
Actor networks, modes of production, and waste regimes: reassembling the macro-social

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Abstract. The author argues for the necessity of a macro-theoretical framework for a systematic understanding of the waste–society relationship—a synthesis of the Marxist mode of production concept and the posthumanist concept of actor networks, sociomaterial assemblages, or collectives. Based on empirical data on Hungary’s socialist and capitalist waste history (1948 to the present), it is shown that macro dynamics are qualitatively different from micro ones and thus their analytical separation is retained. At the same time, it is demonstrated that the common fallacy of Marxist and posthumanist theories to conflate social scale with level of abstraction unduly demonized macro-level concepts. Finally it is shown that existing syntheses of Marxism and actor-network theory cannot but treat waste as a theoretical derivative of the concept of value, and thus elide waste’s concrete materiality. The concept of waste regime is proposed to resolve these shortcomings.

Introduction

In the past ten to fifteen years, waste scholarship has expanded and deepened: we have seen an increasing number of rich case studies both on waste-related social movements (primarily in the US) and on specific waste materials (for the most part in the UK and Australia). Many of these also experimented with new conceptual frameworks, greatly deepening the theoretical foundations and the interpretive capacities of waste scholarship in the social sciences. Some of these novel approaches focused on microlevel practices, such as waste work (Reno, 2008), practices of divestment (Gregson et al, 2007a), managing absence (Hetherington, 2004), arts of transience (Bulkeley and Gregson, 2009), waste ethics (Hawkins, 2007), or practices of reuse (O’Brien, 1999). Others aimed at theorizing the waste–society relationship mostly at the macro level, such as waste governance (Chilvers and Burgess, 2008; Davies, 2008; Fagan, 2004), waste citizenship (Gutberlet, 2008), garbage imperialism (Foster, 1994), toxic-waste capitalism (Hanson, 2001), waste politics (Reno, 2008; Weinberg et al, 2000), waste flows (Gille, 2006), waste networks (Fagan, 2004; Reno, 2009), cities of maintenance and repair (Graham and Thrift, 2007), politics of repair (Graham and Thrift, 2007), rubbish discourses (Hawkins, 2007), or waste public (Hawkins, 2007). Some of these scholars also experimented with concepts that connect multiple scales: such as Fagan’s concept of waste networks and the concept of modes of governing elaborated by Bulkeley et al (2007).

A telling, though perhaps not surprising, division of labor has emerged between studies in which the dominant focus is the micro, and those where it is the macro. The microlevel studies mapped out the social and spatial life of waste, forcefully demonstrating the superiority of observing practices over surveying attitudes (Bulkeley and Gregson, 2009) and, in their analysis of household practices, they demonstrated the constraints posed by the materiality and spatiality of waste and waste-collection activities. Unfortunately, however, since industrial and, in general, production wastes are rarely accessible to fieldwork methods, these case studies exclusively focused on consumer, that is household, waste. Studies pitched primarily at the macro level did

not exclude production waste from their purview; instead they tended to talk of wastes in more general terms which, as usual, came at the expense of empirical thickness.

Instead, this group of scholarship often proceeded by affixing waste to well-rehearsed social science concepts, effectively ‘hyphenating’ them, as is the case with the terms ‘waste governance’, ‘waste flow’, ‘waste networks’, ‘waste citizenship’. The unintended consequence of such hyphenation is that in many cases it obscures how waste becomes materially, socially, and spatially *waste*; how it is transformed, not just in terms of its function and value (Gregson et al, 2007a), but also as material, as it traverses networks and flows. That is, in macrolevel studies waste tends to get reified.⁽¹⁾

A further result of hyphenation is that waste appears derivative of existing social structures and economic logic, so that the roles which waste materials, wasting practices, and waste actors play in coproducing the social remains hidden. It is not just, as O’Brien (2007) puts it, that the “failure of the regulatory complex surrounding waste... is a ‘positive effort to organize the environment’” (page 4) but that waste itself—its production, its consumption, its circulation, and metamorphosis—is constitutive of society.

The problem with splitting waste into the categories of producer waste and consumer waste in the literature is that this reinforces the false assumption that consumers in Western capitalist societies *make* garbage, when in fact neither do they make trash materially nor do they have much choice in what materials they buy and thus turn into surplus stuff. As a result I insist on the definition of waste as any material we have failed to use. In adopting this operative definition, I am following Gourlay (1992) and Bulkeley and Gregson (2009), who talk of ‘surplus material’. A second reason to use such a broad definition is to leave open the opportunity to demonstrate the material and social consequences of one type of waste material metamorphosing into another as it traverses the circuits of production, distribution, consumption, reclamation, and ‘annihilation’.

To point out this patterning in the scholarship is not to belittle its achievements; in fact, these studies collectively provide a strong foundation for my endeavor here: a return to the macro level in theorizing the waste–society relationship but at the same time infusing the macrolevel analysis with a more careful examination of the ‘becoming’ of waste and of waste’s socially generative capacities—a task so well executed by microlevel approaches.

Many will rightly argue that we must transcend the macro–micro divide, or even that such a distinction is no longer tenable—because of globalization’s profound jumbling up of scales (Brenner, 1999; Sassen, 2000), because it makes more sense to talk about not only the production of space but also of scales (Tsing, 2000), or because they do not make sense in particular theoretical orientations, as is the case with poststructuralism and actor-network theory (ANT). I myself have been sympathetic to these arguments and occasionally have even lived by them. However, two sets of concerns in particular have always compelled me to return to the macro level as analytically distinct: the need for understanding historical processes and the nature of power. This of course is not to say that history and power can only be captured analytically at the macro level—far from it. However, as I will show, there are dynamics both of power and of history that are qualitatively different from those at the micro level or that cannot be explained only as emerging from the micro level. In this paper I articulate a macrotheoretical framework of the waste–society relationship

⁽¹⁾ A notable exception to tendencies of reification among those talking about waste networks is Reno (2008; 2009), who describes how the fungibility of waste is rendered through sorting and waste work.

as a synthesis of the Marxist conception of the mode of production and of ANT's concept of actor networks, collectives, or sociomaterial assemblages. Some have attempted such a synthesis, or at least a dialogue (Castree, 2002; Gareau, 2005; Mitchell, 2002; Rudy, 2005), primarily by fusing or bringing Marx's dialectical materialism or his concept of metabolic rift (Foster, 2000) closer to ANT's emphasis on material agency—especially that of nature. Others have rejected such a synthesis as illogical or politically unproductive (Fine, 2005). What I call a 'synthesis' is neither a reconciliation, which indeed may prove illogical, nor is it bringing the two theories to some common denominator—let us say, to the issue of materiality—which might simplify both in an unproductive way. Instead, I retain the macro–micro distinction from Marxism while also preserving ANT's emphasis on material concreteness for the specific purpose of theorizing waste.

Actor-network theory and the mangle

Some have argued that ANT focuses on the microlevel connections that constitute actor networks. Latour and other key theoretical proponents of ANT of course would disagree with this and point out that their goal has been to transcend the micro–macro dichotomy (Latour, 2005). Another posthumanist sociologist, Pickering (1995), argues in a somewhat different way for demonstrating how the macro emerges from the micro. So let us adopt their perspective and see what it would mean to talk about waste as an actor-network, or as exhibiting the "dance of agency" (Pickering, 1995).

First, from a posthumanist perspective, waste is a hybrid entity in the sense of being simultaneously human and nonhuman. That is, if we want to understand how something comes to be called and treated as surplus material, we must pry into more than the cultural conceptions of waste—as the social constructionist impulse of Douglas's (1966) definition of dirt as matter out of place proceeds. We must also understand how those materials came to be, why those particular substances, and not others, were mobilized and transformed, what their uses are, and how the particular physical characteristics of those compounds limit on their use, reuse, and safe discard. ANT rejects concepts such as the mode of production, or capitalism and socialism as reified abstractions. Instead, it sees overlapping and interconnecting linkages among social and material agents. In fact, ANT argues that there is no purely material, just as there is no purely social, and this belief in their separation and separability is a modernist fiction.

While Pickering, for example, argues that the mangle—that is, the back and forth between social intentions and their material realizations—also occurs at the level of the macro, his understanding of that level of analysis is limited. In the only empirical reference to the macro I found in his work, he claims that the intersection of science and the military in World War II demonstrates how science made itself a macro actor. This interpretation of the macro emerging from the micro is insufficient to the extent that it is various macrolevel events (the war, for example) that opened the 'macro door' to science; events, however, that are not analyzed as such. That is, there may be newly emerged macro actors, but the roles which previously emerged, macrolevel events, relations, and dynamics play in the birth of a new macro actor are missing.

Furthermore, there is no theoretical room in this and other posthumanist accounts to discern if these macrolevel dynamics are qualitatively different from those at the micro level. Law (2007) makes this explicit when concluding, from the equality of easiness of dialing 911 and launching tanks in Kabul, that "the same relational logics apply at any scale" (no page). However, his admission of black-boxing, and other strategies of making assemblages durable, seems to contradict the assumed sameness of micro and macro dynamics. For example, explaining the historical inequality of the

West and the Rest, Latour and Law see the West's superiority in its practice of having "accumulated a series of small and practical techniques that generate cumulative advantage" (Law, 2007). Black-boxing, cumulative advantages, and Law's concept of "teleologically ordered patterns of relations indifferent to human intentions", all point to the relative autonomy of the macro social.

There is also another reason for recognizing the macro as having a qualitatively different dynamic and ontology from those of the micro. ANT's preference for the micro and Marxism's preference for the macro are both animated by what Massey (1994) calls the conflation of the social scale with level of abstraction.⁽²⁾ If by 'concrete' we mean the product of many determinations, it is not clear by what standard waste networks or waste governance are less concrete than are recycling practices at the household level. If by microlevel 'subtleties' we mean the particular expressions of more universal laws, logics, essences, relations at the macro level, the predominant approach in Marxist case studies,⁽³⁾ we would still attribute the same primordality to the macro level as if we had never had left it. ANT proponents, in a different vein, argue that things which sociology tends to attribute to macrolevel institutions and relations, such as power or the economy, always emerge anew, and since the task is to demonstrate how that is done at the level of *concrete* actors and *specific* situations, the only empirically important scale is the micro level. That is, despite their theoretical and epistemological ambition to transcend the macro–micro dichotomy, in empirical research associated with ANT, the macro does not emerge from the micro, and the micro is never hooked back up to the macro level (Fine, 2005); that is, the macro simply does not exist. (Fine, 2005; Laurier and Philo, 1999). This explains Latour's insistence that the topography of the social is flat.

In his 2005 book, Latour repeatedly insists on a 'flattened-out' landscape made up of human and nonhuman actors and their linkages as well as on the usefulness of the concept of network—a concept whose prevalent and somewhat careless use in studies of globalization I have critiqued repeatedly (Gille, 2006; Gille and O'Riain, 2002). While Latour places great emphasis on the *making* of the threads within a web or links within network, and thus eschews some of the shortcomings of the concept, the weaknesses associated with the flatness of the concept still remain. Key among these is the assumption that power resides in the connections and threads, rather than being created and controlled by *some* nodes, while other nodes may be simply in passive receipt of such flows.

Law (2004) provides a less flat analytical topology, not only in that he problematizes the concept of network because it is still grounded in the belief in a bounded whole, but also in that he talks of varying degrees of complexity as one travels down or up the rungs of social scale. He does not so much deny that the macro or the global exist, so much as argue that the micro and the local tend to be more complex than the macro/global, and that the global can be contained within the local. That said, he too urges a move to the micro with the belief that the macro is less concrete, and for him higher levels of abstraction are problematic inasmuch as they prevent us from appreciating the true—even if ever-elusive—complexity of the world. As such, he too conflates social scale with level of abstraction.

⁽²⁾ Massey (1994) actually called attention to the common erroneous assumption that phenomena at lower geographical scales (the local) can only be particular, specific, and concrete, while the universal, general, and abstract can only be found at higher geographical scales (the global). It is consistent with her argument to transpose this critique to the macro–micro dichotomy.

⁽³⁾ Notable exceptions include Hart's (2002) relational comparison and Burawoy's (Burawoy et al, 2000) global ethnography.

For ANT, power is emergent, while for Marxian analyses, power is always-already given. In my research I have found that power is neither newly produced in every concrete microlevel situation, nor is it determined a priori by macrolevel social relations of production. An important aspect of power is exactly how it manages to traverse scales, and reproduce itself in different concrete situations. ANT makes gestures towards such an understanding when it talks about ‘centers of calculation’, ‘immutable mobiles’, or ‘translation’ but the analysis always remains at the micro level. That is, it does not recognize that once macro dynamics or macro actors emerge from microlevel ones, they can become relatively autonomous from their micro foundations and temporally enduring. As Castree correctly puts it, they may develop an ability to “collect power and condense it” and thereby compel other actors to act as “intermediaries” or act on their behalf (2002, page 141). Their endurance, and their ability to act as intermediaries, is made possible precisely by them being embroiled in new macro configurations.

To conclude: if we abandoned the macro level we would not only leave unanswered these crucial questions about how (macrolevel) power emerges—that ANT implies is a question of paramount social significance—but we would also reduce the importance of the micro level, which would be in direct opposition to the principles and methodological ambitions of ANT. Latour’s insistence on flatness and the denial that macrolevel and microlevel dynamics are qualitatively different is therefore rooted in the confusion of the social scale with the level of abstraction—the same mistaken assumption many sociological case studies are based on. The solution therefore lies not in switching levels of analysis (from macro to micro) but, rather, in switching levels of abstraction: that is, shifting from abstract to concrete.

The world from the perspective of waste

This move to the concrete is all the more pressing when the specific task is to research waste. As I argued above, most macrolevel approaches in this field have appended waste to existing macro concepts with the result of reifying it: that is, treating it as abstraction rather than as always existing in a concrete materiality and in concrete social relationships. The impulse has been deductive: apply our existing political economy or social science conceptual apparatus to discarded materials. It is forgotten that this theoretical apparatus is predicated on the view of the economy as a sphere where value begets value and a view of politics as a struggle for a greater share of wealth. This last assumption has been effectively debunked by Beck’s risk-society thesis (Beck, 1992), in which he argues that political struggles have been more and more about the distribution not of goods but of ‘bads’—that is, environmental and health risks. As of now, however, the former assumption about the nature of the economy still predominates and, I would argue, gets in the way of empirical research. Let me elaborate.

From the perspective of economics, waste is not merely uninteresting but is rendered explicitly invisible or is explained away in theories and models that somehow marginally relate to the topic of waste. The only opening in economics through which waste as a material can be smuggled in is made by the concept of ‘joint production’. The notion of joint production refers to cases in which “several outputs are produced from a single production process”, and cases in which this is technologically determined are referred to as “intrinsic jointness” (Schefold, 1987, page 1030). Usually, it signifies a type of manufacturing process in which, in addition to a main (intended) product, another product is also generated, one that has a secondary importance. For example, when sugar is produced, molasses is also produced. However, all production processes have one or more by-products, whether these have a market value or not. The fact that

economic theories have treated joint production as an exception rather than the rule in itself a telling sign of the extent to which economists make a waste-abundant reality conform to their waste-free theoretical models.

Even more telling about their biases concerning waste is how they proceeded with modeling such ‘exceptional’ cases of production. The main problem that joint production has posed for economists is one of accounting: that is, assigning costs and profits to jointly used resources (labor, raw material, energy, etc). In applying input–output matrices to joint production, economists have made the hypothetical assumption that the secondary product can be treated as a main product of another industry, and thus its costs and profits can be assigned to the appropriate industry as its single (nonjoint) product. When the existence of such an industry cannot be assumed, as is the case with most wastes, modelers introduce a “dummy industry” that “uses *no* input and shows the secondary product as output” (Schefold, 1987, page 1030, my emphasis). Other models treat the secondary products as negative inputs. That is, waste is produced from nothing or less than nothing.

A von Neumann linear model treats by-products as *overproduced* commodities which then “can be disposed of, that is, the prices of these will be zero” (Schefold, 1987, page 1031). Here it is not the input that is zero but, rather, the profit resulting from wastes. But this treatment conflates two types of wastes: waste from overproduction and waste as a concrete by-product. To paraphrase, this model ‘allows for’ recycling and disposal, but it is assumed that both can be done at no expense to the producer or that, at least, those costs need not be added to production costs. In economic terms, therefore, no waste material is produced; waste simply does not exist other than as a tax-like burden on production, as an abstract factor reducing productivity. Indeed, there is no other conclusion to draw if our point of departure is value production.

Even Castree (2002), in his superbly executed theoretical synthesis of Marxism and ANT, starts his argument with the production and realization of value. As I alluded to in my criticism of mainstream economics above, the assumption that the economy is constituted by the production and exchange of intended things reflects the arrogance which ANT so rightly criticizes as the modernist myth: that through rational action, human and social intentions are fully realizable and nature, human bodies, and materials can be molded to our liking given the right science and technology. While some waste can be turned into value in practice, our social science theoretical apparatus sorely lacks the understanding that some materials will be routinely left unrealized—either as use or as exchange value—and that this systemic absent realization has social and ecological consequences. Although in the Marxist sense waste could be assigned a value to the extent that we can theoretically determine the socially necessary labor time invested in the production of discarded goods, effluents, emissions, by-products, and garbage, such a determination has no bearing on the overall conceptualization of the economy in which not only value but also waste circulates and metamorphoses. As long as the point of departure remains the assumption of value production and realization, waste will always be a *theoretical* by-product—residual, epiphenomenal, and inconsequential for the understanding of the social.

A further problem with proceeding this way—that is, starting with models of value production and realization—is an inherent abstraction. As Castree says:

“For value, though real, is strangely intangible and ‘phantom-like’: it is a real abstraction that is qualitatively homogenous and quantitatively determinate but also imperceptible” (2002, page 136).

This inherent abstraction explains why Marxist attempts to theorize the waste–society relationship in capitalism tended to understand waste as inefficiency, lost opportunity

cost, and as the profligate use of resources due to capitalism's inherent tendency towards overproduction—that is, as the opposite of value; and thus, just as phantom like as value tends to be. Baran and Sweezy (1966) for example, argue that in monopoly capitalism, waste results from unabsorbed surplus that materializes in unemployment and unutilized productive capacity. More recent eco-Marxist analysis has analyzed the ecological and material consequences (Foster, 2000; Horton, 1997; O'Connor, 1988; 1989). When we make the two camps speak to each other, what is clearly demonstrated is that one form of waste, that of surplus materializing as unnecessary and unproductive goods (abstract), will turn into material waste (concrete), immensely increasing the burden on nature. Note, however, that this analysis still departs from an abstract model of value production, and cannot account for concrete materiality modifying the effect of capitalist value production on nature.

To summarize our conceptual prerogatives, a theory of the waste–society relationship should (a) operate with a concept of waste that is not deduced from that of value (so the concept of mode of production will not do); (b) recognize the macro as having dynamics qualitatively different and analytically distinct from the micro (so neither will ANT); and (c) treat waste as having a concrete and socially consequential materiality. That is, we need a waste-specific framework that retains the analytical separability of macro and micro, but retains a low level of abstraction. My solution is the concept of 'waste regime'.

Table 1. The relationship between level of analysis and social scale in waste studies.

	Micro	Macro
Concrete	<p><i>In general</i> Actor-network theory Marxist case studies</p> <p><i>In waste scholarship</i> waste work (Reno, 2008; 2009); practices of divestment (Gregson et al, 2007a); managing absence (Hetherington, 2004); arts of transience (Bulkeley and Gregson, 2009); or practices of reuse (O'Brien, 1999)</p>	Waste regimes
Abstract	<p><i>In general</i> (Chicago School)^a</p> <p><i>In waste scholarship</i> waste ethics (Hawkins, 2007)</p>	<p>Classical Marxism</p> <p>Waste governance (Chilvers and Burgess, 2008; Davies, 2008; Fagan, 2004); waste citizenship (Gutberlet, 2008); waste politics (Weinberg et al, 2000); waste flows (Gille, 2006); waste networks (Fagan, 2004); rubbish discourses (Hawkins, 2007); waste public (Hawkins, 2007).</p>

^a Because no one from the Chicago School wrote about waste, or even economic and environmental issues more generally, I cannot expand on my rationale for including it in this particular cell. However, Burawoy's (1991) analysis and contrasting of the Chicago School with the extended case method is the best explanation I have for this placement.

Waste regimes

The concept of waste regime is a macrolevel concept but is concerned with the production, circulation, and transformation of waste as a concrete material. I use the term ‘regime’ to extend Young’s (1982) concept of resource regimes—a specific set of social institutions that determine what natural resources are considered valuable by society, that lay down the principles of valuation, and that resolve the resulting value conflicts. At their core is a structure of rights and rules, which implies a certain distribution of advantages and disadvantages. Social institutions determine what wastes, and not just what resources, are considered valuable by society, and these institutions regulate the production and distribution of waste in empirically tangible ways. Waste regimes differ from each other according to the production, the representation, and the politics of waste. In studying the production of waste we are asking questions such as what social relations determine waste production, and what the material composition of wastes is. When we inquire into the representation of waste, we are asking which side of key dichotomies waste has been identified with, how and why waste’s materiality has been misunderstood, and with what consequences. Also to be investigated here are the key bodies of knowledge and expertise that are mobilized in dealing with wastes. In researching the politics of waste, we are first of all asking whether, or to what extent, waste issues are a subject of public discourse, what is a taboo, what are the tools of policy, who is mobilized to deal with waste issues, and what nonwaste goals do such political instruments serve. Finally, no waste regime is static, thus we must study them dynamically, as they unfold, as they develop unintended consequences and crises.

I must emphasize that the concept of waste regime is a broader and deeper concept than the macro concepts in the literature I referred to above. Whereas they conceptualize how wastes are regulated (modes of governance), accessed (waste citizenship), or distributed (waste networks and flows) *once they are produced*, the concept of waste regime extends attention to the very production of waste and allows us to understand the economic, social, and cultural origins of specific wastes as well as the logic of their generation.

Hungary’s three waste regimes

To demonstrate the relative independence of waste regimes from modes of production, it is useful to focus empirically on a country that has experienced central planning as well as a market economy. In what follows I demonstrate the merits of the concept of waste regime and how it meets the conceptual criteria referred to above by looking at empirical findings gained from my research on Hungary’s socialist and capitalist waste history, from 1945 to the present. Hungary is also a good empirical case study for these purposes because its version of socialism has been quite diverse, having gone from a crude Stalinist command economy to an ever more liberal model, in which the market was simulated, and which has experimented with consumerism. Hungary was also one of the communist countries in which environmentalism gained a wide support in the 1980s, to such an extent that some scholars even credit this with destabilizing the regime. I have identified three waste regimes: the metallic regime (1948–74); the efficiency regime (1975–84); and the chemical regime (1985–present). From 1948 to 1974 planners and workers alike hailed all garbage and by-products as ‘free’ materials to be mobilized for the fulfilment of the plan. In this period the state implemented a vast infrastructure that registered, collected, redistributed, and ordered the reuse both of production and of consumer wastes. Waste was not only seen as use value, but as a particular kind of material as well. Cognitively, it was

always assumed to be like metal scrap: discrete, nontoxic,⁽⁴⁾ and almost infinitely recyclable or reusable. The key agents of this regime were the class-conscious workers and citizens with a keen collective interest who collected and found new uses for production *and* household wastes. Because of this benevolent perception of wastes and by-products the state discouraged and sometimes even outright prohibited dumping, consistently pushing enterprises to find useful purposes for their wastes or at least to store them until such reuse possibilities were discovered. Public discourse concentrated on waste production, and waste liquidation was a taboo.

In a case study in which I followed the story of the toxic by-product of a herbicide, the chemical company's requests for a safe burial ground were repeatedly denied by the authorities. When after seven years a possible site for disposal was found, the ministry still insisted that "the primary goal continues to be the reuse of wastes. The possibility mentioned above [dumping] must be maintained only for wastes that cannot be sold" (BCW, 1975, page 2). As an unintended consequence, however, the policy tools, such as waste quotas, and the concept of waste led to the increased production of waste and to the accumulation of unnecessary, un reusable, and nonrecyclable wastes.

From the second half of the 1970, the efficiency regime became predominant. It was characterized by a monetized concept of waste: waste was seen as a cost of production, and waste reduction and reuse were seen as steps to increase efficiency. Policy tools emphasized the financial motivation of waste producers and included credits, subsidies, and price manipulation. As the 1950s' strict use-value mentality was relaxed, waste liquidation became legitimate. Professionals with economic and technical expertise were encouraged to participate both in achieving goals of waste reduction and reuse and in facilitating safe dumping. In this regime, both waste production and waste distribution were legitimate subjects of public discourse, even if democratic control over waste distribution was still absent and even if disposal and incineration continued to be the less preferred way to deal with wastes. Instead of waste-disposal sites, legislation prioritized temporary waste storage in the hope that uses for the stored wastes would be found. With the worsening economic situation, funds for technological innovation remained unavailable; thus these hopes evaporated, and the temporary and technologically inadequate dumps turned into long-term wastelands. Furthermore, as growth never ceased to be a macroeconomic objective, whatever beneficial effects increases in efficiency had had for absolute waste volumes were offset by increasing production. Preventative attitudes, such as waste reuse and reduction, remained problematic in certain industries, most notably in the chemical industry. Its representatives, along with other professionals, called for legitimate waste-liquidation facilities, with increasing success. They justified their demands with a particular concern for the environment, arguing that the forced preventative attitude to waste problems and the state's continued resistance to end-of-pipe technologies led to illegal and unprofessional waste disposal.

Third, the chemical-waste regime was fully in operation by 1985 and remains so today. In Hungary, from the second half of the 1980s, scientists and engineers, including chemical industry representatives, became prominent in shaping waste policies, and the state eventually abandoned its earlier waste-reduction and waste-reuse projects. Waste liquidation became the primary point on the official agenda of waste politics. The chemical-waste model, in which waste was primarily seen as a useless and even harmful material, became dominant. At the same time, as environmental consciousness strengthened and as the political purchasing power of environmental claims

⁽⁴⁾I am not talking about heavy metals, which are known health hazards, but primarily about iron and steel.

increased, especially in the aftermath of the Chernobyl catastrophe, an environmental movement coalesced around a different politics of waste distribution from that of the chemical industry: one in which residents and activists effectively resisted the siting of many new waste-disposal and incineration facilities. This focus proved convenient for new, increasingly private, economic actors who wanted the state and the public out of the sphere of production. Privatization and the reign of the chemical-waste model had rendered waste production—the generation of toxic substances, source reduction, reuse, and recycling—a taboo of waste politics. As a result, policies now concentrated on end-of-pipe technologies, rather than on production-centered preventative solutions. This trend was also strengthened by the increasing exports of waste-treatment facilities from the West to Eastern Europe. Through the synergy between the chemical-waste regime and marketization the waste-recycling infrastructure was demolished, ushering in a throwaway society for the first time in Hungary's history.

Waste regimes versus liberal views and modes of production

What would Marxist and liberal approaches say about this history, given that some of these transformations in the waste–society relationship occurred without a change in the dominant form of ownership? State socialism witnessed three different waste epochs, and the most radical political and legal transformation—the end of state ownership and central planning in 1989—did not initiate, but merely corroborated or ‘collaborated with’ the already-existing chemical-waste paradigm. The Marxist and the liberal approaches, both of which single out the dominant property form as the key determinant of the nature of society and its relationship with the environment, would most likely explain away the internal fissures and nuances of state socialism, insisting on the relative seamlessness and internal cohesion both of socialism and of capitalism. They would argue for one dominant waste–society relationship in state socialism—perhaps the one that characterized the metallic period—and would downgrade the efficiency and chemical paradigms to ideological manifestations of a crisis preceding the collapse of communism—the ‘really significant change’. Liberals may continue to argue that all three periods were just desperate efforts to make up for the absence of market mechanisms that in capitalism allegedly perform beneficial functions in waste management (Desrochers and Ikeda, 2003).

Neither, however, could explain policy makers' resistance to disposal and the chemical industry's inability to fit into the metallic and efficiency paradigms, and the subsequent piling up of toxic by-products in factory yards and lands ‘with zero value’ in a haphazard and hazardous fashion. In my analysis these developments, or unintended consequences, however, had less to do with ownership and economic interests, and more to do with materiality, culture, and knowledge. Let me elaborate.

Clearly, the fact that metal scrap was abundantly available in the aftermath of World War II, and the fact that engineering, and steel and iron manufacturing were the most strategically significant and thus the most rapidly growing industries in this period, helped solidify the misrecognition of waste as metallic—discrete, nontoxic, and almost infinitely recyclable or reusable. There were, however, also important cultural, ideological, and cognitive reasons for this dominant identification. Skilled workers employed in steel and iron smelting and engineering had always been among the best organized and were considered by communist leaders as the most ideologically reliable. In these industries the production process was also more ‘Taylorizable’ and thus more easily enrolled in work competitions aimed at the ever-faster fulfilment of the plan. In contrast, in the chemical industry, workers had much less control over production: their jobs consisted mostly of monitoring the chemical and biological processes, that were not amenable to change by individual workers. Here production volumes and the general

success of the technology depended more on design, and that was the exclusive domain of engineers and the technical intelligentsia. This was also the least-understood industry for Communist Party elites, most of whom had little education (in the early 1950s few had had more than six years of schooling) and whose work experience was restricted to the metal-manufacturing or metal-processing industries (Department of Party and Mass Organizations of the Political Committee of the Budapest Party Committee, 1952; 1954). Their suspicion of the unknown, and the strong base of technical intelligentsia in chemical companies, sustained the Party's distrust of chemical companies and their view that they harbored bourgeois and fascist remnants—even at the end of the 1950s.

Neither could chemical companies apply the 'metallic attitude' to their wastes, since their by-products tend to be generated from irreversible processes (Blauener, 1967)—rendering reuse and recycling quotas hard to fulfill. This is not to suggest that reuse and recycling are impossible in the chemical industry. In fact, many of the nominations for material savings awards in the 1950s came from pharmaceutical enterprises. However, because these savings were built into the production technology, and it was thus hard to determine where the conscious intervention of workers started and where the technological design ended, the party-state repeatedly shunned these companies in its awarding practices (Report. Department of State Economy of MDP. October 30. No document number. Fonds. 276. Group 116. Preservation unit 40, 138)

Furthermore, chemical wastes tend to be toxic which makes their storage—until some time in the future when reuse possibilities are discovered—an ecologically hazardous practice. Later, the efficiency paradigm was also harder to apply since chemical production processes rely on objective chemical laws, requiring equivalences and parameters that must remain within fairly narrow margins. In fact, forcing the metallic and efficiency mold on chemical wastes not only failed to produce the desired results in reuse and recycling that engineering and steel manufacturing regularly achieved but, because of the prohibition of dumping, had the unintended consequences of leaving behind decades' worth of toxic by-products that slowly but surely leaked into and contaminated their surroundings, the soil, and groundwater. It seems, therefore, that culture, knowledge, and materiality as well as their interaction played as significant a role in the actual tangible outcomes of waste policies and practices as did the relations of production or ownership.

Waste regimes versus actor networks

How would ANT explain the variation of waste paradigms in state socialism? Unlike Marxists, who have generally argued that capitalism as a mode of production erases its origins—cultural as well as material (Burawoy, 2001)—they might point out that the face of existing state socialism familiar to us owes much to early socialism's heavy reliance on coal, iron, and steel—a reliance that was physical, cultural, and political in equal parts. The microlevel characteristics of metallurgy and metal processing had historically afforded more control over production to blue-collar workers, whose control made threats of slowing down the pace of work a real one but also allowed communication on the shop floor. This was an important factor in blue-collar workers becoming among the best organized segments of the labor movement in many parts of the world in the 19th and 20th centuries. Had the chemical industry or, let us say, forestry been as strategic an economic sector after World War II, or had they been more important sites of the labor movement, it is possible that we could have ended up with a greater political role attributed to intellectuals or to peasants, a different model of managing the economy, and a different understanding of wastes. However, just as in Pickering's case of the emergence of 'big science' in ANT or manglish understanding of Hungary's waste history, there is no theoretical room to discern whether these

macrolevel dynamics are qualitatively different from those at the micro level. It is one thing for 19th-century workers in the engineering and steel industry to exert control over the production process and thus increase their social agency (macro emerging from micro), but quite another for the communist elite in 1950s Hungary to use that history as an ideological justification for its authoritarian ignorance of the technological limits on the rationalization of work and material use in the chemical industry (a new, deferred macro impinging on a new micro).

Waste as constitutive of the social

How does the waste-regime concept demonstrate that waste is not a residue of but constitutive of the social? First, East-European socialist countries relied extremely heavily on metals, not only in the material sense—due to postwar reconstruction and Cold War rearmament—but also, as I argued above, in a symbolic—ideological sense. Such historical circumstances not only rendered metals as a key material battlefield in the building of communism, but also made metal scrap the largest and the most visible form of production waste in most of state socialist history. Second, the materiality of waste placed a limit on its classification and spatialization. Due to the ‘metallic’ concept of waste, wastes and by-products were seen in a positive light as an easily available resource; this leads to a spatialization practice that was about storage and not disposal. Third, the materiality of waste was usually ‘clouded’ by culture: by insufficient knowledge of the materials in use and/or by the ideologies, metaphors, norms, and values. In socialist Hungary the earlier predominance of metal scrap among all waste materials and the lack of familiarity with the new chemical industries made policy makers blind to the differences between metal and chemical by-products. Consequently, they demanded that synthetic by-products be stored, reused, and recycled with the same results as metal scrap had. Fourth, such misrecognition and ‘malpractice’ caused things to “bite back” (Tenner, 1996) and the unintended consequences then limited and modified ‘purely social’ relations and institutions. The treatment of chemical wastes as if they were metallic by-products led to ecological disasters in Hungary. Fifth, the ticking time bombs of chemical by-product storage sites fashioned environmentalists’ and capitalist-era policy makers’ vision of modern waste management. Sixth and last, the processes by which waste metamorphosed from one form to another also exhibit a unique dance of agency between waste and the social that can be captured by waste’s temporality. This is what I turn to next.

Temporal dynamics

Although we increasingly accept that ‘useless outputs’ are also produced out of useful inputs, we have not understood properly how certain ‘useless’ things turn into other useless ones. As mentioned above, in addition to the circulation of value we also find in any economy a circulation of waste. This is no simple circulation of the same waste, however. Rather, as I demonstrate below, it is a circulation in which one form of waste metamorphoses into another form.

Synthesizing Hungarian economist Kornai’s (1980) definition of “really existing” central planning as a resource-constrained economy, and Filtzer’s (1992) and Ticktin’s (1992) analysis of waste as a central systemic feature of the Soviet economy, we can describe the mechanisms by which one form of waste metamorphosed into another. The tightness of the plans and the sanctions associated with their nonfulfilment forced enterprises to develop several survival strategies—primarily hoarding, substituting inputs, and hiding capacities. Each of these systemically reproduced shortage and waste. As plans could not be fulfilled because of shortage in one or more inputs, available inputs were transformed into what Kornai calls “slack”. The slack that could not be mobilized in a later plan period or in another production process within the

same plant became waste. This waste is a broader category than what Kornai calls “bad slack”—unmobilizable slack due to shortages in other inputs—because it also includes “good slack” that in the process of storage lost its qualities: it rusted, rotted, broke, or evaporated. That is, its materiality rendered this abstract economic concept of waste a concrete form of trash.

Furthermore, there are far-reaching effects of retaining rather than discarding deficient products. In socialism a defective product had to be kept in use because of shortages, but the use of this product incurred further costs; that is, it absorbed resources that were not in surplus to begin with. Filtzer distinguishes among the following concrete forms of waste—lost work time, the duplication of labor, overconsumption of raw materials, incomplete production, physical loss of materials, and defective production—and presents them as interconnected stages of production. The prevalence of defective materials and equipment forces workers to spend their work time rectifying these problems—changing the size of input materials, searching out tools and parts to fix machines—and these efforts necessitate the use of more raw materials than the technological specifications require. In addition, some products may not be completed due to the missing or defective materials and loss of work time, and have a strong likelihood of turning into wastes. These diverse forms of waste snowball not only throughout a production process but also through the entire economy.

To summarize, it is not simply that waste is a systemic outcome of central planning but that its presence and metamorphoses create social relations, social institutions, and a certain material culture that we accept today as the ‘purely social’ features of state socialism in Eastern Europe. This discussion of the temporal dynamics of waste also demonstrates how macro and micro are connected while each manifesting unique dynamics not reducible to each other.

Another aspect of temporal dynamics is how and why there is a shift from one waste regime to another. The relationship of each regime to the others is not simply one of succession, let alone progression. The characteristics and the crisis tendencies of a particular regime may impact a later regime; one may refer to these connections as ‘residual characteristics’—borrowing from Williams (1973). For example, the shortcomings of the use-value mentality that characterized the first regime still affected and limited policies in the second, efficiency regime. On the other hand, the roots of the next regime are likely extant in the present one. For example, the chemical-waste model emerged and was already supported by a large number of industry experts in the early 1980s—in a regime in which the efficiency model was dominant. These we may call ‘emergent characteristics’. Again, it is important to see that, although in any particular microlevel case the dynamics and connections among actors could remain unchanged, once the new hegemonic regime is in place; that is, once the macrolevel context has been transformed, the political evaluation and the economic efficacy of that assemblage may shift—with the possible effect ultimately of changing the microlevel assemblage itself.

Conclusion

In concluding I call attention to new directions for future research. First, as developed here, a waste regime is still bounded within the nation-state. I alluded to the role of neoliberal forces as well as Western environmental discourses and technologies (such as incinerators) in shaping Hungary’s waste history. As I have analyzed elsewhere (Gille, 2007), the increasing connectivity of the Hungarian economy and the links which Hungarian chemical engineers cultivated with foreign experts created a strong push for the chemical regime. I have also called attention to the effects of supranational regulatory frameworks, such as the European Union and various environmental

treaties, on recent developments in waste practices in Hungary. Nevertheless, more research is needed to analyze how the production, representation, and the politics of waste all leech across national borders; and we need a more nuanced understanding of how local and national waste actors and practices deflect or use global ones, rather than simply assuming that the global impinges on the local and national. As the production, circulation, and transformation of waste become increasingly complex materially, so too they do socially. Waste regimes are a modest first step in theorizing, rather than simplifying, that complexity.

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