# Transdisciplinary Engagements with Waste and Energy

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## Abstract

As humans continue to produce and consume ever more, how we think about waste has important implications for the planet and ourselves. Mounting concerns over climate change, air and water pollution, and energy supply have led to an increased interest in waste-to-energy technologies as a potential source of sustainable alternatives to fossil fuels. Waste-to-energy technologies could transform the waste problem into an energy solution, yet the social implications of these emerging technologies remain notably under-examined. For example, little is known about how different waste-to-energy initiatives may impact public perceptions of waste. When waste becomes a resource, does it change how people think about and produce waste? Although energy recovery from municipal waste is a relatively new development, in ecosystems nothing is truly wasted as matter and energy are cycled between different groups of organisms: the concept of waste is relative. In this paper, I explore the sociology of waste, discussing the multiple ways in which waste management technology and policy matters beyond more commonly examined technical, environmental or economic aspects. I will discuss various ways in which waste management decisions affect human relations with the natural (nonhuman) world and intersect with broader societal waste regimes.

*Keywords*: transdisciplinarity, waste-to-energy, classification, material cultures, waste regimes, nature/culture dualis m

> "*When you think about where your waste goes, your world starts to shrink*"
> (Morton 2007, 1)

## 1 Introduction

There is no final ending to the story of matter and there is no absolute meaning of waste. Just as there are roughly 28 billion atoms of Shakespeare's excrement in each of us[1], some of the iron in our blood once belonged to shards of broken pottery – the 'trash' of ancient Greece. In both ecosystems and society, matter shifts into and out of the category of 'waste', and the boundaries of the category itself also shift and change over time. Jars and tins which today move quickly to

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[1] Jupiter Scientific 2004. An Estimate of the Number of Shakespeare's Atoms in a Living Human Being. Retrieved from http://www.jupiterscientific.org/review/shnecal.html February 3, 2011.

the recycling bin would once have been carefully saved and reused. Just as there is no absolute meaning of dirt, which is "matter out of place" (Douglas 1966, 44), waste is only waste when it is demarcated as useless, spent, or undesired. But waste always reserves the potential for transformation and reincorporation into cycles of use and value. In ecosystems, matter, nutrients and energy cycle between different groups of organisms. What is waste at one trophic level in the food chain is necessary input for another; life itself is a planetary system of cyclical building up and breaking down of complex organic molecules. So too is our own municipal waste already teeming with microbes busy metabolizing its carbohydrates, proteins and lipids, using the released energy for growth while leaving their own waste products for the next trophic level to metabolize. Under the right aerobic conditions this process results in the conversion of organic matter to $CO_2$ and hydrogen, or alternatively under anaerobic conditions, methane. Increasingly, municipalities are harnessing this potential in composting facilities and bioenergy production systems. Furthermore, modern biological and thermal waste-to-energy (WTE) technologies allow the transformation of inorganic waste into usable forms of energy.

Waste inhabits the medial spaces between what is desired and what is possible. As waste continues to be transformed, both materially as physical matter moving through systems, and discursively through language and meaning, it is important to understand how these transformations are shaped and are shaping how we think about, and act with, waste. Is waste an environmental problem or a social problem? Is it an economic problem or a municipal problem? Is it a personal problem or a political problem? At its core, the question of waste draws us into an examination of the complex relations between humans and nonhuman nature. Municipal waste is a material point of intersection between our private lives and public sector concerns related to health and environment. These intersections are mediated in material form via the garbage can (Chappells and Shove 1999), a visible trace of our private lives made public at the curb (O'Brien 1999). It is necessary to look expansively at the material and the social, the individual and the institutional, scientific and technological developments as well as everyday individual practices, as all are mutually implicated and inseparably part of one system of waste and potential.

Because problems such as the generation and management of waste are complex and multi-dimensional, they regularly exceed the grasp of the boundaries of any single disciplinary framework. On one hand we can view waste as a challenge that calls on a variety of disciplines and sectors to work together, for example through conferences or colloquia. This could be called the multidisciplinarity of waste. Multidisciplinarity juxtaposes the theoretical models of various disciplines in ways that produce a complementary understanding of the object of study from a plurality of viewpoints (Ramadier 2004). However, a lack of shared understanding among those involved may persist. Other times, two or more disciplines must work in close cooperation to meet one of the challenges waste poses, such as when microbiologists and chemical engineers work collaboratively on anaerobic digester design, or city managers work with engineers in charge of sorting recyclables. This could be called the interdisciplinarity of waste. In interdisciplinary work a common model is constructed through dialogue between the disciplines involved (Ramadier 2004). It is most commonly seen among closely related disciplines, within the natural and applied sciences, or within the social sciences or the humanities. A third way that waste challenges disciplinarity most directly is what I will call the transdisciplinarity of waste. Rather than spanning a number of disciplines, here waste calls into question the division of these disciplines in the first place.

I will argue that to fully comprehend the question of waste and society requires a transdisciplinary approach. Transdisciplinary knowledge transverses and transgresses the boundaries between disciplines and between academics, policy makers, practitioners, technicians and the public. Transdisciplinarity addresses the inherent complexity, non-linearity and heterogeneity of the human and nonhuman world by taking a more holistic view than the typically fragmented understandings that modern systems of knowledge production provide. The failure of specialization and expert knowledge to place specific knowledges in full societal context can lead to an "applicability gap" (Lawrence and Després 2004, 398) where disjuncture between technical knowledge and translation into real-world contexts become evident. Transdisciplinarity is problem-based and action-oriented, aiming at increased accountability while contributing to solutions (Thompson Klein 2004). It brings together knowledge not only across academic disciplines but also puts academic knowledge into dialogue with professional, technical, policy-based and lay knowledge (Lawrence and Després 2004). Ramadier (2004) suggests that rather than seeking consensus between different perspectives, transdisciplinary research looks for the articulations between viewpoints. Whereas both multi- and interdisciplinarity avoid paradoxes and do not question the mode of disciplinary thought, transdisciplinarity differs by embracing the generative nature of paradoxes (Ramadier 2004). The existence of paradoxes is taken as an indicator of different levels of reality, and dualities are seen not as binaries but as points on a continuum (Wickson et al. 2006). While disciplinary knowledge seeks to understand complex objects of study through simplification and a generally reductionist approach, transdisciplinarity seeks not a unity of knowledge that would collapse complexity, but a coherence of knowledge that embraces reality as many-layered and multidimensional (Ramadier 2004). The knowledge that results is "more than the sum of its disciplinary components" (Lawrence and Després 2004).

Most transdisciplinary work has been done within the physical sciences, and full engagement between the natural and social sciences and the humanities is rare (Horlick-Jones and Sime 2004). But waste research must go further. Because of the boundary defying tendencies of waste, transdisciplinary engagements with waste need to span the social, physical and applied sciences and the humanities, as well as engaging with political, institutional and public life. The very existence of garbage in society draws our attention to the complex mix of material and social practices that create this phenomenon. As we have increasingly removed ourselves from natural cycles, modern waste management systems have acted to render waste as "matter out of sight", at the end of commodity chains, the residual of better-studied systems of production and consumption (Gregson 2007). As a result it has been largely ignored by disciplines such as sociology, although the social element of waste production is significant: "wasting is, in its own right, a social process" (O'Brien 1999, 275). It is not just how we think about waste, but how we *act* with waste that matters. Waste generation, waste management and waste disposal/transformation are intimately interrelated, both materially and discursively. Why is our garbage so problematic and how might thinking about it differently shape future visions of how we relate to the nonhuman world? In this paper I will touch on some themes that intersect the numerous facets of this amorphous category of 'waste', focusing mainly on municipal solid waste, and the human-nature relations and environmental discourses it informs and is informed by. I begin with a discussion of the very process of classification that defines waste in the first place.

## 2 Sorting: the Classification of Waste

Waste transcends boundaries of nature and culture. It is never a final state, but is always in the process of becoming. In her classic work on taboo and cleanliness, *Purity and Danger*, Mary Douglas discusses how we come to classify some things as dirty or impure. Waste lies on the margins of our psychology and society, both part of us and defined through our rejection of it. It is connected to our sense of self and invokes feelings of both guilt and virtue (Hawkins 2001); we physically relegate it to landfills at the edges of cities, where the impure is banished and abhorred (Douglas 1966). We create garbage through a process of cleaning and sorting wanted from unwanted. Garbage strewn around a house or yard is viewed as dirty, but once secured in a bin, the threat it poses to order is overcome; mess becomes trash, recycling or compost. At the curb, at waste management centres and sorting stations, and at recycling and composting facilities, the sorting process continues as humans and machines tackle the heterogeneity of municipal waste, purifying it into its component metals and fibres, digesting organic matter into pathogen-free compost and re-processing plastics into items society once again deems useful. The residual of these sorting practices, what cannot be purified through classification, is left for the landfill. Or is it? With emerging thermal WTE technologies, even these reticent residuals may be transformed, for example into syngas.

As Foucault (1970) has discussed at length, how we categorize, understand and order things is neither given nor fixed. It could always be otherwise, and usually it once was. How we create waste is historically contingent, as is how we deal with it. Before there was an easy way of disposing of garbage, people found resourceful ways of diverting items back into use (Strasser 1999). But with the normalization of landfilling dominated by the "logic of (apparent) disposal" (Bulkeley and Gregson 2009, 931), a new classification of waste as 'garbage' was created (Anderson 2010). Arguing that "dustbin technologies provide a revealing indicator of waste relationships within society", Chappells and Shove (1999, 267) trace the evolution of garbage collection in the UK, from its inception in response to the decline of at-home trash-burning, through various designs linked to shifting waste regimes, to the current situation of multiple recycling and composting bins. There is no one 'waste' or 'garbage' that is clearly definable, yet the category does a good deal of work in society in articulating and classifying certain things as wanted and others as problematic. Emphasizing this heterogeneity is the increasing complexity of sorting practices, in which "we are exhorted to work on and with things and materials in their discarding, to clean them, to evaluate the substances absent and present in things, to separate materials out, and to store them for increasingly complex collection services that are themselves choreographed around materials difference." (Bulkeley and Gregson 2009, 929). The changing practices of sorting and classification involve significant changes in people's daily domestic practices, intersecting with changing norms surrounding values of comfort and convenience (Shove 2003). The materiality of waste classification acts to entrench the discourses and epistemes that Foucault identified as shaping how we live in the world (Bowker and Star 1990), but as waste itself symbolizes, nothing is permanent.

## 3    Waste, Households and Consumption

Social research on waste has traditionally focused on attitudes and behaviours regarding household-waste management (e.g. Bar, Gilg and Ford 2001; Tucker and Speirs 2003), ignoring larger societal networks of technology, waste and energy. This differs from practice-oriented models derived from research on consumption that examine what people actually do, and a common theme in transdisciplinary engagements with waste has been to explore consumption and material cultures (O'Brien 1999; Strasser 1999; Shove 2003; Shove et al 2007; Bulkeley and Gregson 2009). A growing trend in this literature investigates the generation of household waste not as a separate realm or residual of consumption, but as a problem that must be tackled as part of broader changes in consumer culture, tying waste reduction to the "extension of the social, cultural, and economic lives of things (and materials)" (Bulkeley and Gregson 2009, 930).

Another term for garbage is 'refuse'; it is quite literally that which we refuse. Yet it is actually our choices of acceptance, to buy things that are disposable, ephemeral in use-value, excessively packaged and often unneeded in the first place, that create much of our garbage. The history of modern garbage disposal is telling. Coordinated municipal waste management practices arose in both Europe and North America in the late 19th century in response to concerns over public health. However, it was not until the rise of mass production and consumption and manufactured obsolescence, combined with the increasing demand for convenience, that garbage production really exploded (O'Brien 1999; Strasser 1999; and Shove 2003; Gregson 2007). Sociologists such as Elizabeth Shove (2003) examine the hidden practices that underlie daily life, and how what is considered "normal" shifts and changes over time. What people throw out can tell us much about culture, norms, social habits and economics. It is not difficult to understand how the currently dominant societal desires for convenience and cleanliness (Shove 2003) pair to produce much waste. The sheer volume that North Americans throw out also makes a shocking economic statement. In Canada, consumer behaviour accounts for half of all food waste (more than 600 million tons) (Felfel 2011). According to Paul Hawken (1997), the Western capitalist economy is based not on production of goods but on production of waste, with an overall material and energy efficiency of only 1 or 2 percent. In fact, the majority of resources we extract from the environment become waste within months (Ayres 2008); very little that we create is durable, save perhaps our garbage itself, which can remain a surprisingly well-preserved record of our lives for decades or even centuries (Rathje and Murphy 1992).

Besides the importance of looking at how consumer culture shapes household waste production, Bulkeley and Gregson (2009, 930) also warn against subsuming households within the "spatialities and temporalities of collection services… [that] ignore that waste collection is a situated practice, enacted through many conduits outside of the immediate waste-policy realm". Based on practice-oriented ethnographic work on household waste management practices, Bulkeley and Gregson (2009) identify important intersections between socio-economic class and spatial circumstances that impede recycling uptake, such as lack of space outside the home for multiple bins and a desire to maintain order within the home. Furthermore, recycling stored outside can easily become litter as it escapes bins by various means, making the neighbourhood appear untidy and unkempt. Following Douglas, we could say that by escaping its classification, recycling "out of place" becomes litter, a category of matter that invokes annoyance and revulsion rather than virtue.

Although we have come a long way from the careful stewardship of materials practiced until the mid-twentieth century described by Strasser (1999), larger items of value continue to cycle through various channels of formal and informal second-hand exchange, which could be strengthened and supported by waste-diversion programs (Bulkeley and Gregson 2009). However, as Bulkeley and Gregson (2009) review, there are certain events that create such excess that the aforementioned "arts of transience" that take an extra amount of care and effort are abandoned in favour of more expedient means of ridding the home of the excess waste. The primary generators of excess are removals, household clearance following the death of the resident, and home renovations, though Christmas and parties are also significant waste generators (Bulkeley and Gregson 2009). The challenge of the "lumpiness" that such events generate is felt by waste management infrastructures that are typically based on the assumption of a steady flow of materials. Bulkeley and Gregson (2009) suggest one way of addressing household waste generation is increased recognition of "lumpy" spatial-temporal dynamics: "This would entail working with a range of partners who are currently outside of mainstream waste policy, including, for example, estate agents, universities, auctioneers, and house-clearance specialists, as well as coordinating with voluntary-sector organisations collecting furniture and other household goods for reuse." (Bulkeley and Gregson 2009, 942). Even at this single level of the story of waste, household waste production, many different disciplines and sectors need to be involved to get a complete picture of the underlying forces and factors. Next I turn to another level at which waste can be understood: the technologies of waste management and WTE transformation.

## 4    Technological Transformations of Matter to Energy

As waste management policy has shifted from economically efficient disposal to management of the risks of waste, diversion from landfills into recycling and composting has become a major policy focus, but diversion and prevention/reduction of waste can produce conflicting policy goals (Bulkeley and Gregson 2009). The movement toward conversion of waste into energy further complicates this picture. There is mounting concern that building infrastructures to turn waste into a resource may decrease incentives for waste reduction, recycling and composting (Gold 2008). Yet as discussed previously, waste is always in a state of becoming, and waste management has always been about transformation: "treatment technologies are not, in material terms, disposal technologies as they are presented but rather transformative technologies and storage/containment technologies" (Gregson and Crang 2010, 1029). Transdisciplinary research calls us to engage not only with the social aspects of waste generation, but also with the science and technologies of waste processing and management.

Science and society develop and in a co-evolutionary manner (Nowotny 2008). This two-way process of influence and knowledge-sharing means that how science develops will have far-reaching impacts in society, and societal, cultural and political trends will impact science. As discussed in the previous section, ethnographies of household waste production have been very useful in revealing hidden realities of how we produce waste. In a similar fashion, more ethnographic work on waste management systems and technologies may uncover important information about how the science and technologies of waste management are shaping society's waste relations. Contrary to popular mythology, science is not value-free, and we continue to treat it as though it were at our peril. Social order and natural order are constantly co-producing one another (Jasanoff 2004) via complex networks and assemblages of actors that include both

humans and the nonhuman world (Latour 1987; Haraway 1997). In examining the phrase "science is politics pursued by other means", Latour (1983) discusses how the point should not be to disparage science by placing it at the level of politics, but to become curious about what these "other means", evidently powerful, are. These "other means" are the nonhuman actors, the objects around which assemblages of knowledge production and decision-making form (Latour 2005). The category of 'waste' homogenizes something that is inherently indeterminate and multiple. It is composed of both organic and inorganic matter, a heterogeneous mix of natural and artificial, with varied properties that call for different technological waste-to-energy responses; some waste streams are better suited to anaerobic digestion, gasification, plasma-arc processes, and so on. How we classify things shape the things themselves, but the matter that we classify also shapes how our classification systems develop. Rather than a one-way "projection of the social onto the natural", classification works through the "coconstruction of nature and society" (Bowker and Star 1999, 61). The material infrastructures of our classification schemes, the process technologies and collection systems of waste management, as well as the waste itself, play an integral role in determining the outcome.

Just as there is a political element to marking something as waste, there is also an emerging politics of reclaiming waste into energy cycles through WTE technologies.

Waste management technologies act to stabilize and normalize certain ways of thinking about waste while excluding other possibilities (Gregson and Crang 2010). Bringing waste back in to the boundaries of acceptance and reintegrating it into cycles of value can be seen as an important step in shifting our relationship with the nonhuman elements of our lives and society. As discussed in previous sections, the category of 'garbage' is a cultural construction and it need not be a final endpoint. Because what is waste today may not be waste tomorrow, emerging and evolving through complex interrelations between the material and the discursive, the natural and the social, it is important that we pay attention to both the materiality and the social construction of waste (Gregson and Crang 2010). When classifications are really effective, they become invisible, converging with reality and leaving us blind to how things came to be this way: "this blindness occurs by changing the world such that the system's description of reality becomes true" (Bowker and Star 1999, 49). Whereas "reliable knowledge" is generally evaluated by whether it *works*, "robust knowledge" is relational, depending heavily on the societal context *within which* it must work (Nowotny 2008, 4). This requires moving beyond the application of knowledge to thinking about the broader implications of how we frame research problems and view issues (Nowotny 2008). How we approach waste management and landfill diversion, whether focusing on reduction, recycling, composting, energy production or a combination of these options, will have effects that reach beyond the simple question of what happens to our waste. It is thus important to consider how emerging WTE technologies might interact with broader societal beliefs and practices surrounding waste. As garbage shifts from matter to energy, transdisciplinary analysis can help to assess what these possibilities might be. I end with a discussion of one possible transformation that waste-to-energy technology might be implicated in, this time focusing on the level of societal worldviews.

## 5    Living in the Wastelands

"Ecological politics is bound up with what to do with pollution, miasma, slime: things that glisten, schlup, and decay" (Morton 2007, 159).

Try as we might, out of sight is not necessarily out of mind; after a century of banishing our heterogeneously impure, unwanted waste to the boundaries of society, it is becoming harder and harder to ignore the immense buildup of global garbage (Hawkins 2001). We see it blowing about on the streets as litter; city residents smell it piling up in local parks during garbage strikes[2]; plastic bags and bottles clog the beaches and bird intestines of distant islands[3]; and municipalities face challenges of "not in my backyard" and environmental justice in the placement of new landfills (Lober and Green 1994; Pellow 2004). Waste represents excess, an exceeding of our boundaries both materially and perhaps also ethically (Hawkins 2001). Zygmunt Bauman (2007, 29) argues that our current situation is one in which the planet is "choking on its own waste products" produced by the modern capitalist system which can "neither reassimilate or annihilate, nor detoxify" the waste it produces. Drawing from Marx, he connects capitalism's tendency to create wastelands, with our treatment of the planet as well as how we treat other humans such as refugees and the unemployed. In fact, it can be argued that all aspects of our world are increasingly 'messy': climate change, deforestation, industrial pollution, nuclear radioactivity, and ever-growing human populations all confound modernity's drive toward simplification and purification of categories. Despite the attempts of modernity to classify and separate humans from nature, we continue to live in an impure world of hybrid forms (Latour 1993). In such a case, "what does one do with the leakiness of the world?" (Morton 2007, 159).

Environmental problems are always in part human problems. In fact, it can be argued that the very concept of "the environment" is *part* of the problem, emerging at "exactly the moment when it [the environment] became a problem" (Morton 2007, 141). This concept remains problematic, as "in a society that took care of its surroundings in a more comprehensive sense, our idea of environment would have withered away" (Morton 2007, 141). In a world where ideas of pristine nature are increasingly untenable, perhaps we must work from where we *are*, in order to have a chance at achieving positive changes. Modernity has seen the rise of what Andrew Pickering (2005) identifies as the Mondrian way of being, after the painter Piet Mondrian's signature style of a black on white grid coloured in red, yellow and blue. Everything is carefully planned and ordered, and boundaries rigidly patrolled. Alternatively, we might accept the indeterminacy and flow of what Pickering characterizes as the de Kooning way of being, after the abstract painter Willem de Kooning, whose style embodies an active and evolving relationship between artist and canvas. Similar to Pickering's discussion of de Kooning, Félix Guattari (2000, 52) discusses how an emerging new "eco-logic" resists resolution into binaries such as natural and artificial, and instead "resembles the manner in which an artist may be led to alter his work after the intrusion of some accidental detail, an event-incident that suddenly makes his initial project bifurcate, making it drift far from its previous path, however certain it had once appeared to be." He thus invites us to take a step back from always trying to return to a state

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[2] George Tulcsik. Photo taken on July 5, 2009. Toronto garbage strike - June/July 2009 - Christie Pits. Retrieved from http://www.flickr.com/photos/35458915@N08/3693067868/ February 3, 2011.

[3] Chris Jordan. 2009. Midway: Message from the Gyre. Retrieved from http://www.chrisjordan.com/gallery/midway February 27, 2011.

prior to our mistakes and thereby fighting what is now, and instead work from where we are, with what is here. Rather than yearning for a return to the 'good old days', Morton likewise suggests that we become "nostalgic for the future, helping people figure out that the ecological 'paradise' has not occurred yet" (2007, 162). Morton illustrates the pragmatic reality and necessity of this approach by quoting from Coleridge's *The Rime of the Ancient Mariner*, who is left "Alone, alone, all, all alone" yet "a thousand thousand slimy things/ Lived on; and so did I" (quoted in Morton 2007, 157).

Cronon (1998) argues that the romantic idea of an uncontaminated 'nature' free of human influence prevents us from clearly dealing with the ways in which our daily actions are harming the environment. Although we live mostly urban lives in an industrialized society, the romantic notion that a wilderness "out there" is our true home permits us to "evade responsibility for the lives we actually lead", leaving ourselves "little hope of discovering what an ethical, sustainable, honorable human place in nature might actually look like" (Cronon 1996, 17). If we continue to define nature, wilderness, and what is worth saving as those places in which we are not, we leave ourselves and the planet very few options; if where we live will by definition never be 'wild', perhaps it is time to rethink how we conceptualize and value nature, starting with the nature that is actually all around us, in our cities, our bodies, even our waste. Similarly, Morton (2007) confronts the need to see humans as part of nature for there to be any hope either for us or for "the environment" in which we are supposedly embedded. Rather than elevate the natural to a pristine category of 'other-than-human', inherently separate from us, Cronon argues for an ethics of awareness and response to the pragmatics of our current condition: "If living in history means that we cannot help leaving marks on a fallen world, then the dilemma we face is to decide what kinds of marks we wish to leave" (Cronon 1996, 23). As we do indeed live "in the thick of things" (Pickering 2005), perhaps the "only ethical response is to muck in" (Morton 2007, 13).

Contrary to the nature writing critiqued by Morton (2007) that reinforces the nature-culture binary, poetry about garbage has investigated the borders between human and nonhuman, artificial and natural, growth and decay, material and spiritual, ephemeral and permanent, challenging us to see garbage as a "site of self-reflection" and an "unexpected emblem of spiritual and ecological renewal" (Anderson 2010, 37). Contemplating our waste forces us to face the impermanence of things and even ourselves. Yet there is also redemption possible in the reintegration of waste into energy cycles:

> "Compost is our future.
> The turgid brown mountain
> steams, releasing
> the devil's own methane vapor,
> cooking our castoffs so that from
> our spatterings and embarrassments—
> cat vomit, macerated mice,
> rotten squash, burst berries,
> a mare's placenta, failed melons,
> dog hair, hoof pairings—arises
> a rapture of blackest humus."
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> (Kumin, Maxine. "The Brown Mountain." *The Long Marriage*. New York:
> Norton, 2002. 35–36. Quoted in Anderson 2010)

Waste-to-energy initiatives parallel this shift in perspective in a technological and institutional way, materially reimagining the substance of waste and our relationship with it. How we think about waste and the waste relations we enter into transcend boundaries of human and nonhuman. As we get better at accepting where we are at and finding ways of transforming problems into constructive solutions rather than burying and denying our waste in landfills, this attitude could help us to face other consequences of our current economic and political systems more constructively as well.

The transformation of waste can be transformative. Our categorizations are viscous, and boundaries indeterminate. We are therefore called to take epistemic responsibility for the types of relationships we enter into, which subsequently become materially entrenched (Code 2006, Tuana 2008). Douglas (1966) discusses how disorder is creative and full of potentiality not yet realized. The disorder and heterogeneity of garbage simultaneously threatens order and pattern and also provides the starting material for the creation of new patterns. Waste embodies both promise and peril. Classification systems are neither static nor apolitical, as they create order that becomes ingrained, particularly once we enroll material infrastructures into these systems. Classification becomes embedded in relations that are self-perpetuating and self-validating; after a time we may stop even recognizing the potential to be otherwise. And yet, the classification of waste is not a one-way imposition of human ideas onto matter. As a growing number of scholars remind us, matter resists (Bennet 2004; Latour 2005), and what we take for granted as fact, is actually the outcome of an ongoing dance of human and nonhuman agencies (Pickering 2005). In the transdisciplinary work of science and technology studies, the unit of analysis is shifted to a posthumanist space in which objects of study are viewed as neither pure nature nor pure culture.

Ultimately, what I am arguing is a paradox: that we simultaneously accept and work from where we are, in the wasteland, *and* that we make choices that are, as far as possible, informed by a clear and complete meditation on what the potential implications may be. It is exactly for the reason of tackling this paradox that transdisciplinary research becomes so crucial. Classification of waste operates at various levels of reality, from household practices to the political economy of consumption; from institutional infrastructures and competing waste management policies and technologies to prevailing societal attitudes and beliefs about waste, nature and the environment. As waste is reclassified as a resource, we must continue to investigate how these different levels of classification intersect and what is being naturalized or marginalized in the process, always evaluating if this is indeed the direction we want to take.

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