be able to go on a holiday to the Caribbean with that sort of money.

Nevertheless, profitability is far from the only positive value our informants attach to dumpster diving. They probably would not have started to dumpster dive had they not thought about it as a morally and politically inviting activity. All the interviewees see dumpster diving as an ecological practice that saves nature and provides resistance to the ethos of disposability. Tommi, for instance, speaks of dumpster diving as a form of 'counter-politics' and Milla states that, for her, dumpster diving 'is, in general, part of a criticism of capitalism'. She remarks that 'one is terrified by how many good products go to waste—it is incomprehensible. There is so much good food there, and one could fill so many stomachs with it'. Accordingly, instead of feeling ashamed and humiliated, our informants take pride in what they do. Noora, a thirty-something female university teacher with two children, says half-jokingly, with a smile on her face, that she and her friends sometimes talk about dumpster diving as a kind of 'informal waste management': while waste management firms charge money for collecting waste, dumpster divers do it for free. Therefore, store managers should in fact be grateful to dumpster divers instead of trying to prevent them from scavenging, she explains, because diving

reduces the amount of waste that the supermarkets and stores produce and thereby their expenses as well.

Feeding people with this food instead of letting it go to waste is, for our informants, also a way of showing respect for the food. They perceive disposal as revealing a lack of respect for the commodity and for the life and labor that have gone into producing it. The fact that things end up in dumpsters is a sign of improper use because disposal literally wastes and neglects the many kinds of values that could be generated via the foodstuffs. Dumpster divers, by contrast, as we have already suggested, actualize the capabilities of these foodstuffs by not only finding and eating them, but also by using them as gifts, for example. They feel that they make the best use of the items that others ignore or are simply unaware of.

All in all, while our informants certainly appreciate a good catch, for them dumpster diving is thus not merely a means of finding food for free. They also value the practice in itself. They see it as both economically profitable and eco-friendly. The latter point is intertwined with morals, with doing the right thing, 'living in the city in an ecologically sustainable way', as the *Aamulehti* newspaper described the thoughts of a female student practicing dumpster diving (*Aamulehti*, 29 Nov, 2002).

Furthermore, dumpster diving has also to do with pleasure. As Antti, a thirty-something male who says he has practiced dumpster diving for a couple of years in Finland and the Nordic countries, sums it up: '[T]here's the economic profit, the fact that one recycles, that it is eco-friendly, and on top of it all it is also fun.' For our informants, dumpster diving is, to some extent, sociable, driven by the pleasure of being with others for the sake of being with them (cf. Simmel 2001 [1911]: 178). It is something that one does collectively, with others. For example, Salla, a 29-year-old female student in fashion design, says that especially in the past, dumpster diving was, for her, also 'a way of spending time with your friends'. Noora mentions that she practically never goes diving alone. Rather, she always goes in the company of friends or with her partner. Alina has occasionally done it alone, but she says that 'it's not nearly as fun'.

This different relationship to waste also involves valuing others and the surrounding society in a different way. Dumpster divers not only assess their own conduct and lives according to certain criteria but also assess the life of others. By valuing waste differently, they establish alternative measures of goodness and aspire to live otherwise than the majority. The ecologically sustainable mode of life enables one, at least in one's own view, to assume one's rightful position in society. Salla, for example, laments that 'we have somehow got used to this ridiculous overabundance' and states that it is better to keep matter in circulation rather than waste it. The point is not that dumpster divers would be able to live without throwing anything away. Rather, their

practices reveal that there is nothing inevitable about the habits of exclusion and the elimination of waste that characterize the contemporary western form of life.

Perhaps the category of 'waste' is an unavoidable part of the human condition because *some* forms of eliminating (food) waste seem inevitable. However, dumpster divers are able to problematize when and how we exclude materials and items, and precisely what we eliminate and why we do so. Ultimately, their activity reveals that this is not only a question of individual or even group choices but rather that our waste infrastructures lead us toward unethical everyday practices—unethical in the sense of leading us to forget to problematize our relationships to waste (Hawkins 2006).

Ultimately, dumpster diving entails a practical valuation of an entire mode of life. Its critical relationship to wasting and to the ethos of disposability entails a critique of how we live today. It is not only about passing judgment but also about thinking, acting, and being otherwise, living differently from the majority. Barnard's extensive study *Freegans: Diving into the Wealth of Food Waste in America* (2016a) provides a detailed analysis of how the freegan social movement in New York is striving to create a way of life that is conspicuously critical not only of the way the majority lives but, even more importantly, of the food (infra-)structures that configure this way of living. Barnard is also very clear about how and why this aim on the part of the freegans is not easy to accomplish in practice.

In Simmelian terms, valuing an entire form of life requires the creation of an in-between space that enables one to view the contemporary form of life from a distance. It is this critical distance that allows one to question what is regarded by the majority as having value and what is regarded as undesirable. Simultaneously, thanks to this distance, one can see oneself as a subject detached from a way of life that, in itself, has come to be perceived as an object of value judgements. It is easy to see dumpster diving as a practical actualization of a critical attitude toward collective wastefulness. However, listening to our informants, it appears that in addition, the practice itself further nuances this distancing and the valuating activity. In other words, there is a looping effect: the more one does things differently than other consumers and the more encounters (directed by the scavenger gaze) one has with the retail environment, the more manifold become the concrete contexts in which valuation can take place—not only the modes of valuation but also the potential ways of being critical of the contemporary way of life, as manifested in its concrete details. Thus, dumpster divers are not simply critical of the contemporary way of life in the whole. Rather, this comprehensive attitude is nuanced because they value the most various things related to their practice: they value access to waste areas, the condition in which the discarded foodstuffs are obtainable, the range of items

available, the economic value of the hunt, whether one has fun with one's fellow-gleaners, and the modes of storing and preparing food, for example. On the whole, then, as a voluntary practice dumpster diving is essentially about valuing. However, insofar as it is about valuation, it is about *many modes* of valuation.

Conclusion

How is voluntary dumpster diving intertwined with the question of value? What can dumpster diving teach us about valuation more generally? If one begins an analysis by examining *what* is valued in the practice, it seems to concern, above all, whether the items found in the waste containers are edible or not. Yet, as we have seen, there are also a number of other elements that our informants value in the practice of dumpster diving. In addition to assessing the urban environment in terms of the prospect of extracting nutritional value or culinary pleasure dumpster divers also value the practice itself because it enables them to live differently in the midst of consumer capitalism.

However, in this article we studied not only *what* is valued in dumpster diving, but also, importantly, *how* valuation takes place in practice. First, valuation is revealed as dynamic: value does not lie inherently in the discarded object, just waiting to be realized, nor is it merely a matter of subjective cognitive assessment. Instead, our informants have a hands-on relationship to their objects of valuation, and they enact value in embodied practices. For them, the judgment regarding whether something can or cannot be eaten is not a separate activity but is, rather, intertwined with other activities. In dumpster diving, the practices of moving in a townscape, diving into waste containers, as well as sorting, picking up, transporting, washing, peeling, freezing, and cooking, for example, are integral to valuation.

Second, the fact that valuation is inextricably entangled with practices that are not explicitly about value also means that valuation is not only about *knowing* what can be eaten but also about *making* things good to eat (see also Heuts and Mol 2013). For us, dumpster diving thus entails an important lesson about the *creativity* involved in valuation. We have thematized that creativity with the help of the conceptual pair of the actual and the virtual, as developed by Deleuze. To actualize discarded food as good to eat means that one creates something new out of what is given, something that is not actually yet there in the discards.

The actual–virtual axis also relates to our third point. Because the food waste found in the containers is not yet actual edible food, valuation is bound to remain more or less uncertain. It lacks fixed variables. The operations involved in performing the recovered food waste as edible do not offer control over value, because one can never be absolutely certain that the items one finds are good to eat and

worth taking home. Instead of fitting standards, the waste matter spills over. It remains beyond and in excess of classifications.

To sum up, an important result of our study is that instead of there being only one or two forms of value relevant in dumpster diving—for example, use value and exchange value—a multiplicity of forms of valuing are at play in our data. Thus, in this article we have *mapped* these modes of valuation; we have shown that they coexist and are interlinked. Indeed, it is because of the rich variety of modes of valuation that dumpster diving as a practice clarifies the unarticulated norms of the western form of life as regards food waste. The practice illuminates the presence of waste at the heart of our consumerist way of life. By studying dumpster divers and listening to their accounts of their practices, we come to understand how waste is intimately intertwined with questions of what is of value, how to live well, what we see worth striving for and keeping, and what we want to get rid of. Appreciating the pragmatic, immanent, and creative nature of valuation in dumpster diving can be useful more generally for understanding practices of valuation: it is an inventive activity that involves not simply 'finding' or 'rediscovering' value but also helps to create value. It draws on a combination of multiple skills, the usage of various techniques and tools, and a particular orientation to the world. However, thinking along the actual–virtual axis stresses that valuation is always an act of creation. We maintain that valuation can be an act of creation also in the seemingly automated, repetitive, and routinized forms of value- and waste-making implied by 'normal' valuation and disposal practices.

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Sorting, Shredding and Smelting Scrap: The Production of Value by Deformation at a High-tech Recycler of Electronic Waste

Stefan Laser

Abstract

The global economy of e-waste recycling has received much attention in recent waste studies literature. This article gives an account from the inside of two different sites within a leading high-tech recycling and smelting company in which such e-waste is assessed; and discusses the valuation of electronic waste in the course of its industrial processing. Based on a two-month long ethnography by way of an internship, the article examines how the recycler manages to distinguish and separate out valuable 'scrap', in contrast to valueless 'waste'. The article subdivides the inquiry into two questions. What practices are involved when transforming e-waste into scrap and waste? And how can we appreciate differences in how they are configured? The study of two different facilities in operation next to one another provides additional leverage to the inquiry since the valuation practices involved when assessing the incoming e-waste differ between them. Differences are tied to specificities in how the electronics are sorted out, shredded, and smelted. The article shows how these processes of deformation are linked to the valuation practices and the accounting system of the company. Calculations, it is argued, succeed only because things are literally broken.

Keywords: electronic waste; high-tech recycling; ethnography; accounting; economic value; materials

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Introduction

E-waste, short for electronic waste, is a staple feature of today's global economy. It is the material flip side of the seemingly immaterial IT industries (Gabrys 2011). In 2018, roughly 50 million metric tonnes of computers, smartphones, and printers, as well as plenty of chips were disposed of worldwide (Baldé et al. 2015: 20), and such discarded electronics can be full of hazardous ingredients. At the same time, however, various actors are interested in mining this waste stream, because it includes a high amount of precious materials such as gold, copper, or cobalt as well as lots of sellable aluminium and plastic. During the recent two decades, large-scale high-tech recyclers have emerged that specialized in this type of waste. Vast smelters have been processing e-waste since it was first thrown away about half a century ago. However, before this waste stream grew significantly (because of various fresh digital devices) and new legal frameworks were established (that set up an infrastructure of recycling) (Knapp 2016), it was mostly the so-called 'informal sector' in the Global South that appreciated these materials. This transformation of the global economy of e-waste has already been identified as a significant field of study with various 'hot' controversies (Neyland and Simakova 2012; Pickren 2014; Kama 2015; Kirby and Lora-Wainwright 2015; Bozkurt and Stowell 2016; Laser and Stowell 2020; Lepawsky 2018; Schulz 2019). But the rather new and now powerful high-tech recyclers are still under-studied sites.

In this article I discuss the valuation of e-waste in the course of the industrial processing of this waste. The smelting, often overlooked, is pivotal for the capacity to identify and transform materials and is thus tied both to the valuation and actual processing of the e-waste. Its specific role needs to be examined. Previous research on high tech recycling, moreover, has largely relied on expert interviews and tours of recycling centres offered by companies. Such forms of access can provide and have provided interesting insights, but they cannot provide detailed enough encounters with the valuation and transformation practices in these facilities. Outsiders to a recycling company are not usually allowed to come close to energy-intensive practices (for security reasons and sometimes also for data protection reasons). Recycling centre tours, moreover, can be considered the 'front stage' in Goffman's (1978) sense; they enact a distinct reality (Zapata and Zapata Campos 2018).[1] I went on to study a high-tech recycler from the inside precisely to be able to examine the practices of valuation and transformation up close.

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[1] In the field of Industrial Ecology the situation is different (e.g. Manhart 2011), but there the discussion is very 'technical', that is, focused on evaluating machine set-ups or management schemes. Adam Minter's journalistic account *Junkyard Planet* (2013) does a nice job in bridging the debates.

This article presents an analysis of valuation practices based on an ethnographic inquiry of a high-tech recycling company. Employed as an intern for two months, I studied the operations of a global market leader of e-waste recycling in the Ruhr Valley in western Germany. The recycler firm claims to recycle properly and efficiently, and emphasizes that this is the source of its market leadership. The public relations department of this recycler, to give just one example, likes to showcase that almost 500 tonnes of e-waste are processed per day. Recycling is not a trivial task and one has to look beyond those numbers and popular stories though; the company invests heavily in the transformation of materials and has developed various skills to handle their supplies. Their main objective, I learned, is to separate valuable 'scrap' from worthless 'waste'. This distinction between scrap and waste is a key differentiation used by my informants. In this article I will use these terms accordingly, while reserving the notion of 'e-waste' for the unsettled middle ground. E-waste, then, denotes materials with a fate still unknown and where actors grapple with the uncertainties of what the materials are and what they can become.

This article focuses on the following questions: What practices are involved when transforming e-waste into scrap and waste? How can we appreciate differences in how they are configured? I use the notion of *deformation* to signify this transformative process. Deformation has the connotation of a transformation that brings something out of its usual shape, which here is the original shape of e-waste as printers, monitors, computers, and so on. The term emphasizes that forming also necessitates de-forming. The article specifically examines how valuation of scrap occurs around three interlinked material processes of deformation: sorting, shredding, and smelting. In what follows, I bring related discussions organized around waste studies and valuation studies further together by framing the issue of scrap production as a topic of accounting. The sorting, assessing, and processing of e-waste, I argue, is intertwined with the creation of economic value, so that the company tries to gain a surplus with each contract that is concluded (Vatin 2013). This has not been appreciated enough in previous research on high-tech e-waste recycling. The aim with this study is not to assess the quality of the practices, but rather to highlight the practices employed to value e-waste as integral to the industrial processing of such waste. I will follow the material practices, and think with material practices.

The article is divided into three major sections. The first section gives a brief overview of the recent history of the investments the studied recycler has made, while zooming in on their in-house value chain. Against this backdrop, I clarify my methodological tools while adjusting to the particular situations of the field site. A key methodological aspect of this study arose from the fact that the studied company has two distinctly different facilities in operation next to one

another, and they each value incoming e-waste in their own distinct ways. This means that similar deliveries of e-waste are assessed and invoiced differently depending within which of the two facilities the work is done. In the subsequent section, I introduce an ethnographic account of these two preparation facilities. Here, I will also deploy the notion of 'deformation'. In the final section, I will discuss the contribution of my ethnographic analysis to previous e-waste studies in particular and waste scholarship in general as well as the field of valuation studies. New insights into the core practices of doing calculations will be provided.

Background to the study and focus of the analysis

Fieldwork at two adjacent sites

I began my fieldwork at the beginning of November 2015 as part of my now concluded PhD research.[2] My ethnography is based on an internship, which translated into two major tasks. I worked with the engineers and workers on the ground to keep the daily workflow going, and I had to produce reports that were checked. My work was paid based on a minimal wage, and I was transparent about my research interest. I had, as part of the internship, to sign a non-disclosure agreement regarding certain sensitive information. Yet, this agreement did not inhibit me from doing fieldwork observations. My fieldwork was making observations, internalizing practices, keeping a diary, creating notes, collecting documents, taking pictures, playing with memos, and drawing connections with my other studies. As a general rule of thumb, I tried not to disturb my interactions with my colleagues when keeping track of things, which meant that I had to draft urgent notes during the lunch break or when I was waiting for somebody (a regular thing to do at this company would be waiting for a call to clean *this* or transport *that* or repair *this* over *there*—being in transition was a normal practice for the other workers as well). I further refrained from tape-recording so as not to disturb interactions. As a result, my notes were written immediately after my shifts.

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[2] In my thesis, I focused on the global enactment of high-tech recycling infrastructures; I followed transformations of waste economies and conflicts over values that ignite during these transformations. I began with a study of e-waste in India, where a new law was passed (and discussed intensively) to support high-tech recycling operations (instead of 'informal sector' work) (Laser 2016). In India, I merely managed to interview these recycling facilities. However, in Germany I gained access to one major recycler. A private reference from an executive was helpful, so that I could directly pitch my interest to the department of human resources without having to explain myself to the critical public relations department (in India, this department was sceptical of my interest).

The weather was sunny during the November mornings when I started my first shifts. After entering through the gates I was greeted by heaps of materials lying around (Fig. 1). What can be seen here are industrial materials, I learned. Copper, above all. The leading engineers also call it 'classic' scrap, as in their main source of revenue since this site's establishment. For more than 100 years, the company has been recycling metals from such materials. When first introduced to this notion, I learned how eager the company is to talk about 'scrap' (valuable entities) instead of 'waste' (valueless). This is the key notion to be explored. With this the recycler also wants to stress their facilities strive towards 'zero waste' where everything is transformed into something to be reused. But I am sceptical since there still is waste: hazardous materials in need of containment, materials that are burned and thus removed, various tiny excess materials that stick to certain surfaces. That is why I will keep using both notions, scrap and waste, plus 'e-waste' for materials which are still not transformed and where there is substantial uncertainty.

Figure 1 Classic scrap
Notes: In front, there is classic scrap (lots of copper). A water cannon keeps the materials soaked to tame the dust, hence the mist. The smelting facilities (see below) are in the background. The smelter on the very left, here in front of the pillar and under the small red alarm light, is about 65 metres high.
Source: Photo by the author.

Before I introduce a few conceptual tools for studying the valuation practices at hand, it makes sense to unravel the in-house workflow of the recycling plant. Looking at this helps elucidate why, in the first instance, valuation practices are central to the realm of handling e-waste.

The workflow I present is necessarily simplified to a depiction of a linear flow. The geographers and waste scholars Lepawsky and Mather (2011: 243) correctly suggest that value chain analyses and flow charts often deploy a limited notion of linearity, whereby stuff is considered moving 'up' and 'down' or 'forward' or 'backward', 'implying vertically and/or horizontally arranged beginnings and endings'. Think of products having a life or (as is the case in this situation) discarded electronics being prepared to become raw commodities. In their ethnographic research on e-waste in Canada and Bangladesh, Lepawsky and Mather contend, it made no sense to arbitrarily describe a certain transformation as a beginning or an end of some process that was yet to be realized. They found rather messy value transformations everywhere. Lepawsky and Mather (2011) then propose thinking in terms of (shifting) boundaries and edges—a thought-provoking concept that makes use of notions of science and technology studies (STS) and actor-network theory (ANT). It does, however, make sense here to adhere to a linear structure as a heuristic start: It is through such a linear scheme that interns and visitors are guided through this plant. The staged linearity is a common strategy in the world of recycling technologies for presenting a neat workflow. In other words, the clear step by step sequential process is a way to present the soundness of operations. These depictions therefore help bring the economic facets into being. While there might be boundaries and edges, the actors *stress* that they are grappling with beginnings and endings. It is a performance with consequences.

This is what the recycler's workflow looks like (Fig. 2). The company (1) has *preparation facilities* where materials are prepared for smelting, *smelting operations* where materials are purified, and a *refining factory* where standardized raw commodities are produced. All of these are furthermore accompanied by multiple vast storage and decontamination facilities. To clarify the key processes in the words of the engineers involved: preparation implies shredding materials so that discrete material streams are collected; and smelting and refining are (mostly) pyrometallurgical processes in which unwrought metals are manufactured. Moreover, a lot of activities take place before this recycler gets its supply. Electronic gadgets are produced and used, e-waste is collected, specific materials are stripped off by third parties, and so on. But I will not elaborate what happens before the activities at the preparation facilities. What is relevant for this study is that the company receives its materials from municipal, national, and industrial

suppliers. And I'm interested in how the value of these suppliers' deliveries is assessed. As elaborated below with more detail, this will result in a focus only on the first stage of the workflow, the preparation facilities. Before doing that, it makes sense to follow the historical trajectory of this workflow. The entire in-house e-waste recycling process is a rather new operation.

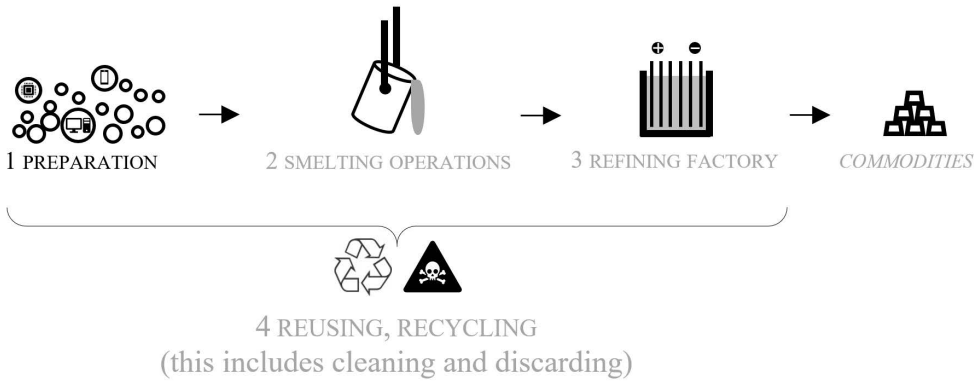

Figure 2 Workflow and in-house value chain of the recycler
Notes: The numbers describe separate facilities on the premises, and the greyscales of the text indicate the focus of the present article: the preparation facilities.
Source: Illustration by the author.

Up until the late 1990s, the recycler only processed 'classic' copper materials. Then, however, management decided to invest in what they call 'complex' or 'modern' scrap: discarded electronics. Engineers proudly told me they were among the first 'global players' to focus on e-waste end-processing in a large and integrated fashion. The statement seems exaggerated, but there is some truth to it. From the 1950s onwards, at least in the global north, electronics began spreading (when households started using kitchen appliances and 'bulk consumers' invested in computers, to name just two iconic developments [Gabrys 2011; Knapp 2016]). These products were thrown away—and recyclers indeed started processing them. Already during the 1980s and 1990s, moreover, e-waste had been identified by pioneers of recycling technologies as an interesting field to experiment with (Sinha-Khetriwal et al. 2005). The scope of these early operations, however, was deemed limited. *Only* when the consumption of electronic devices grew exponentially *and* when e-waste regulations were established during the 1990s, with (for instance) the European

legal infrastructure of 'WEEE' and 'RoHS'[3] on the verge to being finalized (Cooper 2000), large mining and refining companies like the recycler discussed here felt confident enough to invest millions of dollars in new technologies. E-waste requires special treatment because of embedded materials such as plastic (which creates additional heat) and because of the new environmental regulations; which is why this was initially a tricky decision, even though an essential one against the backdrop of growing global competition in the sector of mining (Knapp 2016: 1886).

The company studied opened two new facilities in 2005 and 2006 respectively for preparing e-waste deliveries. These two facilities were both integrated into the existing plant. The first facility, which from now on I will denote the *separation site*, processes roughly 400 tonnes of e-waste per day with shredding and automatic separation, and then sends parts of the output to the smelters while other parts (such as plastics) are moved on to be sold to third parties. In the second facility, which I will denote the *sampling site*, e-waste deliveries are assessed by sampling, and it manages about 80 tonnes of materials per day. In my fieldwork, I decided to focus on these e-waste facilities, the *separation site* and the *sampling site*. As a consequence, I worked in the smelting facilities for one day only and just had a quick glimpse of the refineries. Against this backdrop I can now flesh out the concrete focus of my study.

The recycler receives its materials from several sources. The economic value of each delivery is assessed at either of the two preparation facilities. It is here where contracts are successfully completed even though the negotiation precedes these facilities (see below in the next section on the preparation facilities). A key methodological move I now perform is to frame e-waste processing as an issue of accounting. Given that the two sites operate differently, this means that I can examine two different 'moments of valuations', each stabilized by a particular accounting apparatus (Hutter and Stark 2015; Mennicken and Power 2015).

The handling of waste as interlinked with accounting and deformation practices

How do I define accounting, and what will I be focusing on when studying accounting practices as valuation practices? I understand accounting as a two-fold task. The *Oxford English Dictionary* captures this quite nicely. Accounting, it emphasizes, may be understood as 'keeping and verifying financial accounts' on the one hand and 'giving of a satisfactory explanation' on the other. I take

[3] The 'Waste Electrical and Electronic Equipment Directive' (WEEE) and the 'Restriction of Hazardous Substances Directive' (RoHS) are the two instruments with which the EU manages e-waste. Member states must comply with these standards by setting up their own legal recycling infrastructures.

these two kinds of practices as inextricably intertwined. Accounting implies making a judgement, and making calculations are part of this endeavour. From a sociological point of view, such a general understanding of accounting is paramount. The focus should lie on practical issues, as summarized by Hendrik Vollmer (2003: 355) in his seminal review article: 'A sociological exploration of calculative practice [...] should […] locate notions of accounting, such as those of financial value, calculability or efficiency within the empirical field and treat them as issues, not as resources, for sociological research.'

The issue I am interested in is the separation of valuable scrap from waste. Accounting then means assessing what materials a delivery consists of, and to put a number used in further calculations. Materials are classified (Bowker and Star 2000) and then evaluated with a particular focus on the prices on commodity markets. The supplier of the e-waste is then paid based on the economic value that was established for the delivery. And, importantly, a supplier should not be paid too much, since that would result in an overall loss. It is this calculation that the preparation facilities produce.

Crucially, however, accounting here does not mean that the recycler 'finds' or 'discovers' numbers or fixed relations that are just waiting to be revealed. I draw on Michel Callon's economic sociology to, first, clarify some common misunderstandings about accounting and, second, further sharpen my focus. In the *Laws of the Markets* (Callon 1998: 23), he emphasizes that concrete socio-material practices make a difference: 'The most interesting element is to be found in the relationship between what is to be measured and the tools used to measure it. The latter do not merely record a reality independent of themselves; they contribute powerfully to shaping, simply by measuring it, the reality that they measure.' To put a value on scrap then implies enacting the categories of scrap and waste.

In addition to Callon's performative approach, I moreover frame the accounting endeavour as a pragmatic process in which an apparatus of accounting is stabilized by 'moments of valuation'. This term, introduced by Hutter and Stark (2015), has further been identified by Mennicken and Power (2015) as a fruitful way to approach valuation practices inherent in accounting apparatus. Hutter and Stark (2015: 4) suggest using the notion of 'moments' to emphasize that valuations are spatially and temporally marked. They occur in specific places, and they have a recognizable beginning and end. I use their term as a heuristic to focus on the pragmatic aspects of the valuation process at hand. Hutter and Stark reflect John Dewey's (1939) classic suggestion to focus on value as a verb, to understand values as practical achievements that require hard work. In Mennicken and Power's (2015) research, this is also captured by the notion of 'apparatus'—as the alignment and cooperation of multiple actors with particular skills and passions.

The handling of e-waste is more, however, than accounting practices involving moments of valuation. The e-waste that turns up at the gate of a recycling plant is not only enriched and transformed by numbers. It is equally subject to material transformations. The notion of deformation will be used here to denote how e-waste materials have *become resources*, while something is done to them in a very material way. I take a cue from Nicky Gregson and Mike Crang (2010) who suggest we should focus on processes of becoming and 'unbecoming' in the study of waste. Gregson and Crang argue that waste (inorganic waste in particular) is not something out there which is lying at a certain place, disturbing someone, waiting to be managed; 'waste is a long way from stuff that "just is", but rather that it becomes' (Gregson and Crang 2010: 1028).

The focus proposed by Gregson and Crang helps me situate the handling of e-waste in a broader process of world making. Crucially, they further link waste with processes of *unbecoming*, and this term provides a key background to the notion of deformation. While reflecting on shipwrecking (see also Gregson et al. 2010a), Gregson and Crang highlight that the physical work of demolishing ships is an activity in which things 'are literally unbecoming, reverting to materials as the object materializes' (Gregson and Crang 2010: 1030). The notion of unbecoming clarifies what happens to material arrangements that are broken up and reworked. Most importantly, it is shown that things do not just disappear, whatever is done to them. In yet another study, now on the thorny materials of asbestos, Gregson et al. 2010b: 1067) emphasize this foundational argument: 'It is about material possibilities as well as limits. For, to disappear would be to contradict a fundamental part of the second law of thermodynamics: that material, matter, cannot be got rid of or destroyed, but rather can only transform, mutate, morph.' This calls for a different way of thinking about wasting at the agency level. The authors continue: 'Material might become something else through various treatment technologies; it might morph to conjoin with other materials; or it might stay in the same material state, but what it does not do is disappear.'

Materials, in short, are transformed based on concrete events and practices. As a result, the technologies to treat e-waste should best be understood as transformative technologies, and not as 'disposal technologies' (Gregson and Crang 2010: 1029). The notion of deformation then highlights the particular processes involved when materials are unbecoming. Practices of deformation are of prime importance to the processing of scrap. Based on this I can now return to the empirical details. In these, I need to pay particular attention to how the deformation of e-waste is linked to an accounting apparatus.

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In this section I have given an overview of the empirical field under study as well as provided some conceptual bearings for how to study the processing of e-waste, and in particular the role of valuation practices in these processes. I do agree, as previously mentioned, with Lepawsky and Mather's (2011) general insight that there are no clear beginnings and endings to a value transformation. At the same time, though, it is clear how the facilities, with their configured valuation and deformation practices, enforce the idea of clear beginnings and endings. This then again fits well with Lepawsky and Mather's (2013) more general, performative approach to reality. At the recycling facility, the enforcement of beginnings and endings starts when a contract is set up and ends when a contract is validated. Hence the accounting practices linked to the contracting are further entwined with and demarcate the deformation practices.

So how is valuable scrap produced in moments of valuation and practices of deformation at the two different facilities? What are the tools, skills, and energies used to assess the economic value of a delivery of e-waste? The main problem the two preparation facilities have to grapple with is that the materials need to be broken up and reassembled to be assessed. The uncertainty of 'e-waste' stems from the fact of its diffuse material composition, on which I will now focus. This, furthermore, allows inquiry into how practices of valuation might be differently intertwined with practices of deformation in the two sites examined.

Sorting, shredding, and smelting scrap: The production of value by deformation

Attuning to the first preparation facility and its contracts: the separation site

As explained above, there are two preparation facilities at this recycling plant. I will first discuss the *separation site*. This facility for preparing e-waste consists of roughly two-thirds outdoor space and one-third factory hall. The former is a junkyard-like area where materials are stored whereas the latter is where a shredder and sorting machines are located, all of which is being supervised by a control centre inside the factory hall.

The outdoor area of the separation site is captivating. Journalists, taking waste tours through the separation site, like to focus on the huge piles of e-waste to tell dramatic tales about humans' craving for new electronics. The company, in turn, is keen on talking about the enormous investments they had to make to master the materials. They emphasize, for instance, that a 'one-of-a-kind shredder' had to be built.

But there is more to this than anthropocentric narratives on over-consumption or technological ingenuity respectively. Sticking to the issue of accounting helps me stay focused. As emphasized earlier, crucial parts of accounting apparatus are contracts, which offer a good starting point.

The suppliers of materials to the separation site sign a contract before making deliveries. The agreement is a promise to be fulfilled with a clear temporal marker. In business terms the accounting logic of this first facility is called 'tel-quel' also known as 'bought as seen'. Tel-quel is a rather plainly structured contract that can be split into two major work steps: buying and accepting. First, thus, the purchasing department of the recycling company examines the e-waste the supplier is offering. They need to decide whether the materials are worth buying. This happens before delivery, outside the recycling plant. If the recycler is interested in the materials, a contract is set up in which both parties agree on the scrap to be delivered and its potential value.

Different kinds of scrap indicate different costs. On the one hand, this is a matter of market prices where gold, for instance, is sold at higher prices than copper. On the other hand, different kinds of materials require specific treatments by the company's machinery. The recycler invoices this treatment to cover the abrasion of its machines separately and depending on what machines are to be used. Accordingly, these particular costs are booked under the heading 'treatment charges'. I will return to this notion in a little more detail below (subsection on feeding the accounting apparatus with information); it becomes of relevance at a particular stage of the practical negotiations.

Yet, all these values and costs are tentative at this point. When the materials are delivered to the plant, they are examined for a second time. The e-waste has to be 'accepted'. This is where the contract is actually concluded, while the proper valuation of the materials is of particular interest to the recycler.

On the visual assessment of e-waste deliveries at the separation site

I will now analyse a situation that is key for the conclusion of the tel-quel contract. This will also bring the investigation closer to the practical issue of enacting valuable scrap. In a lucky moment during one of my work shifts, I managed to take a snapshot of this particular situation (Fig. 3). The photo differs from common depictions of the industry, and it will assist me in making my argument. I use a black and white rendering of the snapshot and a grid reference to stress the analytic angle.

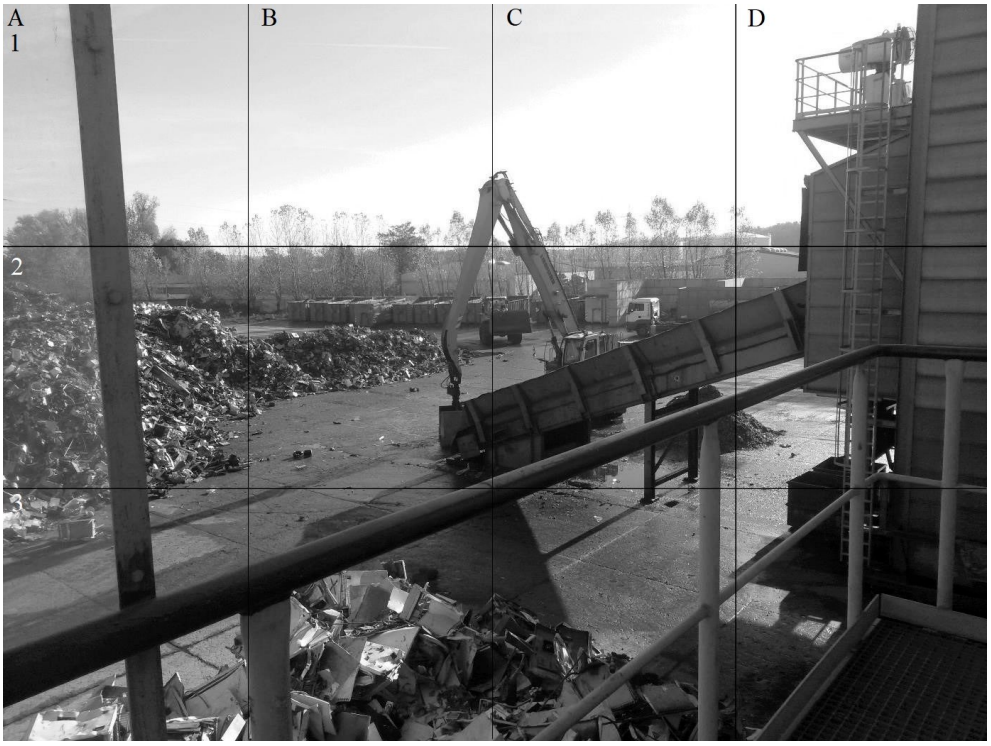

Figure 3 Outdoor space of the 'separation site'
Source: Photo by the author, grid reference added digitally.

Moments of valuation (Hutter and Stark 2015) also denote situations of uncertainty, when something unknown calls for attention precisely because of its being unknown. The idea then is to observe the actors in their very own inquiries. In this particular situation, unravelling the moment of valuation emphasizes practices of deformation. This calls for seeing some things and 'un-seeing' others, however, to appreciate the relevant actions. I will start with the description of a selection of empirical details to then specify the notion of deformation.

Note that right at the centre of this picture there is a heap of materials that is spread out to the right (quadrant B2). The rest of the e-waste, left of it (A2), is about twice as high. This is no random negligence. The entire outside area is divided into segments; it is strictly organized and work is routinized, which is similar to industrial landfills (Reno 2009). What is going on with this heap of e-waste?

When the separation site receives a new delivery of materials, a certain routine is performed. First, trucks and their materials are weighed, where the deliveries also obtain an individual ID-number that is saved in the intranet, both of which happens at the entry gate of the recycling plant. Next, the trucks enter this preparation facility from behind (on the back of the excavator on the right [Fig. 3, quadrant D2]), in order to drop off the materials next to the existing heap of discarded electronics. Above, there is a truck that just delivered its e-waste (C2). In such situations, a truck driver is usually waiting for further instructions from an employee of the facility who oversees new deliveries (this is the only thing that this snapshot does not capture, because the person had already left the area when I took the picture). This employee is in charge of assessing incoming deliveries; he is also

the foreman of this facility and oversees security instructions and some other key tasks. He (there are only men working here![4]) plays a crucial part. During my internship, I followed and helped this person (on and off) for about two weeks. It is useful to pay some extra attention to experiences stemming from that period.

The foreman is informed via walkie-talkie when a new truck delivery for this facility arrives and registers at the entry gate. For him (and me, as I am following him doing this), the arrival means quickly grabbing our helmets and going downstairs to the designated drop-off area. Truck drivers and this recycling employee—let's call him Mario—know where to meet. Mario greets the driver and pinpoints the place where the materials should be dropped (Fig. 3, quadrant B2).

When a truck presses out its materials—trucks and containers are equipped with devices that actively push—Mario becomes alert and aware. The pressing-out is a process that takes about two minutes. Printers are squashed, ink is bursting out, computers break, small pieces of metal start falling and rolling—and Mario sees, hears, smells, and senses what is falling out. Here the diffuse mix of e-waste is being de-formed. Because of the way in which the materials move away from each other, or are being squeezed together, it will be possible to *distinguish* different materials. The distinguishing that Mario does here, however, is not *yet* about collecting and transporting actual material streams. This is what the shredder in concert with a complex separation system does, and I will come back to this below. Mario instead is doing essential preparation work that helps to 'find' valuable scrap.

Linking deformations to practices of classification

Mario carries a notebook in which he records information about the incoming e-waste. The notebook helps stabilize the organizational account; the materials dropped can thus be classified and processed in the accounting apparatus. Drawing on Bowker and Star (2000: 10) I take classification to be 'a spatial, temporal, or spatio-temporal segmentation of the world'. This definition of classification is helpful here since it emphasizes the pragmatic and context dependent aspects of any classification.

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4 Among the 500–700 workers on the ground (the subcontracted workers are hard to count), just a few are women. In the facilities I've worked at, there were no women at all working on the ground. Other facilities had some diversity because of apprentices. Two general exceptions need to be emphasized. (1) In the middle and higher management (white collar in general), more women are working. (2) As is the case with other waste-related workplaces (Campkin and Cox 2007), there is a clear gender division. Even inside this recycling plant, it appears, the infamous private/public gender divide is reproduced. As a rule of thumb, the safe and rather neat offices are cleaned by women. Every place that is full of dust, debris, and danger—because of the presence of heavy machines—however, is taken care of by men. This might explain, for example, why men clean the shredders.

In his notebook, Mario carries a list that differentiates between, and thus classifies, eleven kinds of scrap, a ranking developed over time and regularly updated within the facility. The routines described here are in constant flux. When the truck driver finishes emptying the container, Mario further investigates the heap of e-waste while keeping his notebook and the ranking with him. He goes around the e-waste and looks for evidence. Sometimes he steps into the heap to pick up and manipulate certain items or to uncover buried stuff; if the pushing out of the materials produced ambiguous signs, Mario has to perform some further material deformation and check again what lies in front of him. It can be as simple as kicking some things around. In his notebook, he then writes down what he takes the delivery to consist of. The notebook is a matter of distancing himself from the heap of e-waste, while the notes demonstrate a proximity to the materials. Totals of '50% e-mix', '30% printers', '20% hard drives,' for instance, is what Mario's notes look like. These are, in fact, the most common classifications he makes use of (although I cannot inform you about the exact composition or make-up of these categories). In short, Mario aims to do two things: identify scrap categories and estimate the volume that each scrap category represents of the whole. The allocation and counting of the materials are used to adapt the separation machines (some sorting technologies may not be needed for less complex e-waste deliveries), but as I will show further below, this is also crucial for the accounting system to be able to allocate value.

The truck driver curiously observes the entire situation within walking distance until Mario finishes his investigation and stops scribbling. The assessment comes to an end when Mario puts a plastic clip with the delivery's ID on the heap of materials (Fig. 4). Mario needs these little helpers to take informative pictures in order to preserve his observations in digital format. I have seen such clips in different places at the plant; they also appear in other pictures below. They play an important role. Later, if there are inquiries by the purchasing department because of revisions or complaints, the ID makes it possible to unambiguously assign a photo to a delivery as it was documented in the intranet. After taking the pictures, Mario goes to the truck driver and gives him permission to leave. This formally concludes the transfer, but not the moment of valuation. Still, when there are no security issues (e.g. hazardous materials) or gross mistakes (very misleading information from the supplier), the materials are ready for shredding and further processing, as indicated above. And this is what happens in the vast majority of cases. Mario thus calls for a wheel loader, which pushes the materials into the rest of the e-waste heap (look closely at Fig. 3, quadrant B2/C2). From now on, it will be quite difficult to reassess the composition, except based on the photos. The newly delivered materials are mixed with other e-waste deliveries.

Figure 4: ID-card
Source: Photo by the author.

Because of the visual assessment, the foreman is able to validate or challenge the numbers originally defined in the tel-quel contract. To achieve his goal, however, Mario has to make use of further devices of the accounting apparatus.

Mario continues working with the notebook when we re-enter the control room. Here, he sits down at his desk and opens an Excel file to calculate the worth of the delivery, which can also be retrieved directly by the purchasing department by way of the intranet. Mario is doing some simple maths to process his notes. Based on the automatically saved accounting data, he can receive information about the weight of the truck at the time of entrance and of exit (via the intranet), which allows him to calculate the weight of the delivery. He finally calculates the value of the delivery by consulting his list of classifications. But there is plenty of work to be done to enable Mario to perform this calculation in the first place.

I use the notion of deformation not only to emphasize particular material transformations that occur during the processing of the incoming e-waste; but also to tie this notion directly to processes of accounting, where calculation practices are key.

Deformations are linked to classification practices. What information, however, is inscribed into these classifications? The accounting apparatus (which Mario is a part of) consists of several

additional devices. One must go beyond the immediate situations to understand the links. By following these devices, in fact, one can find more (preceding) deformation practices that were necessary to make classification possible.

Feeding the accounting apparatus with information

One key valuation of the facility I call *the separation site* takes place before high-tech machinery is used to systematically rework the e-waste. This is what the introduction of Mario's routines above emphasized. Nonetheless, the materials are still processed, and the knowledge produced during this processing informs the accounting apparatus, and it also informs Mario. It is a kind of circular process. Previous experiences shape how new deliveries are handled. What machines are used, and what is their relation to the contracts this facility concludes? How is the accounting apparatus fed with information?

In the picture in Fig. 3, there is an excavator with a rather large arm. When I took this picture, the designated worker of this machine had just taken a break, but usually he uses this tool to put e-waste onto a conveyor belt (quadrant C2-D2, hidden behind the protective wall). The belt leads to the powerful shredder that shatters e-waste materials and then feeds a complex system of conveyor belts, sorting machines, and, finally, containers. All of this is located *inside* the facility, protected by a roof and noise-cancelling doors.

In the containers separate fractions of scrap are collected. 'Fraction' is an industry term describing distinct material streams. The term helps the actors to draw boundaries between flows. Each fraction usually consists of similar materials, but the selections are not yet pure enough to be reprocessed. The boundaries between flows are not necessarily very stable. Here the engineers and workers, however, begin to refer to valuable *scrap*, because some of the materials are ready to be sold while others may be sent to the in-house smelting facilities.

Multiple fractions are collected in the separation facility. There are plastics and aluminium; both look like dust and are sold to third parties. Dust in fact appears to be the ideal form in which to offer materials to external partners (and it is a great metaphor for rethinking the electronics industry; see also Gabrys 2011: 138). Imagine finely shredded piles of material, which are difficult to keep apart, yet suitable for further processing without having to shred again. Then the following logic applies: the more separation, with as little contamination as possible, the more value a fraction has (Gregson et al. 2015: 229). But there is also a fraction of 'mixed metals' which is full of leftovers from printed circuit boards—brass, copper, and more—which will be sent to the vast smelting system. This is in-house processing. Finally, a filter system collects the emissions

from the shredding process in a separate container. This is a different type of fraction; it can be considered the waste that is sorted out, because it is a hazardous remainder. Note, however, that this waste element may also be reprocessed so that some valuables are recovered. I can only suggest ways in which these waste materials are treated, because I have not worked in the extra filtering facilities of this recycling plant. At the end of this process, this information is centralized, and a selected heap of dust is thrown back into the shredder of the separation site, so that the sorting machinery might pick up some more valuable pieces. Not everything can be recovered though. Instead of following these small (though fascinating) fractions I will keep my focus on the establishment of the contract.

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Here is a clue illuminating how the contracting system at the separation site is calibrated. The preparation facility constantly keeps track of the materials it is processing. Mario and the entire accounting department use that knowledge to guide their calculations. The tracking is performed in two different ways, although both ways emphasize the internal links of the preparation facilities.

One way has to do with the containers in which the fractions of 'scrap' (or 'waste' respectively) are collected. These containers at the end of the separation machines have to be emptied quite often, when they are filled to capacity. To empty the containers the contents are dropped in designated boxes somewhere on the plant's premises, for instance in a storage hall that collects and sorts materials for the smelting facility.[5] But the separation site is not merely sending its materials away so that they may simply be processed. It wants to track its output. Each time a container is emptied somewhere, a random sample is taken and collected in a separate, rather tiny box. At the end of every month, these particular boxes are sent for assessment to the sampling site next door.

The second way to track the materials only applies to highly specific deliveries, e.g. when a supplier delivers tons of only one type of electronic device, which is so far unknown to the recycler but comes in large quantities at a time. For example, it may happen that a supplier sends a container full of specific devices no longer intended for sale or a load of faulty products. The recycler issues a 'certificate of destruction', which is of particular value in these situations and where suppliers seek data protection (for more on this performance of

[5] This is where the complex internal network of the entire plant comes to light. There are materials going to the smelters, some will be sent to recycling machines and their filters, and others might simply be dropped in boxes on the separation site, as indicated in the text. Look for example at the background in Fig. 3. However, this article is not the place for discussion of all these links and the workers who take over the transitional tasks.

destruction: Herod et al. 2013). In the case of such homogeneous but so far unknown deliveries, the entire shredding and sorting machinery of the separation site is emptied and *only* this delivery is put through the system at the separation site. Similar to the first tracking approach, the resulting output is sent to the sampling facility that inquires as to its exact composition. The difference is that in this case colleagues receive the entire output, not merely a random selection.

Based on the tracking system and the numbers provided by the sampling facility, Mario and the accounting staff can finally perform their calculations. I am not in possession of the accounting algorithms that this company uses or has tried out in the past, but I accompanied Mario while he was doing the basic calculations. And he was in fact eager to explain what is at stake, thus emphasizing the key relationships. Later on, managers validated these basics based on my reports.

The attribution of value, at this stage of the workflow, follows clear guidelines. By way of testing the exact material composition the company now declares what categories were processed with what kinds of precious materials. Then, the value of a delivery is first of all linked to market prices. Each gram processed translates into commodity values, as in: this was a delivery with x% of gold, which was worth \$$y$ at the agreed date in the financial markets, add to this the other precious materials and their values, which in the end mean that the delivery was worth \$$z$. But it does not stop with this simple maths. The calculation that is sought after and agreed upon in the contract is also influenced by the costs of machine abrasion. The heavier are the materials that pass through the system (e.g. metals, instead of plastics), the more the system gets strained, which is measured by standardized costs. Here the company seeks for compensation. This type of cost was introduced above as 'treatment charges', which turns out to be a key yet complex feature of recycling reality.[6] The engineers need to register unusual strain, but neither do they want to charge unrealistic rates, because that could damage the trust of the business relationship. Against this background it becomes clear how important it is to know what kind of material flows through the system. Mario's expert knowledge and the valuation that he performs are crucial for a successful purchase and the adequate adjustment of future contracts.

As indicated with the tracking system, this first separation facility cannot directly assess the materials in detailed fashion. It needs help

[6] More research is required, however, to fully capture the nature and dynamics of treatment charges. The general structure of these charges is shaped by industry-wide negotiations that take place every year, the so-called benchmarks. Focusing on the flexibility of certain companies and their contracts sounds like a promising site for further investigation, while being party to the actual discussions at the negotiation table would for sure provide vital insights.

and therefore cooperates with its neighbouring facility, the e-waste sampling site, which makes a precise calculation possible. But this facility needs help too. I will now shift to this site, which lies directly next door on the same premises. There are links between the operations, yet the two facilities also handle e-waste differently—a different instance of valuation comes into focus.

Turning to the sampling site and its different mode for making contracts

It is now time to turn attention to the other facility studied: *the sampling site*. At the sampling site, there is also an accounting system around e-waste. Besides that, there are suppliers who deliver discarded electronics in need of assessment. Yet, when I moved from the first preparation facility to the second, I was intrigued by the differences. At the sampling site, the e-waste appeared more homogenous than it was at the separation site. I was, for instance, confronted with shipments consisting of only discarded laptops *or* shipments solely made up of printed circuit boards. In fact, there were different kinds of deliveries of different printed circuit board qualities. Heaps of 'dust', in some cases. I remembered that such deliveries were rather rare next door. The machines used and the people working here also differed from those working at the separation site. Different topics of conversation, different break routines, even different smoking habits (like classic cigarette smoking in one facility vs e-cigarette vaping in the other). What is most important, however, is that the sampling site used a different system for agreeing contracts with suppliers. This was somewhat surprising; the uncertainty of electronic waste leads to a strange but (in the end) useful flexibility in the preparation of this type of waste.

The tel-quel contract used at the separation site enables the quick processing of large volumes of materials. (Remember, the separation site handled up to 400 tonnes per day.) The quick and dirty approach of the separation site, however, might be considered problematic for more valuable materials. When faced with precious materials, a minimal difference in the material composition translates into a *significant* adjustment of the economic value of the delivery. The decimal places become of crucial importance. But, interestingly, this is not necessarily the key aspect at this site. The decision where to conclude a contract (in the separation site or the sample site) is also a matter of individual preference. Some business partners just *prefer* to deliver their waste to the sampling site rather than to the separation site, simply because they want to be compensated based on more precise valuations, and they don't mind that the assessment at the sampling site takes more time, which indeed is a key difference.

At the sampling site the processing of e-waste is based on a certain temporalization. The moment of valuation lasts longer. The sampling

site wants to determine the precise material composition of a delivery, which justifies much slower processing in more complicated apparatus. For the production of valuable scrap (and partly also to assist the separation site, as shown), a precise assessment is important. So how does this facility process e-waste to produce valuable scrap? Similar to the first facility, a contract is set up before any e-waste is delivered. In this case, however, the delivery is not pre-assessed. The materials need to be brought to this facility for a thorough valuation. This is about zooming in and mobilizing material properties.

Delivering and documenting e-waste deliveries at the sampling site

When a supplier's container arrives at this facility, a worker checks whether the rough attribution made at the entry gate was correct. This process is similar to what is done at the separation facility. Releasing and documenting newly arrived e-waste is also a recurring theme (Fig. 5). Although these particular actions again *appear* similar to what is done at the first facility, this is where things are in fact starting to work differently.

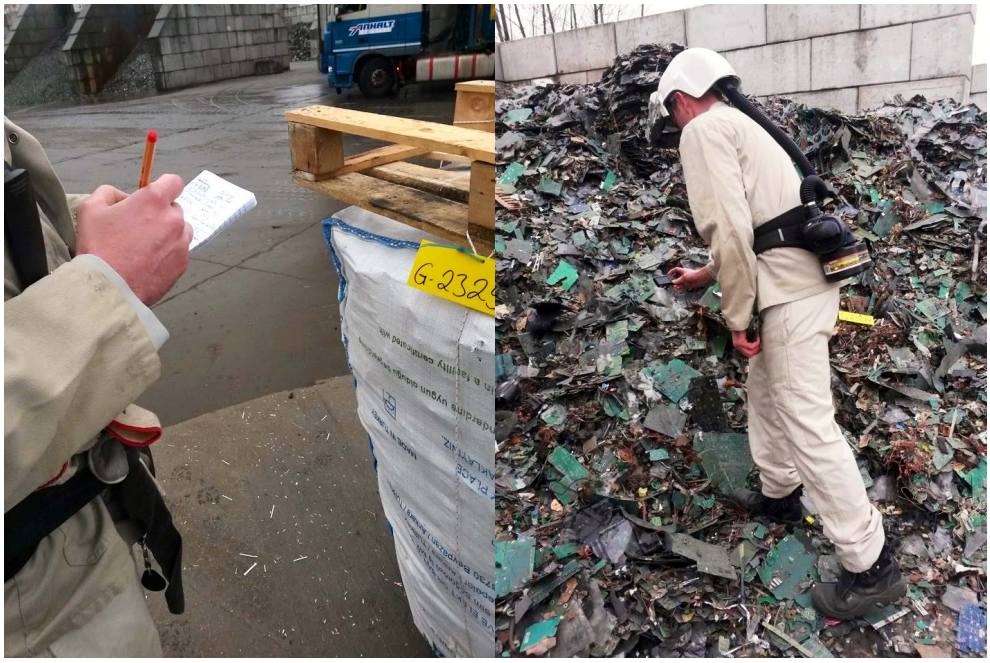

Figure 5 Documenting e-waste
Notes: The foreman on the right uses a digital camera.
Source: Photos by the author.

Expert knowledge plays a different role in this facility, as emphasized by the way in which the peculiarity of materials is handled when deliveries arrive at the outdoor space. Depicted here (on the right-hand

side) are printed circuit boards of a medium to low quality. This selection is full of 'organic materials' (some also categorized as 'dust', for instance), as the foreman explained to me. Experienced engineers, he told me, know what lies in front of them, even if they stand in front of vague material composition that looks like dry flower soil (again, this is his analogy, and it is just one way to specify, or approach, 'dust'). This knowledge can be helpful for a quick allocation of materials. Analogies assist in situating the materials.

The order in which materials are then tested is based on an elaborate system, because the smelting facilities of this recycling plant require different materials at different times of the day, and the smelting facilities are communicating their demands to the preparation facilities. What they are not doing in the sampling site, however, is putting a value on a delivery based on a visual assessment in the way Mario did at the separation site. This is also the reason why documenting and classifying things works differently in this second facility. Usually, notes in a notebook and the documentation of things here are used to emphasize that the process went flawlessly or to show that disturbances have been controlled. Against this backdrop, I now turn to the explicit material processing of e-waste at this site.

The deformation practices of the sampling site's shredder system

Even though the e-waste is moved and dropped off at the outdoor space of this facility, the first deformation that is significant for the valuation process occurs in the shredder that comes next, in the factory hall of the sampling site (Fig. 6). From here on, employees are particularly careful as to what is done with the e-waste. Each delivery, and this is critical information, is put into the system separately. In the separation site, in contrast, mixing deliveries is normal (apart from the rare tests of new very specific items). Putting e-waste into the shredder, then, is a slow process controlled by at least two workers. One worker, as seen in this picture, checks the e-waste before it goes into the shredder, while another worker (outside the picture) cautiously puts these materials on the conveyer belt with a wheel loader.

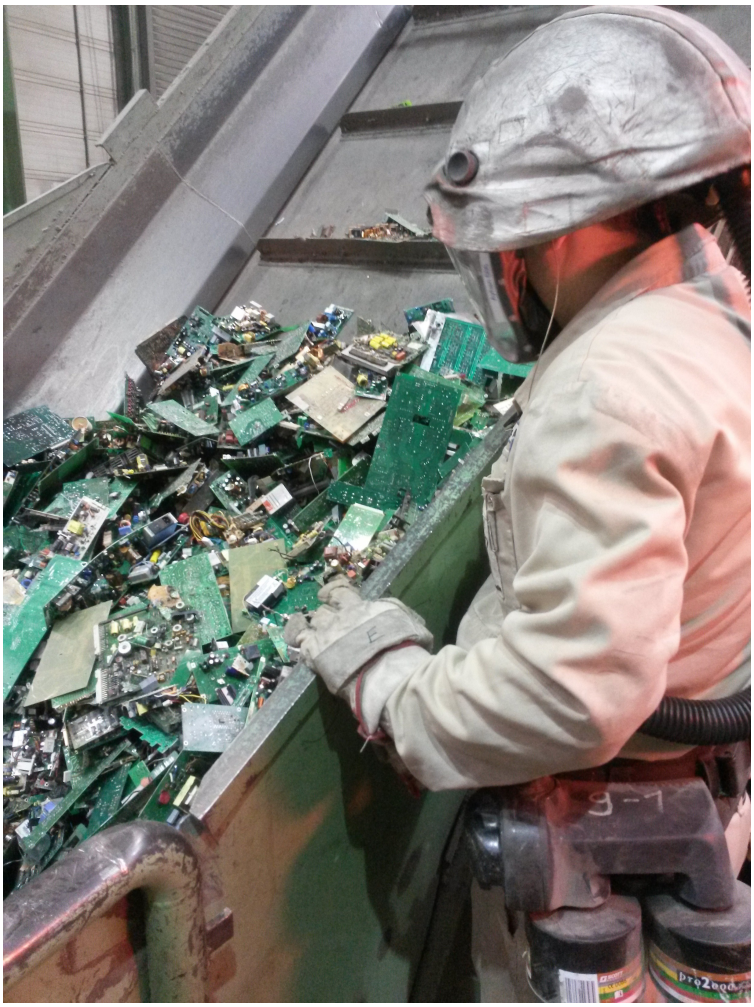

Figure 6 Inside the separation site and on the way up to the shredders
Source: Photo by the author.

What is most important in this particular transformative practice of deformation is its sensitivity. This facility does not use one but three shredders to deform the materials—it is a system of shredders that works in concert with conveyor belts and additional devices. (More on them below in this subsection.) And the system requires careful handling, which first of all is emphasized by the shredder technology itself. As elaborated, materials are dropped slowly onto the conveyor belt that feeds the first shredder. This is to ensure that (a) the worker depicted above can check for large or potentially dangerous items, and (b) the first and most sensitive shredder (situated at the end of this conveyer belt) is not overheating because of too many things coming in. The shredder can only take a limited amount of material at a time. Instead of shattering e-waste (like in the separation site), the materials

are rather 'cut'—this is at least how the engineers summarize the differences between the machines here and next door.

What is the benefit of this sensitive and costly deformation? At the end of the shredding process (illustrated in Fig. 7), the materials are collected in two small barrels. Studying the details of the workflow in between helps understand why the e-waste materials require special attention.

Figure 7 Where the output of the shredder system goes
Source: Photo by the author.

The sampling facility cannot test all the materials of a supplier, for instance the 20 tonnes of e-waste coming in with a typical container. The recycler here makes use of statistical methods common in analytical chemistry. In abstract terms, the company strives for a representative sample by way of 'concentration'. The goal is to produce a tiny sample in order to make possible a physical and chemical analysis of what was in the delivery. The shredder described here then is part of a larger process that I will gradually delve into.

Fig. 8 shows the detail of the concentration process from the shredders to the barrels. Three shredders, gradually producing finer-grained pieces of material, work in concert with two devices that select

a randomized choice of material. They split the flow of materials twice to increase the degree of concentration, while conveyor belts link all the machines. Only the materials that emerge at the end, however, are of importance for the sampling done at this facility.

In short, two flows of materials can be distinguished. (1) Most of the e-waste that is put through this shredder system is 'discarded'. That is, it is not chosen for the sampling procedure. Therefore, it is thrown into a container. This sorted material is either stored for further processing in the smelting facilities (if free of glass, plastic, etc.) or needs to go through the purification and sorting process provided by the separation site (see the small heap of materials below the conveyor belt in Fig. 3, quadrant C2/D2). Here the two preparation facilities again rely on each other. (2) The materials that are collected in the final barrels by the shredder system are the samples collected. These 10–50 kg are part of the statistical procedure and the valuation process. The 'concentration' process, however, is not yet finished. Much more energy is required to assess the materials at hand.

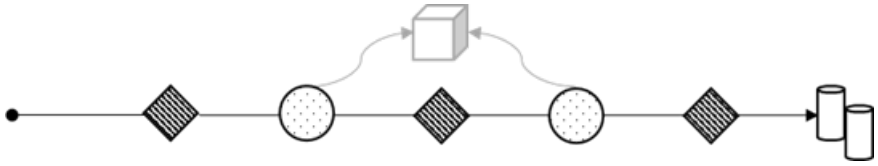

Figure 8 The concentration process of the shredder system inside the sampling facility
Key: Each line is a conveyor belt; a square represents a shredder; a circle stands for a device that splits the e-waste flow by selecting random materials; the box represents a container, in which the discarded materials are put. These are materials waiting to be processed when the sampling is concluded. The barrels at the end of the flow stand for the few materials that are selected for sampling. In reality, thus, the barrels are much smaller than the container.
Source: Illustration by the author.

The shredding of e-waste in this facility can be interpreted as deformation in multiple steps, which explains the vulnerability of the system. Formally, the processing of materials is described as being automatic, even though in reality the workers constantly need to maintain the machines to ensure that the materials are successfully put through. It is not a self-operating system. The first shredder of the system described here for instance needs to be serviced each day, which can involve replacing outworn 'knives' which do the 'cutting', while the conveyor belts and other tools are often clogged so that the colleague shown in Fig. 6 has to repair the system—often by being creative. I also have been part of this process, by helping locate an

issue or by cleaning things that were full of dusty materials. My internship involved quite banal cleaning activities that might have been considered degrading at other places, but at this employer these are serious and essential tasks. The control centre of the separation site usually helped; they are equipped with sensors that monitor the system and can tell where to look for what kind of blockages. Their equipment also includes deafening alarm signals to which, paradoxically, one quickly becomes accustomed.

Smelting scrap, turning up the energy use

The shredder system is a first major operation at this facility, but it is not the only one, and perhaps not even the most important one. The concentration effected by the shredder system is just the initial one of this kind. There are multiple concentration processes in this facility—but based on different socio-technical set-ups and alongside new deformations that require new oversight. It becomes increasingly more complex to rework the materials.

One of the 'chosen' barrels pictured above (Fig. 7) has to be moved to an adjoining room to begin the next phase of concentration (the other barrel is stored as a reserve). In other words, most of the materials of the initial delivery of e-waste are not part of the procedure; they have been sorted out in the containers. These are materials on hold.

In the new room, the e-waste chosen for sampling is prepared for transitioning. Recycling is about keeping flows flowing. The materials are tested for any remaining hazardous substances (e.g. mercury), and put into a stove, so that any moistness is removed. After that, the materials are weighed again. The outcome of all the measurements is meticulously documented. At this stage, the materials that were selected by the shredder system already look rather homogeneous—dust, often with a touch of light green. Eyesight, however, is of no use in this case. From a chemical point of view, the materials must be mixed and deformed even further —by way of smelting.

The e-waste preparation facility does not have the machines necessary to do the smelting, which is why they send their barrels full of remaining e-waste over next door to let colleagues do this job. This leads me to a new location. The pictures shown (Fig. 9) are from this other facility, where I spent the last weeks of my fieldwork. This is the so-called 'old' preparation department of the company. It has been sampling material compositions (of 'classic' copper scrap in particular) for half a century but also supports the rather new e-waste facilities. Note that this particular smelting operation I am referring to here is *not* part of what this company actually categorizes as *the* smelting facility (see the idealized value chain in Fig. 2). In what follows I describe a rather tiny machine that is only used to support the sampling procedure; I'm still 'zooming in' to the preparation facilities.

The 'true' smelters are located elsewhere on the plant's premises, and, as indicated at the beginning of the article, they are roughly 65 metres high and used to produce 'new', raw, and standardized commodities. For valuation of the scrap bought, however, the 'tiny' smelting operation done here is sufficient, and of vast importance.

Figure 9 Smelting down the e-waste in a crucible induction furnace (left); and the result of this process (right)
Source: Photos by the author.

Smelting materials is a particularly energy-intensive practice of deformation. The snapshot in Fig. 9 (left) shows the key device of the new process: a crucible induction furnace. This is a high-temperature furnace (it reaches >1200°C), designed for small selections of materials. Altering the aggregate phase of the materials is the ultimate way to blend the selection. Low-value ingredients (such as residual plastics) are removed from the selection, even though, as Gregson and Crang (2010) remind us, nothing is literally destroyed but rather moved.

The entire smelting procedure performed is based on standardized routines, which are also agreed on in the contract. To check that these standards are kept to, a supplier can send a consultant who observes and checks what is done to the materials. This is an intermediate actor that ensures mutual trust. Contamination would result in significant economic losses, which is why it is a good idea to certify the deformation practices. Nonetheless, taking care of the furnace is a challenging task with various non-formalizable skills.

Just like the shredder described before, the smelting system is not running on its own. Putting the materials in and pulling them out is not that problematic, but keeping things going can be quite exhausting and dangerous. Regularly, a worker has to stir the materials with a rod-like device so that the smelting really mixes things through. By way of putting in a rod he (again: only men here!) feels how far the deformation of the materials has proceeded. To do that the worker has to climb up the small stairs (Fig. 9: left) and open up the round protective wall (which also serves as a filtering device for the fumes). I was also allowed to stir the materials once, in full body safety clothing. It is indeed incredibly hot in front of the device; it seems impossible to stand there for long; and it is tricky to feel anything about what is happening inside this machine. Yet workers endure. Some actually enjoy the proximity to the materials. For one person I was talking to, it was a hands-on version of science. Metallurgy in action. Another one, however, did not particularly enjoy what happened to him one day. There was a small explosion in the furnace during stirring which, long story short, hit him so hard that he temporarily had to be put into a coma. He is now used as one prime example of occupational health and safety. Maintenance can be tough; some traces of the work remain permanent.

The outcome of the smelting process, also shown in Fig. 9 (right), is black stone that the workers and engineers actually call 'stone' (*Stein*). In this snapshot, one can see the new metallic entities that have been produced. Well, actually one cannot see any differences anymore, especially no clear colour highlights. This indeed just looks like black stone—even though it is full of precious metals. This is what valuable 'scrap' looks like, in the eye of the sampling site, despite the fact that the stone still needs to be prepared to be assessed. It is important, however, to note that the smelted materials do not represent all the stuff that belonged to the original e-waste delivery. And this goes beyond the plastics.

Metals are also referred to as things that—due to their 'natural' state—can be endlessly recycled. Yet there is a loss of metal during this smelting procedure (which comes on top of the plastics being removed), because 'dross' is produced that requires further treatment. Dross is an impure residue of molten metal that sticks to the furnace and needs to be scraped away, while some things get lost, along the way. For the actual smelting facilities such dross requires a certain creativity to make the most of the procedure. However, for the sampling facility, such loss is less of an issue, because only a small portion of the material is needed for the examination to come. And not all materials are of interest.

Understanding what's going on during the smelting procedure helps in understanding the recycler's priorities. Even though the company emphasizes that it carefully prevents wasting (and sometimes even

talks about 'zero waste'), I want to stress that each treatment of e-waste materials (each deformation) is indeed associated with the production of some sort of waste. In the case of the smelting procedure of the sampling site, for example, it is only because of the forceful removal of things (e.g. plastic) that new metallic entities are produced. And some energy reserves that once went into materials are ignored as well. Wasting and dissipation are part of the production of value, just as are hazardous emissions, as others have pointed out (e.g. Tsydenova and Bengtsson 2011; Lepawsky et al. 2015; Stubbings et al. 2019).

My tour through the separation site is almost finished; there is just one more operation to follow. When the smelting is finished, the black stone is moved back to the e-waste preparation facility, where a final sample of the scrap is produced, which is done in a tidy laboratory. The engineer in charge at this laboratory cooperates with yet another specialized chemical laboratory to evaluate the ingredients of the sample, inside or outside of the recycling company depending on the contract. A last key thing I learned while being introduced to these practices is that the key materials the scientists are looking for are just a handful of elements: gold, silver, copper, aluminium, palladium, and platinum. The recycler aims for these metals while, for instance, the much-discussed rare earth metals that can be found in plenty of discarded electronics have to be ignored. The reason here is that they are considered too expensive to extract. It makes more sense for the recycler to let the materials dissipate. Based on this, in any case, the accounting numbers are fixed. I have only briefly referred to the scientific processes that are carried out in the laboratory, because they are of minor importance to the central research question that I am pursuing here.

In the end, the supplier is paid based on a precise overview of what the initial delivery consisted of. The sampling site aims for a representation, while again subtracting standardized treatment charges. In addition, the contract is limited to a few materials, and a margin of error is taken into account which allows for loss or inaccuracy without being penalized. These standardized margins of error can in fact work to the company's advantage, which is why the recycler tries to reduce the actual errors. The more maintenance, the less loss, and the higher the value, without having to compensate.

This is how the preparation activities are concluded. Finally, the materials that have so far been stored are released. Various flows start flowing. What has been collected in the containers during the shredding processes can now be processed by the internal smelting and refining facilities—to produce raw commodities that are also sold at the metal markets—while low-quality and very heterogeneous selections are run through the separation site to produce separate 'fractions' of materials. Having issued a reminder of this general

overview, I can now close the empirical section and move to the discussion and conclusion of the article, which will bring it together.

Conclusion

Having visited two adjacent facilities of an e-waste recycler set in the Ruhr Valley of western Germany, it is time to take a step back. What are the practices involved when transforming e-waste into scrap and waste? The comparative element introduced by looking at two e-waste preparation facilities allows inquiry into how the practices of valuation and deformation were differently intertwined at the two sites examined. The comparison illuminates the key valuation practices to keep in mind when discussing high-tech recyclers. But, as I will indicate in this conclusion, my investigation also aids the general understanding of calculation practices and the materiality of valuing.

The first observation is clear-cut. Contracting with suppliers, valuation of the incoming e-waste, and the practices of deformation are intimately intertwined at both sites. Yet, the way these practices are configured differs between the 'separation' and 'sampling' sites. Contracts vary, to adjust to the needs of different suppliers. This is also a matter of establishing a trustworthy relationship. The accounting apparatus of each facility is what ties together the mode of contracting, the moments of valuation, and the processes of deformation. At the separation site, contracting is subject to a rather early valuation where much of the deformation remains to be done. At the sampling site, the contract is concluded only after a more thorough analysis. Different routines and sensitivities are required. Hence, at the sampling site, the moment of valuation tied to the conclusion of the contract goes hand in hand with a very energy-intensive deformation process.

The accounting apparatus is key for the recycler, since it is part of ensuring that it can calibrate what it pays for different supplies in relation to what can be extracted at what cost. The value of the materials is not simply 'detected'. Arriving at a valuation is an achievement depending on both accounting and processes of deformation. The concrete way in which valuation occurs around practices of deformation is crucial—the 'how' of the process is where the different material affordances and skills make a difference. The preparatory work is not a bureaucratic formality in which stiff procedures are to be observed. Without the expertise, flexibility, and attention of the separation and sampling sites, the large smelting and refining plants of this company cannot operate. No 'fractions' of distinct material streams would be produced; economic value would be 'lost'. The actors introduced in this article have adapted to the specificities of e-waste, making possible work on and with these 'complex' materials. This is also about maintenance work worth appreciating, and bodies at risk. In the vast smelting and refining

plants, where the prepared e-waste moves to, new services and routines then take place, which may be examined in further research.

From the perspective of valuation studies, my main contribution to the field lies in highlighting that the valuation of scrap is a very material process. I suggest using the notion of deformation to understand the valuation at hand. In order to identify and thus classify things, the foreman I called Mario watches deliveries of e-waste being dropped, squashed, and twisted. And it gets more energy-intensive at other places. The first preparation site puts e-waste through a massive shredder and operates a powerful filter; in order to produce a concentrated block of materials the second preparation site makes use of a high-temperature furnace, while also operating a complex shredder of their own. These are specific deformations. Recycling always means calculation, and especially in following the calculation practice of this industry it becomes clear how much the foundations of a calculation rely on very material breaks. Things must be disassembled with force. The calculation is based on creating deformations, because the accounting apparatus needs separate entities to work with. The machinery in use then not only makes valuations possible, it is part of it and shapes it. Maintenance and tinkering is part of it too. This observation could be useful for completely different empirical sites as well. In other fields of investigation, the induced transformation does not always have to be as irreversible as in recycling, but in many cases it should be possible to identify the consequences of a deformation as an issue that actors have to deal with. Things are altered, which translates into stress, but also introduces new insights and perhaps surprising relations.

From the perspective of waste studies, valuable scrap now can be better understood as a practical achievement. During the internship I learned that contracts are concluded while reflecting on experiences and anticipating future developments. Plus, treatment charges are an important component without which the decisions of a recycler and the establishment of a contract cannot be understood. Much information, however, is missing on that matter. This also hints at the financial markets, and global negotiations among the most important raw material players. The rhythm in which excavators and foremen move around a recycling yard is set by global financial flows, even if recyclers develop creative tools to set their own pace. The commodity markets are showing a complex, sometimes curious reality here. Matching this, my article has also shown that only a limited number of materials is recovered during the recycling process. The peculiarities of this should be taken seriously. High-tech recycling is a special practice that can only handle a limited amount of electronics while consuming a large amount of energy and producing new waste materials.

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