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On the (In)visibility of Practices: Opportunities for the Promotion of Household Waste-Segregation in Western Switzerland

RESEARCH

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ABSTRACT

Organic waste is both a refuse and a resource. Focusing on household waste in a city in Western Switzerland, this study examines the practices of waste segregation in relation to the city's (organic) waste management system. Based on qualitative research with diverse households and experts in waste management, we use social practice theory to discuss the meanings and materiality of household organic waste segregation. We show how more or less visible meanings, tied up with material arrangements, can be either enablers or deterrents for such forms of waste management.

The article argues that certain aspects of the waste system could be rendered more visible, such as the proper labelling of collection bins, while less visibility could be given to certain meanings around waste segregation, such as the financial cost of not sorting. We also discuss how organic waste sorting, as a practice, contests the dominant understandings of change based on technological efficiency, economic benefits, and individual changes. More collective forms of change are needed, working at the level of social contexts and materiality, to further support organic waste sorting.

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1. INTRODUCTION

It is estimated that a total of 2.6 million tonnes of food waste (weighed as fresh matter) is generated annually in Switzerland at various stages of the food value chain, of which kitchen waste produced at the household level is estimated to be responsible for almost half (45%) in terms of calorific content (Beretta et al. 2013). A distinction is usually made between avoidable and unavoidable kitchen waste: the former refers to food that could have been eaten prior to being discarded, and the latter to the fraction of food that is usually not eaten, including peelings, eggshells or bones (Quested et al. 2011). The high amount of fruit and vegetables that are discarded compared to other food products is ideal for compost production. Kitchen waste is thus both the offshoot of what is unwanted, what is discarded, but also represents an opportunity for creating compost, a rich source of nutrients for gardening. Kitchen waste can also be directed towards non-human food use, for example for feeding livestock, as input to anaerobic digestion plants, or an end of life in a landfill (FAO 2014). The proper use of household waste, for any of the above reasons, is heavily dependent on the segregation of household waste at source (Gomez 1998). This brings us to the main aim of this paper: how households could be further encouraged to separate out or 'segregate' organic waste.

Large-scale municipal collection of organic waste began in some European countries around the 1970s and 1980s (Slater & Frederickson 2001). The centralization of waste management has its benefits, partly in relation to volumes: converting refuse into a resource is more attractive when there is enough of it to justify the cost of the effort. Yet, in many cities of the global north, waste management systems may have served to hide from view the flow of the by-products of food consumption practices. What happens to household waste tends to be rendered invisible: as Mary Douglas (1966) famously put it, waste is matter out of place. Putting what is dirty or unclean out of sight is thus one way of creating order in society. In the United States, it was the very visible question of landfill waste that acted as a catalyst for the first Solid Waste Disposal Act in 1965. When waste is visible, on city streets and in mediatized, overflowing landfills, it becomes a problem, but also a tool for social change – as people take action to demand better conditions in their cities (Moore 2009). What is invisible or visible when it comes to solid waste thus becomes an interesting heuristic for reflecting on opportunities for change.

How waste is treated in our cities today reveals three normative assumptions that are continuously challenged in the sustainability literature: first, that of technological optimism, whereby engineering solutions are privileged rather than addressing problems at their source and devising more 'low tech' solutions (Cohen 2020; March 2018; Miller 2020). In Switzerland, waste incineration for energy generation remains the dominant waste management solution, given the high average heating value of municipal solid waste (Harris et al. 2015; Setyan et al. 2017). Beyond the standard municipal waste management chain starting from door-to-door truck collection to landfill and manual recycling, Switzerland stands out in Europe for its complex system of incineration with air cleansing features, and centralized mechanical composting (Ghesla et al. 2018; expert interview 2020). Second, and tied to this first assumption, the cost of environmental solutions is often given much place in public discourse; for example, when it comes to the deployment of renewable energy sources in Switzerland, financial considerations are prominent in both the media and the policy arena (Hirt et al. 2022). While how much something costs is certainly a value, there are other values that could also be considered, such as the environmental and social costs and benefits of waste treatment.

A third assumption around what is sustainable is also problematic and relates to the role of households: there is a dominant notion that individuals need only be better informed to then behave better, when it comes to bringing about more sustainable forms of consumption. Yet, this is a limited understanding of how change comes about. Hebrok and Heidenstrøm (2019) claim that current policy efforts towards behavioural change are not decisive in terms of changing how people handle food. Schanes et al. (2018) argue that the complex and multi-faceted food waste issue must consider individual attitudes as part of wider social, economic, and cultural structures, which gets us closer to grappling with complexity. Spurling et al. (2013) demonstrate how observing people's behaviour is just the tip of the iceberg: more in-depth, qualitative research is needed to uncover another way of framing social life, whereby individual actions are embedded in social practices. While it is certainly not the only theory for reflecting on complex social dynamics, Spurling et al. draw on social practice theory, which has emerged in recent years as a prolific area of study on everyday life dynamics (Shove 2003; Shove & Pantzar 2005; Sahakian & Wilhite 2014). Approaches drawing on this theory seek to overcome the tension between the importance of structure versus individual agency by focusing on what people do in everyday life – such as preparing a meal or sorting waste – and how these 'doings' are made up of different, inter-related components. In one interpretation, practices such as waste sorting involve material arrangements, skills and competencies, and meanings (Shove & Pantzar 2005). For Welch and Warde (2015), the components are 'material, embodied, ideational and affective' (p. 85), and involve both 'doings' but also representations or meanings around the practice.

In this paper, we describe what people do with household food waste as a social practice, with a focus on two components: first, we consider the materiality of the practice, or the objects, technologies, spaces and things that relate to dealing with food waste in and outside of the home; second, we seek to uncover meanings, or the representations that are associated with that practice, and how they involve values and ideas, but also rules and restrictions. Further, we use the notion of '(in)visibility' to discuss what is both physically present in the practice, but also what are the normative and explicit assumptions around the right way to handle kitchen waste – as visible parts of the practice. What is less or more visible allows us to then discuss opportunities for the promotion of waste segregation, in the case of households in Western Switzerland and of relevance to other urban areas. We pay attention to what is visible or not when it comes to waste management in and outside of the home, to understand what enables or hinders waste segregation practices. Through this effort, we challenge the assumptions that technological solutions and economic benefits should be highly valued, and the assumption that change is merely about informing people to behave better.

We start by presenting our conceptual framework, which combines a social practice approach to understanding waste management, with the notion of 'visibility' in the social sciences. When uncovering what is visible or invisible, we focus on material arrangements and meanings related to kitchen waste. We then present our methodology, before exploring our key research findings along three themes: how does the practice of sorting kitchen waste play out; what is visible, in terms of both meanings and materiality; and what remains invisible, as either implicit or hidden from sight. We conclude with a discussion on how organic waste sorting could be further supported.

2. CONCEPTUAL FRAMEWORK

For Haraway, the term 'compost' is a metaphor for how humans relate to the earth: it is at the same time death and decay, and life and regeneration. Compost as a metaphor allows us to rethink the ways in which humans and other, 'more than human' species co-inhabit the planet (Haraway 2016). Making compost can therefore have rather radical interpretations, for example in feminist literature, where composting is associated with care work, whereby making compost is about caring for the environment and caring for others (Hamilton & Neimanis 2018). But for many, composting remains a messy and smelly affair. This relates to how waste is considered in our societies. For some, waste is 'matter out of place' (Douglas 1966) which should therefore be rendered out of sight. Municipal level efforts to collect household waste support the process of rendering complete waste cycles invisible to most people: after sorted or unsorted waste is placed in municipal containers, the remaining life cycle of the waste becomes invisible to households.

Some elements of the organic waste management cycle are more visible than others, for example the recycling bins that are found in homes might be tucked out of site, while containers on city streets can be highly visible in public spaces. Material arrangements that are invisible from view can be nonetheless highly significant when it comes to waste management strategies, such as incineration or landfilling facilities. Thus, simply being 'invisible' does not mean that something is insignificant, quite to the contrary. Recycling bins are clearly material and physical, but using containers also carries certain meanings, which might tell us something about what is understood as the right or wrong way to handle waste-as-a-resource. Labelling on containers, for example, might indicate the type of waste that can be disposed of therein. Meanings relate to how a practice ought to be carried out, what might be the wrong or right way to engage in a practice. As such, there are also meanings around practices that are more or less visible, or normative assumptions around what is right or wrong that are more or less explicit. In this way, 'Visibility is a metaphor of knowledge, but it is not simply an image: it is a real social process in itself' (Brighenti 2007: 325). In other words, there are some things that we know, but these are not always established as explicit rules or standards; they are tied up with practices, or embodies way of doing, and can be revealed – through qualitative research – as more or less visible. What is invisible or visible reveals power dynamics and therefore 'when something becomes more visible or less visible than before, we should ask ourselves who is acting on and reacting to the properties of the field, and which specific relationships are being shaped' (Brighenti 2007: 326). Questions around 'what ought or ought not to be' merit unpacking and are 'never simply a technical matter: they are inherently practical and political' (Brighenti 2007: 327). For example, certain standards or valuations come into play when it comes to judging what can be wasted, which oftentimes engages with the senses to discern what is suitable for further processing or not (Arnold 2022).

The question of visibility and invisibility in relation to waste has been treated in the literature. Daniel and Martin (2021) expose how bio-waste has become a 'clandestine and invisible object' in public spaces, an invisibility which deprives citizens of the ability to engage more fully with what happens to waste after it has been sorted at the household level and collected by municipalities. Sorting waste at home would be more meaningful if the waste management system were more visible, in this argument. For Abrahamsson (2019), what he terms 'food repair' concerns the different ways that people save, experiment, or grow food, including the case of dumpster diving to recover 'wasted' food. He finds that

food repair work is largely invisible or unnoticed, tied to mundane practices and ignored by policymakers. In an ethnographic study of a Finnish supermarket, the grey space between food and waste was studied to render more visible how products are valued at different stages (Lehtokunnas & Pyyhtinen 2022). The work that goes into sorting and storing is essential to understanding how food that could have been wasted comes to be valued as useful. Turning now to the cities of the Global South, a study on waste management in Bangalore found that members of the lower castes and classes, responsible for waste sorting, were rendered invisible in relation to middle class and higher caste citizens, who displayed visible forms of ecological citizenship in caring about waste (Anantharaman 2014). In this case, invisibility is assigned to people, but also the practice of sorting waste when it applies to certain groups of people; the sorting is not as significant as the meanings attached to managing or orchestrating what is seen as a meaningful act of environmentalism. A case study in Oaxaca, Mexico, evidenced that waste that is not removed represents a contradiction in a city that aims for modernity. Moore (2009) recognizes that visible garbage becomes a threat to the integrity of the city and its citizens. Along the same lines, a study in Managua, Nicaragua and Gothenburg in Sweden found that keeping waste infrastructures isolated and hidden is aligned with the idea of a well-functioning city (Campos 2013).

While there are numerous studies on waste that treat the question of (in)visibility in various ways, we attempt to link this heuristic to a social practice approach in this paper. Social practices shift the focus away from individual behaviour, in recognizing that what people do is always a reflection of collective ways of doing. This implies seeing people as performing actions that are recognizable as a 'socially shared bundle of activities' (Welch & Warde 2015: 85), such as driving a car, preparing a meal, or sorting waste. The aim is to uncover the different ways in which such practices plays out, rather than focusing on people and their individual preferences. The social and material contexts that help to organize, produce, and reproduce practices becomes essential, in this approach. As mentioned in the introduction, there are different ways of interpreting what practices are made up of. They can involve 'the integration of a complex array of components: material, embodied, ideational and affective' (Welch & Warde 2015), or more succinctly, can be seen as being made up of three elements: stuff (materials, technologies and tangible, physical entities), meanings (images, values), and skills (competence, know-how and techniques) (Shove & Pantzar 2005). Social practice theory can thus be used as a descriptive tool for uncovering how practices around waste play out, involving 'material' elements, such as food or sorting devices, but also social meanings. Whether food is a 'meal' or a 'waste' relates to such meanings, which can involve 'things' such as labels with expiration dates, but also sensorial approaches to evaluating whether food is comestible or not. Meanings around food and compost refer to what 'ideational and affective' values are inscribed within certain practices, such as sorting, storing, or disposing of waste. Meanings, in this paper, is a broad category that includes both rules and regulations, as well as understandings of what feels right or wrong, both cognitive and embodied, or what might be termed 'motivations'. A label on a municipal container is a prescription, which reflects local or national regulations, and informs people of how the bin might be (mis)used. But there are other meanings, motivations or values attached to the practice of sorting out waste, which we seek to uncover through empirical research.

Using the notion of (in)visibility and applying it to social practice theory requires uncovering what elements of practices are either visible or invisible when it comes to material arrangements, but also applies to meanings – such as prescriptions and shared understandings of how to manage food and related waste. For our study, visibility is both a physical feature as well as an explicit, normative understanding of what is right or wrong. Visible materials refer to the objects and technologies that people use, refer to, and engage with in their waste-related practices, while the invisible materials are those things that remain out of sight or mind. Visible meanings involve explicit understandings of how things ought to be or should be done, while invisible meanings relate to misunderstandings, or an absence of understanding. Invisible meanings can also relate to implicit meanings, which are not top of mind when people go about engaging in routinized and habitual ways of doing, but that can be uncovered through in-depth qualitative research. What is (in)visible and to whom is a question we return to in the methods section.

Social practice theory has been applied to the topic of food waste, at the household level. For example, studies have focused on the importance of de-moralizing UK households in relation to waste generation (Evans 2011). Simply informing people or making waste meaningful would not be enough to encourage less food waste, in that study, as waste has less to do with individual preferences but rather is 'a consequence of the ways in which domestic food practices are socially organized' (p. 438). Katan & Gram-Hanssen (2021) have also studied the waste sorting habit as a practice, influenced by environmental ethics or civic participation, to recognize how a mundane activity such as waste sorting is embedded in collectively held social norms, which are not always explicit. Social practice theory was also used to study social practices associated with food waste among middle class households in Asian cities (Sahakian et al. 2018), demonstrating how access to fresh produce on a regular basis and the presence of domestic helpers leads to less household waste than in European cities. Another

study focused on Bangalore middle classes used material flow analysis towards mapping the different stages of household food consumption and final waste, zooming into the different social practices that help explain wastage (Leray et al. 2016). More recently, Zhan (2022) uses social practice theory to elaborate on the agency of material things, such as waste bins, in prefiguring the prevention of waste among zero waste adepts in Chinese cities. Cultural conventions around care, and relations of love, embedded in material arrangements, are a significant when it comes to handling surplus food.

Taking households as a starting point, we investigate the sorting, storing, and disposing of organic waste, using a practice-based approach, and to a lesser extent, the cleaning of containers. These different practices have also been identified in the literature (see e.g., Katan & Gram-Hanssen 2021), and were substantiated by our own empirical work. We focus on what is visible and invisible as these practices play out, both in relation to meanings and material arrangements, to then discuss how household waste sorting might be further supported.

3. METHODS AND BACKGROUND

3.1 METHODS

Our study took place in Lausanne, the capital city of the Canton of Vaud in Western Switzerland with a population of approximately 145,000, on the shores of Lake Leman. Data were collected through surveys, interviews, and direct observations, for a total of 69 participants (see Table 1). As our fieldwork started in Fall 2020 during COVID-19 lockdown measures, a first set of data was collected through an exploratory online survey, publicized thanks to the 'Zero Waste' association. For the in-depth interviews with households, participants were recruited in 2021 through messages posted on Facebook groups relevant to the city of Lausanne, with interviews taking place either in person or remotely (via Zoom or phone calls). Shorter interviews were carried out in two parks: Esplanade de Montbenon in the city centre, followed by the Louis-Bourget near the University of Lausanne. Other in-depth, 'expert' interviews also took place with authorities from the municipal solid waste management services. Direct observations were made in both private and public spaces in the city, including people's homes. These were complemented by a field visit to the Tridel incineration centre and the Ecorecyclage biomethanation and composting plant. In addition, observations and notes were taken at a workshop which brought together different experts working on the food-waste-gardening cycle in March 2022.

DATA SETS	RESPONDENTS		TOTAL
1	Household online survey	Survey	18
2	Household in-person interviews	In-depth	12
3		Short	35
4	Expert in-depth interviews	In-depth	4
TOTAL			69

Table 1 Survey and interview participants.

For the data derived from households, the non-representative sample of this study reflects the socio-cultural and demographic diversity of the Lausanne population, including people from a range of nationalities and income brackets. Over half of the participants (57%) live in the city centre, the rest in the suburbs; half are single, and the other half live in families of two to five people. More than half of the respondents moved to Lausanne within the last five years and the remaining within the last four decades. Most of them have a university education and their respective jobs cover a range of sectors from education to engineering, communication, and health. The households surveyed (15 tenants, 3 owners) live mostly in an apartment with access to a balcony. Very few mention their access to a garden. Some 50% place their bin on the balcony, 39% under the kitchen lever, and 11% outside the dwelling (directly in outdoor bins or in gardens).

The household survey, with 64 closed and open questions, situated the participants in terms of their socio-cultural background, the source and composition of their food, how they engage with organic waste at home, and their representation and relation to compost for agriculture. The survey was exploratory in nature and allowed us to gain a better understanding of waste sorting practices, as well as helping us to formulate the subsequent interview questions. The interviews aimed at delving deeper into the different sub-practices related to waste sorting, and the different 'elements of practices' that come together, namely material arrangements, skills and competences, and rules, regulations, and other meanings. Shorter, structured interviews were then carried out with the aim of reaching a broader range of people, again designed in relation to practice elements and to gain key sociodemographic information.

The qualitative data was collected in French, with a few interviews taking place in English. All data sets were analysed separately, using data analysis software. The notion of (in)visibility emerged inductively through an analysis of the data, and how we interpreted what was visible or not was discussed among team members. The perspective taken was that of households or respondents, and how the research team was able to extrapolate from our rich empirical data identifying what materials and meanings were visible, explicit and clear, or rather invisible, implicit and either absent, unclear or ambiguous. All participants in this study gave informed consent and the research design was

made in accordance with Cantonal ethical regulations, including the anonymization and de-identification of data and its secure storage. Relevant quotes in French were translated into English. A potential bias in the data is that the research topic may have influenced people's practices; for example, one respondent explained that he had been trying harder than usual to separate out organic waste the week before the interview. In addition to this, there is a potential bias in that the people who agreed to participate may be more likely to be interested in waste sorting or environmental issues than the average person in the general population.

3.2 BACKGROUND ON THE ORGANIC WASTE COLLECTION AND PROCESSING SYSTEM

The collection and processing of household waste in Lausanne is organised by the municipality, who engages private service providers responsible for different waste categories. Specific containers for organic waste allow door-to-door retrieval and transportation from neighbourhood collection points to the different waste processing facilities. Two main processing technologies are used for organic waste: aerobic composting produces compost, and anaerobic biomethanation produces energy, along with liquid and solid digestate used in large farms. In the first case, the composting centre La Coulette processes both the public and private green, yard or garden waste (Nik, 55, municipal yard waste manager, 22.09.2021). In the second case, organic waste from households and industries in the region, from Nyon to Lausanne, are conveyed to two processing facilities: Ecorecyclage in Lavigny, about 25km to the west of the city, and Axpo Kompogas in Chavornay, about 30km to the north (Calvin, 80s, composting plant manager, 29.07.2021). All the household kitchen waste collected in Lausanne is processed at either one of these central plants as. As succinctly stated by one of our interlocutors about organic waste, 'Everything goes into biomethanation' (Kim, 50s, municipal food waste manager, 21.10.2020).

The Canton of Vaud introduced the bin tax in 2013 for the collecting of non-recyclable or unsorted waste. In essence, households must buy special garbage bags, the price of which varies from 10 to 38 Swiss francs per roll of ten, depending on the capacity in litres; a single bag costs between 1 to 6 Swiss francs. Under the slogan 'Sorting waste is adding value', the tax on garbage bags can be considered as a type of behavioural nudge, or a government intervention aimed at increasing the perceived value of an action (Barile et al. 2015). In addition, a basic tax of 0.24 Swiss francs per m3 is applied to homeowners. These two tax sources contribute to one third of the municipal waste management budget in Lausanne, with standard municipal taxation covering the rest. Since the implementation of the tax on household waste in most Swiss cantons, such measures seem to have proved effective in reducing waste generation and increasing waste separation (Jaligot & Chenal 2018). A study has reported a reduction in final waste of about 40% per capita following the implementation of the tax on garbage bags in the Canton of Vaud, thanks to increased recycling and organic waste treatment at the household levels in recent years (Carattini et al. 2018). However, there have also been cases of 'waste havens', where people transport their waste to areas where there are no taxes in place, or they dispose of the waste in municipal bins instead of their household bins (Erhardt 2019). Unsorted waste collected from Lausanne as well as the Northern and Eastern Vaud region in the taxed bags is treated at the Tridel incinerator, an energy recovery facility. Established in 1997, Tridel was conceived as an efficient way to burn large amounts of waste (Peter, 60s, director at the incinerator industry, 14.10.2021).

Biomethanation plants centralise the organic waste from brown containers; since 2018, cooked food and meat-derived waste has also been accepted in these organic waste containers (Ville de Lausanne 2021). This policy change follows the introduction of the biomethanation plants and their use of technological systems and infrastructures that allowed the municipality to overcome challenges associated with high volumes of food waste, such as smell and rodents. The volume of such organic waste has increased significantly over the years (DGE 2017; Nik, 55, municipal yard waste manager, 22.09.2020 and Kim, 50s, municipal food waste manager, 21.10.2020). The biomethanation plants produce digestate, marketed as 'natural fertilizer', that is used by the larger agricultural actors in the region. To smaller gardeners, only compost produced from 'green' yard and garden waste (e.g., leaves, twigs) has been proposed thus far. The city also promotes community gardens where it provides composting units to dispose of garden waste. Although urban gardening is beyond the scope of this article, there is an opportunity in Lausanne to generate local compost for urban gardening, which could contribute to closing the food-waste-gardening cycle.

4. EMPIRICAL FINDINGS

The process of sorting kitchen waste is described using a social practice theoretical framing. First, we explain the different stages of dealing with household waste, and how this relates to five practices (Figure 1). Then, two subsets of our results are presented: we describe both visible and invisible meanings and material arrangements around waste sorting, in both the home and in the municipality.

Segregating kitchen waste at the household level is a common practice: most of the respondents (84% from

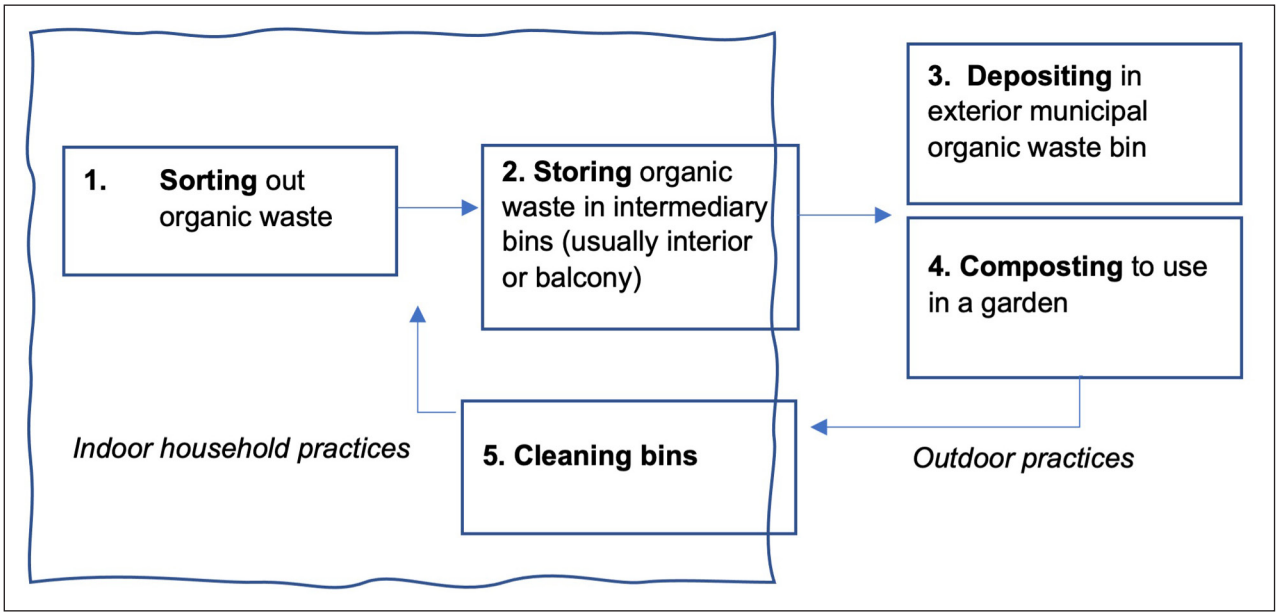

Figure 1 Five practices associated with household organic waste.

the online survey, and 65% from the in-depth and short interviews) systematically separate such waste at home. In most instances, waste is sorted, then stored in the home, and finally deposited in a waste container in or near the home, for municipal collection.

In only very few cases, the sorted waste is used directly in a nearby vegetable garden (five participants overall in the study). Household members developed the necessary skills to sort out organic waste either by learning from other family members, for example when growing up with their parents or grand-parents, or by reading information provided by the city, mainly through a waste calendar which they receive by post once per year. The calendar provides general information on the types of waste which are collected, the location of collection points and the frequency of collection. In what follows, we focus on the meanings and material arrangements that underpin the different practices associated with household organic waste. By exploring what is visible or invisible, we do not suggest that making all stages of the waste management process more visible will lead to changes in practices. Rather, we use the heuristic of 'less or more' visible to understand how the different practices play out, in relation to meanings and material arrangements around sorting waste. We return to the implications of this analysis in the conclusion.

4.1 'MORE VISIBLE' MEANINGS AND MATERIAL ARRANGEMENTS

We now discuss the overall meanings associated with the different stages and practices, as part of the overall household organic waste practice, with first a focus on sorting and storing, then on depositing. There were too few cases of composting in our study, a point we will return to.

Based on our study, the three main reasons for sorting organic waste by households were financial incentives, sense of obligation towards the municipality, and environmental concerns.

The financial incentives are directly related to the tax on garbage bags, as stated by our household participants: 'Yeah…because it's very expensive to buy these bags…' (Layla, 20s, chemical engineer, 26.10.2021). Or in explaining why he sorts, another respondent explains: 'Definitely, yes, when it hits you in your pocket!' (Henri, 50s, full-time employee, 07.10.2021). As one woman put it, the tax also raises awareness around the cost of treating municipal waste:

> I think it's good, I think it's great. It doesn't affect me personally, but I think it's just necessary because people need to realize that somebody is dealing with that waste, that it goes somewhere, someone picks it up somewhere … you know, that there's a cost to it (Olivia, 30s, researcher and teacher, 28.10.2021).

The prominence of the financial incentive – as a core meaning tied up with the food waste sorting practice – can also lead to less legitimate practices. In our study, we discovered the practice of buying counterfeit taxed bags online, to avoid paying the bin tax. During the interview with Chloé and Daniel, they described how one of their friends buys fake bags online, which resemble the official taxed Canton of Vaud bags but for a much cheaper price.

> The friend I'm talking about, she buys bin bags, actually fake bin bags, you know, which are much cheaper because they are made in China … same design and everything! … and then she puts all her rubbish in there! … Just to pay less for her bin

> bag … But in fact, I say to myself, if she sorted her waste, it would be cheaper anyway (Chloé, 20s, student, 22.09.2021).

This demonstrates how counterfeit bags respond to the motivation to 'save money' but keep out of sight or invisible from view the consequences of not sorting waste, or the more collective loss of resources for agriculture, for example. This suggests that only focusing on financial meanings and making them highly visible through campaigns, for example, might crowd out other meanings, such as environmental costs of not sorting waste.

Secondly, several respondents commented that they separate out organic waste because they are required to do so, by the municipality. They expressed a strong sense of obligation, communicated through different prescriptions that tell people what they ought or should do. The following statements from our data summarize this sentiment: 'They oblige us to', 'Because I am told to do it', or 'Because I am required to do so'. Tied to this sense of obligation was a certain fear of sanction, as stated by one respondent in relation to sorting different types of recyclables, in this case glass bottles:

> Being convinced that someone is watching us put bottles and things, so like just being worried that someone will actually call you up and say, 'I saw you put a brown bottle in the green bottle shoot, and I've got video evidence of it and now you're going to be fined' (Paul, 55, lecturer, 27.10.2021).

Studies have found that collection agents will rarely open bags to check their contents, due to smell among other factors (Daniel & Martin 2021), which reduces the risk that people might be caught not sorting organic waste properly. Further, it is currently legal in Lausanne to dispose of organic waste in the taxed bag for regular waste, yet people do have experience with being caught on camera not recycling paper or glass properly, which must be legally separated, and being issued fines. Thus, there is an explicit meaning around waste sorting as a legal obligation for certain products, such as paper and glass, which then creates a sense of obligation towards 'proper' organic waste sorting, for some. In this case, a visible meaning of obligation from one waste category transfers onto another.

The third motivation for sorting household waste relates to environmental concerns. From among participants in both the in-depth and the short interviews, a vast majority consider this practice as an action that is good for the environment. One third of the participants of the online survey also mentioned the environment as a motivation for segregating their kitchen waste. A physiotherapist in her 20s explained to us that she has become a more 'responsible recycler' over the years, due to being 'just more and more worried about the environmental impact, and then also maybe more educated about recycling' (Ella, 25, physiotherapist, 06.10.2021). In the online survey, a female psychologist in her 30s also reported that caring for the environment was her incentive for sorting out compostable waste. Another survey respondent gave the reason, 'for the sake of the environment'.

Many of the meanings above are tied to some form of materiality, like the legal or counterfeit bags. We now focus in on material arrangements. The few participants who do not separate out their organic waste often claim that the level of kitchen waste they generate is not significant enough to be sorted out from general waste. They also claim a lack of access to collection points. DiGiacomo et al. (2018) found that placing specific bins on each floor of an apartment could help make food waste recycling or composting more convenient; it could contribute to an increase in recycling rates by up to 147% and composting rates by up to 139%, in the case of Vancouver.

Generally kept in a small plastic container or in an organic plastic bag at home, food waste is stored in a corner of the kitchen or under the kitchen sink, or, when possible, on a windowsill or balcony. Some people use a 'biodegradable' bag inside their small organic waste container, whereas others do not use the bag at all and rather wash out the bin after emptying it. Paul described how the biodegradable bags are not so sturdy and may become a barrier in the waste handling process: '… they decompose really fast, so if you put in wet peels, then the bag integrity starts degrading so that becomes a problem.' (Paul, 50s, lecturer, 27.10.2021). Rebecca, a female in her 40s who lives in the city centre with her two children, described her kitchen compost bin as follows: 'I have a small bin, which I put outside on my window, but it is small and not very attractive' (Rebecca, 45, part-time employee, 08.12.2021). Layla, a chemical engineer in her 20s, who lives with her husband and young child also explained how the indoor kitchen compost bin is kept in the kitchen during the day but put outside at night to reduce the smell. As discussed by Ames & Cook (2020), regarding household dynamics and the visceral relation between food decay and cleanliness at home, bin storage practices are central to understanding composting opportunities. In our study, even people who are motivated to sort out kitchen waste see the accumulation of such waste and the bin that carry it as undesirable. Keeping such containers 'invisible', both out of sight and out of smell range, is preferred.

Even if the environmental motivation to sort waste can be seen as an overarching meaning that makes the task desirable for some people, the day-to-day practice of dealing with kitchen waste carries explicit meanings which are not always positive. Previous studies have revealed sorting and dealing with

organic waste as 'unpleasant' for many people due to the odour, appearance, and texture of the waste (Lekammudiyanse & Gunatilake 2009; McKenzie-Mohr et al. 1995). This meaning of unpleasantness was uncovered among many of our participants. People who do not engage in waste sorting practice claim not only to be disgusted by the idea of waste separation because of the imagined strong smells, but also worried about kitchen waste bins attracting undesirable animals into the home, such as gnats and worms. People who do sort waste also express some disgust or at least dislike associated with the task of taking organic waste to the municipal waste collection point, and specifically the washing of the bin afterwards. Thus, household sorting practices are inherent to what Daniel & Martin (2021) called ordinary nuisance-prevention considerations, as people find different ways of decreasing the undesirability of sorting and storing household waste at home.

At the third stage of the kitchen waste segregation practice and in most cases, organic waste is disposed of in an exterior municipal bin placed at the bottom of the building for municipal collection. There were few instances of waste being used in gardens (only two among the interviewees and three surveyed), by people who have their own garden and use their kitchen waste to create compost directly on location. They had developed or learned from their parents or others the knowledge of which items could be composted, as well as the skills to manage a compost heap and to using the compost in their gardens to grow fruits and vegetables.

Coming back to waste disposal, the material arrangements necessary for this stage are exterior waste containers close enough to the resident's home. Carrying waste from the indoors to the outdoors is necessary.

Figure 2 shows the typical provision of waste collection containers made available to residents. With the municipal curb-to-curb collection service offered on a weekly basis, households that sort their waste in their kitchen bin come regularly to dispose of the organic waste collected at home in the container near the apartment building; thus, having the municipal container collection point nearby is important, or having the bin on a route that is often used.

Residents might walk from their home to the exterior waste container with their own container. They tend to empty their organic waste bin two to four times per week, depending on how much they have cooked, how many bins they are using at home, how strong the odour is, or depending on the season. Bins are emptied more regularly in summer compared to the winter, as the warmer temperatures increase odour and gnats.

Previous literature has found a definite relationship between reduced distance travelled to a recycling site and shifts towards recycling (e.g., Barr et al. 2001; Sidique et al. 2010). It was also found that implementing curbside collections increases recycling rates (Derksen & Gartrell 1993; Dijkgraaf & Gradus 2017; Koch & Domina 2002). Several interviewees spoke about the convenience of having organic waste containers near to their home which encourages them to separate out organic waste and ascertain opportunities for composting. Most of

Figure 2 Waste bins available next to an apartment building, showing (from left to right): organic waste (here labelled *végétaux crus* or raw vegetables); general waste; and paper and cardboard. (Source: author's own, 2022).

our respondents do have access to a municipal organic container at less than a one-minute walk from their home. This suggests a reasonably good provision of municipal organic waste containers, at least in the city centre. Several residents spoke about how living in Lausanne allows them to separate out their organic waste, in contrast to other cities or countries where they had lived, because of the service made available by the municipality:

> I was in the UK … not 10 years at one shot, but in total 10 years … I didn't have the option to split up my organic waste, so I was recycling but I wasn't segregating organic waste (Alice, 30s, sustainability specialist, 03.11.2021).

Yet, the oftentimes visible presence of non-organic materials in the waste containers are a concern for some, as we also observed (see Figure 3), as stated by this student:

> I'm just wondering, in relation to the sorting of organic waste, what happens with the plastic bags that are put in, or the biodegradable bags that are maybe not really biodegradable. If they really use it for agriculture, do we eat this plastic waste, these microplastics in fact? It's really a question I ask myself (Chloé, 20s, student, 22.09.2021).

Both Chloé and Daniel raised the question of whether the municipality itself sorts through the organic waste collected to remove items such as plastic bags, indicating a certain distrust or uncertainty around the waste management system. Plastic and other non-organic waste is also 'matter out of place' when found in the municipal bins.

Table 2 summarizes the more visible meanings and materials around household organic waste, which are either enables or deterrents for the overall waste sorting practice.

Figure 3 Examples of other types of waste placed in the organic waste bins (Source: author's own, 2022).

OVERALL PRACTICE	SUB-PRACTICES: SORTING, STORING, DISPOSING, AND CLEANING
Enablers:	**Enablers:**
Taxed trash bags/ inancial incentive	Reduced travel time to collection point
Sense of obligation towards municipality	Number and size of bins at home
Environmental concerns	Storage space at home, preferably outdoor
Knowledge of municipal system for waste collection	Summer season (enabler for more frequent disposal)
–	Fear of legal reprisal (for some, based on confusion between waste types)
	–
Deterrent: Counterfeit trash bags/financial incentive	**Deterrents:**
	Insufficient waste
	Accumulation of too much waste
	Unpleasant smell, appearance, texture of waste
	Deterioration of compost bags
	Disgust around washing of compost bins
	Presence of non-organic bags or items in collection bins
	Lack of convenient access to outdoor containers
	Summer season (deterrent due to smells and gnats)

Table 2 Summary of more visible meanings and materials around household organic waste.

4.2 'LESS VISIBLE' MEANINGS AND MATERIAL ARRANGEMENTS

While a sense of obligation towards the municipality is one of the main motivators for the food waste sorting practice, there is much confusion around the right or correct way to sort waste, or the prescriptions around what waste is collected and for what aim. For example, the city waste calendar states that 'Since 2018, households in Lausanne can mix vegetable waste and cooked food scraps in the same container …' (Ville de Lausanne 2021), because of the biomethanation solution that is proposed at a municipal level. However, many respondents were uncertain about what forms of waste can be disposed of in the organic waste bins, and specifically whether cooked foods are allowed. As one person put it, based on her experience of living in the center of the city for more than ten years: 'Yeah 'cos we thought we were allowed everything at some stage and then we re-read it and it said no, and then we … I remember that we went back and forth with that one' (Isabelle, 50s, resident, 22.09.2021).

People claim that they have not seen the waste calendar for some time, where the 'proper' sorting practices are described, or that it may have gotten lost among all the junk mail they receive. Only one person, Chloé, a student in her 20s, declared that she was aware of this change because she had read the waste calendar in detail, and she had also informed friends and family of the change. Very little to no information about organic waste disposal was shown on or near the containers themselves. This was also confirmed by direct observations in the city around confusing container labelling, as can be seen in Figure 4. For example, a container has a label that states *végetaux crus* (raw vegetables), which is out-of-date according to the regulation change in 2018 that allowed for cooked food in compost bins. Other signs indicate 'compostable cooked and raw', 'organic waste', or 'bio-waste'. This results in a cacophony of different prescriptions for the practice of waste sorting. Furthermore, a label seen on only a few containers explains what happens with the discarded organic waste afterwards, but incorrectly implies that it would be composted in addition to being biomethanized (Figure 4, picture on the left). This leads to confusion about what happens to organic waste once it is placed in a container and to a system which remains hidden from view. Exactly how kitchen waste is processed and used by the city is invisible from their view, as was also discussed by Daniel & Martin (2021) in the case of Strasbourg.

As for the treatment of municipal organic waste, the city's waste calendar mentions that such waste is sent to biomethanation plants to produce biogas and/or electricity, and to yield fertilizer that is of high value for agriculture. The very few participants who were aware of this treatment system had either learned it from the official waste calendar (in Chloé's case) or from a university course (in Fiona's case):

> Yeah, I know that they use it for biogas. So, like, uh, heating and fuel … Oh, also, organic soil fertilizers (Fiona, 20s, student, 27.10.2021).

> So yes, it says that it's for biomethanation, agriculture and then electricity and biogas too … but in fact, we don't know concretely how it happens, we've never seen … it's a bit of a black box. People aren't sufficiently aware of what they should and shouldn't put in and why it's important. Maybe if they could see it through

Figure 4 Different labels present on municipal organic waste containers (Source: author's own, 2022).

OVERALL PRACTICE	SUB-PRACTICES: SORTING, STORING, DISPOSING AND CLEANING
Enabler: Waste calendar and clear prescriptions –	
Deterrents: Changing prescriptions from the municipality around what waste is collected and should be sorted Ignorance or confusion around final treatment of organic waste by the municipality (e.g., black box of meanings) Different prescribers giving different prescriptions (from the municipality to acquaintances) Mistrust of municipal waste management system	Deterrents: Confusion around proper way to sort waste (e.g., type of waste) Improper and/or confusing labeling on bins Confusion around actual biodegradable quality of bags

Table 3 Summary of the less visible meanings and materials around waste disposal.

> photos or by visiting the waste treatment centre … so that they realise how important it is and see what really happens with all that (Chloé, 20s, student, 22.09.2021).

This direct quote is particularly telling, in its allusion to a black box – or a complex system whose workings and meanings are not entirely understood. Not knowing what type of waste should be collected, nor why it is important could result in a loss of meaning around the value of treating such waste, whether for biomethanation or composting. For another student, it was a teacher who claimed that the treatment of organic waste was pointless, leading to a lack of motivation on behalf of the student to engage in this practice – demonstrating how prescriptions come not only from formal sources, such as the waste calendar, but also from people considered knowledgeable.

Another issue that was raised by respondents in our study was that of trust in the municipal waste treatment system, as also mentioned above. Some participants suspect that all waste is mixed again in the waste truck, and that the sorting of waste in different containers is solely about giving the city a good image. In contrast to this myth, an employee of the Tridel incinerator plant explained that proper waste sorting at the household level is essential to the functioning of their system, particularly because wet waste – such as organic household waste – is very heavy to transport and not efficient to burn:

> To make good quality heat with as few incinerator plants as possible, we have to choose what we burn. Part of our job is to encourage people to sort better … at the household level. In Switzerland, imagine we engage and pay up to CHF 4,000 francs a month to someone just to sort it out, it would be so expensive, so that would create another problem. It is really good that people sort waste themselves, which means no costs for us (Peter, 60s, director at the incinerator industry, 14.10.2021).

Our key informant from a biomethanation and composting facility agreed that waste segregation at the household level is crucial by highlighting the issue of contamination with plastic elements, the removal of which is costly for the preparation of compost. In his view, kitchen waste is more efficiently treated through biomethanation.

The organic waste management relies on centralized composting and biomethanation plants, which effectively moves organic waste 'out of sight'. This lack of visibility around what happens to waste after it is collected in municipal bins could lead to distrust or misunderstandings, which may act as deterrents for sorting waste. Table 3 summarizes the less visible meanings and materials around waste disposal which are principally deterrents for the overall waste sorting practice.

5. CONCLUSION

Through a social practice theory lens, we have analysed (in)visible practices associated with household organic waste in a city in Western Switzerland. These interrelated practices include 'separating', 'storing', and 'disposing' of waste, and 'cleaning' containers. Focusing now on what is visible and invisible, clearer prescriptions – embodied in calendars, bin stickers or other forms of materiality – are no doubt necessary, so long as prescriptions are not in conflict with each other. But more so, normalizing the practice of sorting waste would need to take more seriously a whole series of other meanings and material things, both inside and outside of the home. For example, household access to ventilated spaces for home bin storage, proximity to municipal bins, but also skills or spaces that allow for a better control over unpleasant smells and messy containers. Having water points near

municipal containers for the cleaning of bins before they are brought into the home could be an interesting intervention, as could a campaign that takes seriously the question of seasonality: at a time when more vegetables and fruits are consumed in the northern hemisphere, the hotter months also mean less tolerance for decaying waste, for some.

In returning to the three main assumptions that are continuously challenged in the literature, around how more sustainable forms of production and consumption might be brought forward, a social practice approach that gives significance to meanings and materiality clearly demonstrates why providing information to change behaviours is a limited approach to social change. People engaged in sorting household organic waste may need some basic knowledge or information, but they must also manage bins and access municipal containers, as well as make sense of the different meanings around waste management in the city. Placing attention on the social and material context helps understand how the sorting of waste could be further enabled.

The second assumption is that change will come about when it's cost effective, or that financial incentives matter most. In this case, the visibility given to the tax on waste bags may be an effective way to promote sorting, particularly among price sensitive groups, but the emphasis on cost may be crowding out other meanings, such as sorting waste through a sense of obligation, or for environmental concerns for resource valorisation. If financial incentives are the only motivator, they can be circumvented – as we have seen in the case of counterfeit bags. On the other hand, the fear of being fined for the improper management of waste seems to be an enabler, but one that is not accurate for organic waste; there is no legal obligation to sort out such waste. Making the non-sorting of organic waste illegal is one way of making the meanings of waste-as-resource very clear and visible.

The assumption that technologies are a silver bullet solution is also somewhat problematic in this study of waste management in Western Switzerland: keeping the end-of-life treatment of waste out of sight, in centralized biomethanation and composting plants, means that people have little visibility on what happens to waste once it's placed in municipal containers. Regardless of whether such end-of-pipe solutions are economically and environmentally sound, this abstract understanding might contribute to an erosion in trust towards the municipality. Not knowing what such plants look like, how they function, and how waste is treated creates a void in meanings around waste treatment and undermines the importance of waste segregation in the home.

For new skills to be acquired, for new meanings to be appropriated, and for new spaces for waste treatment to be created, efforts need to be made at a collective level. What is completely missing from the empirical evidence is the possible link between food, organic waste, composting, and urban food production. In a city centre, access to vegetable gardens is rare, and yet demonstrating how waste might be directly converted into a resource would be an important way of rendering visible the value of organic waste, from plate, to bin, to garden, and back to plate, and developing new competencies and meanings around organic waste segregation. Such demonstrations are underway in certain schools in Western Switzerland, where compost becomes a resource for canteen vegetable gardens, which in turn create opportunities for learning about how food is grown. By making local composting facilities more visible and urban gardens more accessible in city centres, such spaces could become demonstration sites for new skills, competencies, and meanings around the use of kitchen waste – towards closing the food-waste-farming cycle.

ADDITIONAL FILE

The additional file for this article can be found as follows:

- **Appendices.** Appendix 1, 2, 3 and 4. DOI: https://doi.org/10.5334/wwwj.95.s1

ETHICS AND CONSENT

All our respondents have been de-identified and anonymized.

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The authors have no competing interests to declare.

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