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The circular economy futures in the making: Transformativity and object ontologies in food waste practices in Finnish households, supermarkets and biogas plants

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ABSTRACT

This article examines how food waste practices in households, supermarkets and biogas plants contribute to enacting potential circular economy (CE) futures. The article is based on a multi-sited ethnography conducted in Finland during 2019–2021. The analysis focuses on the transformativity of practices, exploring how the CE as a societal transformation is made in hands-on practices at different sites. With the transformativity of practices, I refer to the future-in-the-making aspect of practices—that is, the capability of practices to change both the practices themselves and the materials entangled with and within the practices. I conceptualise three different dimensions of transformativity of practices (habitual, planned and experimental) that simultaneously enact both the ontologies of food waste and potential CE futures differently. The article argues that present practices are not projected towards only one potential CE future—but rather multiple potential CE futures—and that these futures are based partly on contradictory rationalities. I suggest that a focus on the different dimensions of the transformativity of practices and their rationalities enables practice-based research to better articulate how the changing goals of practices can shape different societal transformations and futures, such as the CE.

1. Introduction

Last Saturday, I cooked some porridge and made coffee. It was the weekend, and I had more time than usual to drink my coffee and eat the porridge. I had also made extra effort to cook the porridge in a kettle instead of just heating it in the microwave, as I usually do on weekdays. For these reasons, I made more of both my coffee and porridge than during the workweek. I thought that it would be reasonable to cook a proper amount of both because I had bothered to dig the kettle out and cook the porridge in it. I, however, still ended up throwing part of the porridge and coffee away. For some reason, I find myself repeating this same procedure week after week. Secretly, I think that throwing away a decilitre or two of porridge (note: cooked in oat milk!) is not that bad because it is not meat or cheese, though I feel a bit bad about disposing of the coffee. What is even worse is that I throw the leftover porridge in a biodegradable plastic biowaste bag because they are rather handy. I do this even though I have visited several biogas plants and know that it would be better for the machinery of the plants if I used paper bags.

People in 'Western' countries throw away enormous masses of food, and food waste has been a popular topic for both policy and academic discussions in the last decade (see, e.g., European Commission, 2020; Evans, 2012; Närvänen et al., 2019). However, the circular economy (CE) is a future vision that aims to intervene in such wasteful practices as my weekend porridge cooking and more

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widely in food waste production across the entire food chain. This includes aims such as reducing the disposal of edible food at households and supermarkets and utilising food that ends up as waste through biogas production. Briefly, the idea of the CE is that food waste should be prevented in the first place, and if this cannot be done (the food, e.g., rots quicker than expected), it should be recycled and used as a resource (see, e.g., European Commission, 2020; Geissdoerfer et al., 2017).

A growing body of research has, however, pointed out that it is still unclear how the transition towards a CE will be carried out, arguing that this transition does not happen just like that (Gregson et al., 2015; Hobson et al., 2021; Holmberg and Ideland, 2021). The transition towards a CE future requires sociocultural change (Hobson, 2016) and transforming everyday practices in several societal sectors. Although researchers have started to pay increasing attention to how food waste and its reduction are enacted in everyday practices in households (Evans, 2012; Mattila et al., 2019; Southerton and Yates, 2014) and supermarkets (Lehtokunnas and Pyyhtinen, 2022; Moser, 2019), there is still not much research that would focus on the mundane practices of different actors in the food chain. In the current article, I analyse the transition towards a CE in the food system by focusing on the future orientation in food waste[1] practices at three nodal points of the food consumption process: Finnish households, supermarkets and biogas plants.

In examining the CE as a societal transition that has yet to be accomplished, the present article takes seriously the future's role in the present (Mische, 2009). The article does so by paying special attention to the transformativity of practices. With transformativity, I refer to the future-in-the-making aspect of practices, that is, the precarious enactment of desired futures in the present moment (see also Meskus and Oikkonen, 2020) that aims to transform both the practices and materials entangled with and within them.[2] Previous practice-based research focusing on the future orientation of practices has analysed, among other things, how people engage with potential futures in practices (Mandich, 2020; Welch et al., 2020) and the future-oriented engagement with certain practices (Spotswood et al., 2020). These accounts, however, do not explicitly focus on how practices and materials are transformed to enact societal transformations, such as the CE. To pay special attention to this, I conceptualise three different transformative dimensions of practices: habitual transformativity, planned transformativity and experimental transformativity. With habitual transformativity, I refer to intuitive, ordinary and routinised behaviour in which food waste is reduced. Planned transformativity means deliberate coordination of practices to reduce food waste, such as planning and enhancing material and economic efficiency. Experimental transformativity entails practices of reducing food waste that are creative and innovative in one way or another, such as creating new recipes from leftovers.

In addition to examining the different dimensions of the transformativity of practices, I draw from Annemarie Mol's (2002) praxeological methodology to inquire into how different ontologies are situatedly enacted for food waste (see also Woolgar and Lezaun, 2013) through these three different aspects of transformativity. In my analysis, I show how the different transformative dimensions of practices enact certain ontological statuses for food waste and how these ontological statuses affect the way we orient ourselves towards potential CE futures. By doing this, I argue that present practices are not projected towards only one potential CE future—but rather multiple potential CE futures—and that these futures are sometimes based on partly contradictory rationalities. Thus, I suggest that a focus on different dimensions of the transformativity of practices and their different rationalities enables practice-based research to better articulate how different goals of practices (see Schatzki, 2002) can shape both societal transformations and futures, such as the CE.

My research question is as follows: *How do different dimensions of the transformativity of practices enact different ontologies for food waste, and how do these ontologies shape the potential CE futures*? The current article contributes to the growing body of research concerning CE as a matter of everyday actions (e.g., Lehtokunnas and Pyyhtinen, 2022; Lehtokunnas et al., 2022; Hobson et al., 2021; Holmberg and Ideland, 2021; Schulz et al., 2019). It does so especially by focusing on the potential CE futures made in practices and by offering a systemic viewpoint on how food waste practices contribute to the CE transition in three different interconnected environments in the food chain. In addition, by conceptualising the different dimensions of transformativity of practices, the present article makes a conceptual contribution to practice-based research that focuses on the future orientation of practices (see, e.g., Mandich, 2020; Welch et al., 2020).

The empirical material of the present article consists of multi-sited ethnography conducted in Finland and some supplementary materials, such as newspaper articles. Finland is an especially interesting context for this research because the country aims to be a global frontrunner in the CE (Marjamaa and Mäkelä, 2022). The ethnographic fieldwork was conducted in one supermarket and two biogas plants. In addition, 11 interviews were conducted with people working in the biogas sector. The material collected from households consisted of 26 food waste diaries. The article proceeds as follows: First, I present the literature background of this article. Here, I first discuss the Finnish context and CE as a future vision. Then, I introduce the future-oriented practice-based research. Next, in the section 'Materials and methods', I briefly present my data and methods. After this, I move on to the analysis in which I examine the different dimensions of transformativity of practices in households, supermarkets and biogas plants. Finally, I draw some conclusions and discuss the relevance of my research from the viewpoint of future-oriented practice-based studies and research focusing on CE.

[1] Food waste usually refers to, for example, edible food that is discarded at households or food losses created by the food industry (see, e.g., Närvänen et al., 2019). Biowaste is considered food that has turned into inedible waste, and it can also contain inedible parts of food (e.g., peels and bones). In this article, for the sake of consistency, when I discuss all the datasets, I refer to 'food waste practices', and this also includes practices of treating biowaste at biogas plants.

[2] With the focus on transformativity, I am not assuming that people can 'freely' choose to change their practices without any limitations. Different social factors, such as infrastructures, contradictory requirements of everyday life, habits and social relations, inevitably affect the possibilities of changing the practices (Evans, 2012; Schatzki, 2002; Shove et al., 2012).

2. Literature background

2.1. The Finnish context and circular economy as a future vision

In the EU policies, the CE can be currently seen as a dominating vision for a transition towards a more sustainable future economic system (see, e.g., Calisto Friant et al., 2021). The CE aims, for example, to prevent waste, enhance economic growth and create new jobs (European Commission (n.d.)). The CE is often contrasted with the unsustainable linear economic model of take-make-use-dispose. Multiple definitions exist for the CE, and there is no commonly accepted definition for the concept (Merli et al., 2018). One much-cited definition for the CE reads as follows: the CE is 'a regenerative system in which resource input and waste, emission and energy leakage are minimised by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling' (Geissdoerfer et al., 2017, p. 759). In the present article, however, I primarily take a practical stance and approach CE as a system that is enacted in concrete hands-on practices at multiple sites (see also Lehtokunnas and Pyyhtinen, 2023; Holmberg and Ideland, 2021).

In the last decade, Finland, among many other EU countries, has strongly emphasised the CE transition as a pathway towards a more sustainable society (Humalisto et al., 2020). Finland has a strategic target to be the world's leading CE country (Finnish Government, 2019). Moreover, Finland is also reportedly among the first countries to set a limit on the use of absolute natural resources by 2035 (Ministry of the Environment, 2021; see also Marjamaa and Mäkelä, 2022). The goals set for the CE transition of the food system both in the EU and Finnish contexts aim to reduce food waste production at the consumer and retail stages while enhancing more efficient utilisation of biowaste, for example, through biogas production (European Commission (n.d.)). Multiple efforts have been made to achieve these goals in Finland. These efforts include annual campaigns that aim to tackle consumer food waste and the Material Efficiency Commitment, which was made together by the Finnish retail sector and food and packaging industries (Motiva (n.d.)).

Regardless of the wide positive attention the CE has attracted, the concept is not completely unproblematic. Researchers critically approaching the CE have, for example, pointed out that CE policies and definitions are deliberately vague so as to avoid possible controversies and, thus, attract interest from multiple actors (Lazarevic and Valve, 2017).[3] Because the CE definitions and policies sometimes lack clarity, it is also rather unclear which kinds of CE futures the current practices are aiming to achieve. Different actors may have multiple intentions, goals and hopes projected towards the potential CE futures. There does not exist much research that would explicitly focus on CE futures, but some studies have analysed CE futures through utilising methods of creating different future scenarios (Bauwens et al., 2020; Kuzmina et al., 2019). Researchers have also examined different alternative CE future images (Marjamaa and Mäkelä, 2022). Although these explorations have mainly focused on different CE future imaginaries and scenarios, the present article sheds light on the situated hands-on practices of making these futures. Therefore, rather than focusing primarily on the discursive or narrative constitution of CE future imaginaries, this study demonstrates how ordinary everyday practices contribute to the formation of various CE futures.

2.2. Future-oriented practice-based research

Because the CE transition has not yet been accomplished, the present practices of making a CE are always to some extent projected towards a rather unclear future imaginary of this economic system. My approach toward the making of the CE future through present practices draws from the approaches offered by future-oriented sociology (see, e.g., Brown and Michael, 2003; Jasanoff and Kim, 2013), and especially from recent practice theoretical inquiries into the future projectivity of practices (Mandich, 2020; Welch et al., 2020). However, instead of strictly sticking to the tradition of practice theories, I situate my approach to the wider family of practice-based research (see Hui et al., 2016).

There are multiple definitions for social practices. In the present article, I take up a definition provided by Andreas Reckwitz, who defines practice as 'a routinized type of behaviour which consists of several elements, interconnected to one other: forms of bodily activities, forms of mental activities, "things" and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge' (2002, p. 249). Some recent developments in the field of practice-based research have focused on how practices are *projected towards potential futures*; thus, researchers have turned their focus on the forward-looking dimension of practices (Mandich, 2017; Welch et al., 2020). Daniel Welch, Giuliana Mandich and Margit Keller (2020) have proposed a practice theoretical account of different modes of engaging with the future. In their work, they draw a synthesis on Theodore Schatzki's (2002) practice theory and Laurent Thévenot's (2001, 2014) 'regimes of engagement'. These regimes of engagement illustrate how people engage with reality through four different regimes: the regime of the familiar, the regime of the plan, the regime of justification and the regime of exploration. Each of these regimes has its own realities and 'goods'. The realities of different regimes are always tested through pragmatic engagement, and the relevant reality in each situation depends 'on the different ways one has to 'take hold' of the environment' (Thévenot, 2001, p. 67). The 'good' of each regime can be understood through the moralities embedded in the regime. In the regime of the familiar, pragmatic engagement is constructed around the idea of habits and elements that sustain familiarity in the everyday environment (Thévenot, 2001). The regime of the plan stresses autonomous will in practical engagement. The engagement also happens, within the regime, by acting according to common contracts or projects (Thévenot, 2014). Pragmatic

[3] For a more profound review on the critiques of the CE, see, e.g., Corvellec et al. (2021).

engagement within the regime of justification refers to being responsive to the demands of the public order and making one's behaviour legitimate (Boltanski and Thévenot, 2006, 1991). In the regime of exploration, engagement with the world is characterised by innovation, creativity and a search for novelty (Thévenot, 2014).

Drawing from these regimes, Welch et al. (2020) suggest four different modes of engaging with the future within Thévenot's regimes: 'that of practical anticipation for the regime of the familiar; of probability for the regime of the plan; of possibility for the regime of justification; and of discovery for the regime of exploration' (p. 438). My conception of habitual,[4] planned and experimental transformativity is, to some extent, inspired by this development of Thévenot's work. It does not, however, directly draw from Thévenot's four regimes. In my conceptualisation of habitual, planned and experimental transformativity, I have chosen to focus explicitly on the regimes of the familiar, the plan and the exploration. The main reason for this is that my analysis examines the ways how the CE transition is made through transformative practices, while the regime of justification focuses on articulating the public justifications of actions. Consequently, I did not find the regime of justification as suitable for conceptualising the transformativity of practices as the three other regimes. However, the different rationalities that I highlight in my analysis still show the logic through which different transformative practices are justified.

What is more, my aim is to emphasise the situational nature of practices instead of focusing on how practices are performed within the pre-existing regimes that frame human behaviour. In my analysis, I draw from the idea of situatedness and performativity of practices developed by Mol (2002) in her praxeological methodology. According to Mol, there is not just one possible reality for objects; instead, these realities are always multiple, and the objects are transformed, depending on how they are enacted in situated practices. When analysing the transformativity of practices, I pay special attention to how the practices situatedly enact different realities for food waste, along with how these realities simultaneously shape the potential CE futures differently. Here, my analysis supplements previous practice-based research by illustrating how practices and their different rationalities shape societal transitions differently depending on the situation.

3. Materials and methods

The materials of the present article consist of three datasets collected from Finnish households, supermarkets and biogas plants between 2019 and 2021. In the current article, these datasets have been supplemented with some newspaper articles related to food waste. As I already previously pointed out, the Finnish context is particularly interesting for studying the CE, as the country aims to be a global frontrunner in the implementation of the CE (Marjamaa and Mäkelä, 2022). The sites of this study (households, supermarkets and biogas plants) were chosen primarily because these environments are closely interconnected with each other: for example, supermarket practices shape the behaviour of consumers, and the food waste practices of supermarkets and households affect the operation of biogas plants. Moreover, studying these three different sectors enables the examination of how the CE of food waste is enacted in practice in the final phases of the food consumption process. Table 1 illustrates the data in more detail.

The ethnographic fieldwork (Emerson et al., 1995; Hannerz, 2003) conducted in the supermarket and in the two biogas plants focused on routine daily practices related to food waste and the operations of the businesses (see also Holmberg and Ideland, 2021). In the supermarket, I took part in some simple work tasks, such as shelving the products and organising the shelves. I usually worked daily with the section managers and talked with them while working. This enabled me to form an understanding of food waste management practices at the supermarket. My observations focused mainly on the sections where most of the food waste was produced: milk and bread section, convenience food and cheese section, fruit and vegetable section, fish and meat counter, salad buffet and fresh bakery product shelf.

At the two biogas plants, I did not participate in the work tasks to the same extent as I did in the supermarket because there were not so many simple work tasks in the plants that could have been quickly learned without any previous experience. Rather, I usually spent my days having discussions with the plant workers and observing them doing their usual work tasks, such as running the biowaste treatment process, maintaining the machinery, and monitoring the process. During the fieldwork, I became very familiar with the biowaste treatment and biogas production processes at the plants. Both in the supermarket and at the biogas plants, I wrote some short jottings during the days at the field, and more extensive field diary entries were written after each day (see also Emerson et al., 1995).

The research material collected from the households consists of 26 food waste diaries. In the diaries, the participants were asked to write down every day for two to four weeks whether they threw food away and, if so, how this felt, what they did to avoid food waste and if they went to the store on that day, among other things. It was not possible to conduct ethnographic fieldwork in households, in addition to the fieldwork conducted at the supermarket and biogas plants within the limits of this research project. Food waste diaries were a methodologically compatible way to collect the data from households, in addition to the ethnographic fieldwork. Diaries have many similarities to ethnographic methods: the entries were written regularly, and diary keeping was also contemporaneous. This implies that events were written down in the diary soon after they occurred (Alaszewski, 2006). Thus, the food waste diary material was suitable for examining repetitious everyday situations and practices related to food waste.

The analysis of each dataset was conducted separately through thematic coding (Williams and Moser, 2019). The future-oriented practice-based approach guided the analysis of the data from the beginning, and other theoretical concepts were applied after conducting the preliminary analysis. The different dimensions of transformativity (habitual, planned and experimental) and the ontologies

[4] The idea of habituality is sometimes associated with individualistically oriented psychological research frameworks. However, in this article, I understand habitual transformativity through the idea of socially shared practices (for further reference on habits and social transformation, see e.g. Bennett et al., 2021).

Table 1
The methods of collecting the data.

	Supermarket	Households	Biogas plants
Year	2019	2019	2021
Description of the collected data	Four weeks of participant observation, ethnographic interviews.	26 food waste diaries, kept for two to four weeks.	Three weeks of participant observation, 11 interviews with people working in the biogas sector.
Description of the site / participants	A large supermarket located at the centre of one the largest cities in Finland.	Participants were mainly women living in the largest cities in Finland. They were recruited mainly through social media.	The ethnographic fieldwork was conducted in two Finnish biogas plants that both treat biowaste collected from for example households, retail stores and food industry businesses. One of the two plants was considerably larger than the other.

they enact for food waste were identified through a systematic reading of each dataset and encoding them by using the Atlas.ti software. As a result of the large quantity of data, the analysis in the present article does not provide a fine-grained and detailed description of the practices in each field. Instead, it offers a holistic view and raises some examples from each dataset.

4. Analysis and findings

4.1. Habitual transformativity: Food waste as a problem to be prevented

In the food waste diary data I collected from the households, the research participants reported that they had formed several habits that helped them prevent food waste. For example, the participants said that they found it useful to go to the store often because this helped them keep track of what they already had at home, and buying only small amounts of food items at a time helped them to prevent food from spoiling. I call forming these kinds of habits habitual transformativity. Habitual transformativity refers to routinised actions (see also Reckwitz, 2002) that are considered in one way or another to be familiar and useful in preventing food from ending up as waste or biowaste being left unutilised. Often, this kind of behaviour does not require much deliberate effort to change habits, and it emphasises intuitive actions. These kinds of practices may not often be considered as especially 'transformative', new or future-oriented. However, these habits may still become framed in a new way (consciously or not), contributing to projecting the practices towards CE as a future vision. In habitual transformative practices, food waste is enacted as a problem to be prevented.

Forming habitual transformative practices at households requires the practices to be coordinated in relation to retail stores and that the rhythms of going to the store are orchestrated to prevent food from spoiling in the near future (see also Mattila et al., 2019). Moreover, one participant wrote that she and her partner have a reoccurring routine of always cooking certain meals. This helps them plan their shopping so that they do not end up buying anything that they do not eat. Forming this kind of routine was not, however, always that typical for people who had children because the parents often planned the meals situationally based on the preferences of their children. In situations when the children did not eat all the food from their plates, eating the leftovers of family members was also part of habitual transformativity. Habitual transformativity was well illustrated by one participant who said that, during the diary keeping period, she realised that it was unclear for her what food waste was because preventing food from ending up as waste was so natural for her:

> Not until the last day of my diary keeping period did I start to wonder what food waste actually means. Does food turn into waste if it is not eaten at once? Or are the leftovers from an opened can of pea soup food waste if I consider whether to cook a small portion of soup from them or try a new tip I found and eat the leftovers on top of a bread? I do not think that is food waste, and I do not think I am using any measures to prevent food waste if I eat the same dish two times in a row or if I eat a leftover vegetable patty on top of bread later. (Food waste diary, 3 Feb 2019, 67-year-old woman living with her dogs)

Even though habitual transformative practices are not necessarily considered deliberate efforts to reduce food waste, as the above diary entry suggests, they still contribute to enacting food waste as a problem to be prevented. Here, the practices constitute a CE future in which household practices should be transformed so that no food waste will be produced in the future.

For supermarkets, the habitual transformativity of practices was often most clearly visible in the normative goal of reducing food waste. This goal was apparent in the routinised work tasks performed daily. For example, the supermarket employees organised the shelves every morning so that products that would expire soon were placed on the front of the shelves and, thus, be sold first. This so-called first-in-first-out practice (see Moser, 2019) aims to transform the future trajectories of food items so that they would not get buried in the back of the shelves but would rather be sold:

> The section manager says that the front of the self is the best-selling place for the products, and the food items that will go bad soon are placed there to avoid food waste. The section manager also pointed out that it is important to organise the shelves so that they look full and well-ordered before the customers come in when the store opens. (Field diary entry, 3 Sept 2019)

In the supermarket, the habit of organising the shelves every day and placing older products on the front of the shelves was part of enacting food waste as a problem to be prevented. All employees are oriented to this principle when they start working in the supermarket. Organising the shelves was also an important part of making the shelves look inviting for the customers; when the products are placed at the front of the shelves, the shelves look fuller. Thus, this practice is not only motivated by the goal of reducing food

waste, but also by increasing sales. What is more, food waste prevention must always be coordinated in relation to customers and their expectable behaviour. For example, the section manager of the convenience food section once mentioned that the sales at her section were clearly better when the section was well organised. When food waste is enacted as a problem to be prevented in supermarkets, the CE future is constituted based on the assumption that the practices should be coordinated in a way that all products are always sold before they spoil.

At biogas plants, habitual transformativity usually simply means the ordinary running of the biogas production process, such as feeding biowaste to the biogas reactors, as well as maintaining and monitoring the process. In the daily practices of biogas plants, the biowaste material is literally transformed into new products, namely, biogas and biofertilisers:

> During the tour at the plant area, the CEO of the plant told me that it takes 21 days for the bioslurry to go through the biogas production process inside the reactors. The gas is directed down from the reactor through a gas pipe, and it goes to gas storage. After coming out from the reactors, the biowaste mass that the microbes have broken down goes to a sanitation plant, and its temperature is lifted to 70 °C at least for an hour. In this process, hazardous bacteria will be killed. After this, the mass is put through a sand separator. After the sand has been separated from the mass, the bio-based slurry goes to a storage pool located at the fringe of the plant area. Customers can then come to pick up this bio-based soil conditioner from the pool using their own trucks. (Field diary entry, 25 May 2021)

The biogas production process described above does not, however, function without the continuous efforts of the plant workers. Mundane, routinised and redundant maintenance of the machinery is a central part of the habitual transformativity of practices because it aims to prevent potential problems from appearing, thus hindering the possibilities of turning biowaste into new products. Some of these maintenance practices are regular, such as checking the biowaste pretreatment machinery, and some are more occasional, such as fixing broken parts of the machinery. Enacting biowaste as a problem to be prevented through these practices means preventing waste from being left unutilised. The orientation towards the CE future here is based on the need to enable the future continuity of household and retail food waste practices that situationally lead to the generation of biowaste.

The habitual transformative practices explored in this section are not necessarily in any way ‘new’ or oriented towards changing ordinary habits. This dimension of transformativity is still essential from the viewpoint of forming a CE future. What is more, these practices are not always only motivated by the aim to reduce food waste: they can also be guided by goals such as increasing sales, as in supermarket practices of organising the shelves. As a whole, however, habitual transformative practices enact food waste as a problem to be prevented, which means that the rationality of the practices is based on frugality; thus, the practices are oriented towards a CE future in which food waste should not occur at all.

4.2. Planned transformativity: food waste as a utilisable object

Although habitual transformativity is based on familiar routines that do not require much deliberate effort to change the practices, the planned transformativity of practices is more related to calculative leaning to probabilities (see also Thévenot, 2001) and the deliberate planning of future operational principles. Thus, planned transformativity is not only about securing future reproduction of useful practices to prevent food waste, but it is also more about planning and actively changing the practices. Often, planned transformativity focuses on securing the economic and material efficiency of practices. Through planned transformativity, food waste is enacted as a utilisable object.

In the studied households, the planned transformativity of practices was often related to planning shopping lists and future meals to avoid making unnecessary purchases. Planning future meals usually means planning what will be cooked, cooking portions that are not too big, utilising food items that one already has at home, putting surplus food into the freezer and coordinating when each cooked dish will be eaten and by whom. When performing planned transformative practices, the participants often clearly articulated that they had a goal to reduce food waste; in some cases, this also concerned other types of food waste, in addition to the waste they generated at home. Some participants, for example, often bought discounted and soon expiring products from the store and then coordinated the use of these items at home:

> I made some supper using ingredients I found at home. I used the discounted tofu I bought yesterday. (Food waste diary, 31 Jan 2019, a 34-year-old woman living with her spouse)

In addition to buying discounted products from the store, some participants used mobile applications that allow retail stores and restaurants to sell their expiring products at a reduced price. Some participants also dumpster dived to reduce retail food waste. When performing this kind of planned transformative practices that aim at material and economic efficiency, food waste is turned into a utilisable object: consumers can save money by utilising retail food waste. Although not all participants explicitly stated in their food waste diaries that they bought discounted products to save money, many of them reported that they engaged in practices such as dumpster diving, both for environmental and economic reasons. Here, enacting food waste as a utilisable object makes a CE future in which food waste at all stages of the food chain does not necessarily need to be completely prevented because, for example, consumers can utilise at least part of the excess.

For supermarkets, practices such as developing strategies and technologies to avoid food waste are a central part of the planned transformativity of practices. In the supermarket where I conducted my fieldwork, this included the practices of keeping track of all produced food waste. The produced food waste was tracked by using certain technological devices. By tracking all produced food waste, the store could plan which products should be kept in the selection of items. This also helped them constitute their operational principles for the future. The following fieldnote illustrates the usage of this technology in the everyday practices of the supermarket:

> I gave the products I had removed from the shelves to the section manager, and she recorded them as 'food waste' by using the device. The section manager always carries this device with her. The device is used to track food waste and place price tags on the digital screens that are attached to the shelves, among other things. The section manager reads the bar code of the product and chooses the correct function from the device, which in this case is 'food waste'. Through this procedure, the store can always keep records on their food waste production. (Field diary entry, 3 Sept 2019).

It is, however, crucial to note that the store did not aim to completely eliminate all the food waste produced. To secure product availability, section managers often deliberately ordered slightly too many products for their sections. To keep food waste production under control, each section of the store had a specific goal percentage for food waste, and this percentage should not be exceeded (see also Lehtokunnas and Pyyhtinen, 2022). The store employees still aimed to utilise the excess products from their sections so that they will not be discarded. They, for example, used discount stickers for spoiling products, sold some surplus products through a particular mobile application with a reduced price, and donated some products to food banks. It is notable that many of these strategies were, again, coordinated in relation to consumers and their mobilisation. Thus, the planned transformative practices in the supermarket were not based on efforts to minimise food waste production in the first place but rather to create the means for distributing the surplus products through optional routes. Retail stores often highlight their efforts to distribute surplus food in public discussion, and this is part of their marketing practices (Sutinen and Närvänen, 2022). Through these marketing practices, food waste is enacted as a utilisable object not only from the viewpoint of making use of retail food waste. Retail stores also utilise and highlight their efforts related to food waste reduction in gaining positive publicity. When food waste is turned into a utilisable object in retail stores, this simultaneously enacts a CE future in which it is not obligatory to prevent all food waste from occurring, as long as the potential surplus is utilised efficiently.

At biogas plants, the planned transformativity of practices had much to do with utilising waste as efficiently as possible and, at the same time, securing future business operations. In Finland, the potential income from biogas and fertilisers has still been rather low for several reasons. Consequently, the biogas plants have relied on the so-called gate fee they collect from their waste treatment services. Because there is fierce competition for biowaste between the plants, it is important for the plants to prepare for the regular competitive tenderings by offering as low prices from their services as possible:

> Well, always, when there is a competitive tendering in municipal waste management services, you have to set the price so that the [contract] concerning a certain area remains [with the plant]. These days, there always exists a risk because it is always the cheapest price that determines [the outcome]. At the time when we started our business, it was an advantage for us that we had a biogas plant that utilised [the waste] as raw material to produce fertilisers and energy, instead of composting it, but this is not the case anymore […]. (A quote from an interview with a CEO of a biogas plant, 29 April 2021)

Because the competition for biowaste is fierce in the biogas sector, food waste that has been turned into biowaste situationally transforms from a problem into a resource. During my fieldwork at the biogas plants, some employees even mentioned that it was possible that the plants should pay for the biowaste in the future because competition on biowaste between biogas plants is so intense. As a result, turning biowaste into a utilisable object at biogas plants simultaneously makes a CE future in which biowaste may not be only a resource for the plants, but also a commodity (see also Abrahamsson, 2022) that the plants have to purchase.

The planned transformative practices discussed in this section entail deliberate actions to efficiently utilise food waste, and these practices enact food waste as a utilisable object. Here, the practices are based on the rationality of utility: food waste is not necessarily seen as something that must be completely avoided on all occasions; rather, the practices aim for making use of it. Thus, the practices are projected towards a CE future in which food waste is not necessarily seen as a problem that we should get completely rid of.

4.3. Experimental transformativity: food waste as an object of speculation

The experimental transformativity of practices refers to innovative and creative ways of engaging with the future. The experimental transformativity of practices differs from habitual transformativity aiming to reproduce practices that are useful in preventing food waste. It also differs from planned transformativity, which is often based on probabilities and expectable future developments. The experimental transformativity of practices is different compared to these two dimensions of transformativity especially because it projects the practices towards more hardly imaginable or unclear future visions that may or may not be realised. In addition, this dimension especially entails everyday creativity enfolded in the practices (see, e.g., De Certeau, 1984). Because the outcomes of these creative practices are often unclear, experimental transformative practices are usually performed through acts of 'trying, adjusting, and trying again' (Mol, 2008, pp. 18–20). Thus, experimental transformativity is not tied to rule-bound requirements to reduce food waste (see also Hawkins, 2001) but rather to precarious and broadminded experiments with potential futures with waste. In experimental transformative practices, food waste is enacted as an object of speculation. Here, speculation is understood as not knowing (Stengers, 2005): it is hard to know what food waste may become and what kind of effects it may have as part of different assemblages.

In households, experimental transformativity often entails creative practices such as inventing new recipes on the run when cooking to use leftovers or products that would otherwise spoil (Närvänen et al., 2018). Some participants who dumpster dived regularly situationally planned their meals based on what they happened to find from dumpsters. Often, in this kind of explorative cooking, the outcome was rather unclear, and the food may sometimes even turn out to be inedible. The participants, however, also reported that using leftovers in cooking can make life easier when one does not have to cook dishes from the beginning or go to the store. Moreover, the participants often pointed out that it felt good to creatively utilise leftovers. Sometimes, this experimentality in practices, however, also entailed the potential danger of getting ill when preventing food waste:

> I ate the supper that was forgotten in room temperature yesterday and now my stomach hurts. … It was, however, still worth it since I had forgotten the food there myself. (Food waste diary entry, 18 April 2019, a 26-year-old woman living with her spouse and dog)

Experiments with food waste may sometimes have negative consequences that may or may not be predictable. Thus, these experiments always entail speculations related to the safety of the food, the possibilities of cooking from certain food products and different feelings when the experiments are more or less successful. When food waste is enacted as an object of speculation in experimental transformative practices, the CE future is constituted as unclear and unpredictable. Although this unpredictability may sometimes lead to problems, it may also create the space for creativity and inspiration.

In supermarkets, experimental transformativity can mean, for example, creating new products from excess food. In the supermarket where my fieldwork took place, the employees, for example, situationally used excess meat from the meat counter in ready-made meals they cooked to be sold at the meat counter:

> The section manager says that marinated meat starts to look bad quite quickly, even though it would still be completely edible. It cannot, however, be sold from the meat counter when it no longer looks good, and marinated meat often ends up as waste resulting from this. The store employees still try to do their best to utilise leftover marinated meat, for example, in ready-made meals cooked in the store, if they have enough time. In addition, leftover fish from the fish counter can also be used when cooking these meals. (Field diary entry, 30 Sept 2019)

In the supermarket, experimental transformativity was constituted around the situated practices of making use of excess food: one can never perfectly predict how much and which products will be under a threat of ending up as waste. Thus, one must be creative when planning how to utilise them. Although the supermarket where my fieldwork took place did not explicitly use this experimental practice of utilising leftover fish and meat in their marketing, many supermarkets have highlighted similar experiments in their marketing. For example, one Finnish supermarket received media attention after they innovated a new product that enabled them to reuse their leftover sushi rice by mixing it with salmon (Tuominen, 2021). This product is called 'sushi hash' (my own translation) and it is sold at a reduced price. Through these kinds of experimental practices, supermarkets can highlight their efforts to reduce food waste. By testing whether or not consumers accept these new experimental products, food waste is enacted as an object of speculation in supermarkets. This simultaneously enacts a CE future in which food waste is an object through which different ideas can be tested while potentially attracting positive publicity for the business.

In the biogas plants, experimental transformativity meant innovating new products and testing novel technologies, and these kinds of experiments often take place. For example, during my fieldwork, I discussed with the CEO of the plant one experiment they had conducted. The goal of this experiment was to test whether they could produce liquid fertiliser from the excess water produced in the biogas production process:

> I asked the CEO why there are tanks in the yard of the plant that look like oil tanks. He said that these tanks were used in a previous project, but the project ended because it was not profitable. According to the CEO, the idea of the project was to develop and produce liquid fertiliser from the reject water produced in the biogas production process. The fertiliser could have been marketed for greenhouses, but they were not able to create a suitable composition for the liquid. (Field diary entry, 10 October 2021)

Although biogas plants operate as sites for many different experiments related to CE, it is often uncertain whether the end products of these experiments will turn out to be suitable for certain uses. It is also often unclear whether there will be markets for these products in the first place. Thus, making the CE future in environments such as biogas plants is often very precarious because attempts to introduce new circular products may not be successful. In these practices, biowaste turns into an object of speculation in a very concrete way—it may or may not turn into what people would wish it to be. The only way to find this out is through trial and error. Thus, the CE future enacted here is based on accepting that waste cannot always be perfectly managed and turned into what people

Table 2
A table summarising the analysis.

	Habitual transformativity	Planned transformativity	Experimental transformativity
Households	Forming habits that prevent food from ending up as waste (e.g. always cooking certain meals)	Planning in order to reduce food waste (e.g. buying discounted products from the supermarket and coordinating their usage)	Creative cooking practices (e.g. cooking from products found in dumpsters)
Supermarkets	Food waste reduction as a normative goal in the everyday operations (e.g. organising the shelves according to the first-in-first-out principle)	Creating efficient processes to keep food waste production under control (e.g. tracking all food waste, utilising excess products)	Creating new products from excess food and potentially attracting positive publicity for the business (e.g. utilising excess meat when cooking ready-made meals)
Biogas plants	Ordinary running of the biogas production process (e.g. feeding biowaste to the reactors and monitoring the process)	Efficient utilisation of biowaste and securing business operations (e.g. price competition)	Innovating new products and testing novel technologies (e.g. experiments with excess water produced in the biogas production process)
Ontology of food waste	Problem to be prevented	Utilisable object	Object of speculation
Rationality	Frugality	Utility	Innovation

would want it to be (see also Lehtokunnas and Pyyhtinen, 2023).

The experimental transformative practices examined in this section form a dimension of transformativity stressing the creative and precarious testing of new ideas. These practices enact food waste as an object of speculation, meaning that it is not always clear what it may turn into or what kind of effects it may have; thus, the practices are projected towards a CE future that is rather unclear and hard to imagine. Experimental transformative practices are based on a rationality of innovation—when creating something new, one can never exactly know what the outcome will be.

4.4. Summary and discussion of the analysis

Table 2 summarises the results of my analysis.

In my analysis of habitual, planned and experimental transformativity, I found that different CE futures towards which the practices are projected in the different fields of this study are based on different rationalities. First, in habitual transformative practices, the rationality of frugality constitutes a CE future in which practices are oriented towards preventing food waste through control. In my analysis, this meant forming routines that prevent food from ending up as waste, such as reasonable consumption in households, regular practices of ordering in supermarkets and waste management practices that fix the occasional failures in food waste prevention. Here, enacting food waste as a problem to be prevented highlighted the need to prevent food waste production in the first place. Second, and contrary to the first orientation, the orientation towards the CE future constituted through the rationality of utility in planned transformative practices aligns with practices moving towards solving the food waste problem by turning food waste as a resource for efficient utilisation. This utilisation can happen through the consumption of soon-to-expire products, tracking all food waste and marketing products produced from potential food waste, and biogas production from biowaste. Enacting food waste as a utilisable object here emphasised planning and securing the economic and material efficiency of practices. Further, in biogas plants, the utilisation of biowaste in some cases meant competing on biowaste as a scarce resource (or even as a commodity) in the future. Thus, the planned transformative practices do not aim for a future in which food waste is completely prevented; rather, the waste is made use of. Finally, the rationality of innovation in experimental transformative practices stresses a future orientation based on giving up on the idea of perfect control over waste. Giving up this kind of control is necessary to enable precarious experiments with food waste that have unclear outcomes. These experiments include practices such as creative utilisation of food waste in cooking, creating new products from food waste, and testing novel technologies. When food waste is enacted as an object of speculation in these practices, in contrast to the habitual and planned transformativity, the practices are projected towards a more hardly imaginable CE future in which one must accept that waste is not a completely manageable object.

5. Conclusion

Through a multi-sited ethnography, the present article has analysed three different dimensions of transformativity in everyday practices in Finnish households, supermarkets and biogas plants. It has paid specific attention to how these dimensions contribute to enacting different ontologies for food waste. By focusing on the transformativity of practices, the current article has shown how not yet realised future transformations such as the CE are made in ordinary mundane practices. The article has highlighted that, when different ontological statuses are situatedly enacted for food waste (Mol, 2002), the potential CE futures are simultaneously constituted differently. In doing this, it has been shown that the practices are projected towards not only one CE future, but multiple potential CE futures (see also Meskus and Oikkonen, 2020).

My analysis has identified different future orientations related to the CE transition. Although these orientations often overlap with each other in everyday practices, they can still also be asymmetrically stressed, depending on the situation. The policy-level CE discourse often highlights that the practices of different actors in the production–consumption system must be transformed towards circularity if we want to achieve a CE in the future. In doing this, the discourse often downplays the fact that this circularity can mean very different things to different actors (Kirchherr et al., 2017). Luke Yates (2022) has argued that discussion on power, politics and resources is often absent from research focusing on practices and their connection to ecological changes. As I already discussed in Section 4.4, my analysis has shown that multiple different and partly contradictory rationalities can be entangled with the practices aiming for a CE future. For businesses, such as supermarkets and biogas plants, the main goal of mundane practices is, maybe rather obviously, to secure efficient business operations. The rationality of utility that aims for efficient utilisation of waste (but does not necessarily emphasise the need to reduce waste) is sometimes rather hard to bring together, for example, with the rationality of frugality and enacting food waste as a problem to be prevented. Thus, there is a risk that this orientation towards the CE future is not taken equally seriously. These kinds of tensions are not often openly articulated when speaking about potential CE futures.

As I already pointed out in the analysis, some practices studied in this article are not particularly new or ‘transformative’ at first glance. Moreover, the people performing the practices do not necessarily always themselves explicitly associate their actions with the CE transition. For example, frugal household practices, or practices such as ordering the shelves in supermarkets, have existed long before the CE became a guiding sustainability vision. However, this does not diminish the relevance of studying these practices, as they still contribute to enacting the CE transition. Furthermore, studying practices that are not necessarily novel or directly associated with the CE allows us to highlight the multiplicity of different practices (and their rationalities) that contribute to making the CE futures.

The most obvious limitations of this study pertain to the scope of the data. This study specifically focuses on the final phases of the food consumption process. However, it is important to recognise that other actors in the food system, such as producers, also play a crucial role in driving the transition towards a CE. In future research, it would be valuable to conduct studies that examine how, for example, food producers project their practices towards different CE futures. Furthermore, it is crucial to note that this research has

solely focused on the Finnish context. While the Finnish context holds international relevance, it would be important to conduct similar studies in non-EU countries as well.

The current article has contributed to two different fields of research. First, it contributes to research that focuses on the CE as a matter of everyday actions (Hobson et al., 2021; Holmberg and Ideland, 2021; Lehtokunnas et al., 2022; Lehtokunnas and Pyyhtinen, 2022; Schulz et al., 2019) by offering a systemic viewpoint on how food waste practices shape the CE transition and futures in three different interconnected environments in the food chain. In contrast, previous studies examining everyday practices and the CE have mainly focused on certain actors in the food chain, such as consumers (Lehtokunnas et al., 2022; Mattila et al., 2019) or waste management (see e.g. Lehtokunnas and Pyyhtinen, 2023; Holmberg and Ideland, 2021). Furthermore, to develop a more nuanced and comprehensive understanding of the multiple potential CE futures, including their differences and potential asymmetries between various visions, research focused on fostering CE transitions (see e.g. Cuomo, 2022; Sousa-Zomer et al., 2018) could benefit from following the path set by this study. This could be done, for example, by analysing the role of different rationalities (frugality, utility and innovation) in constituting the CE.

Second, the article contributes to practice-based research that focuses on the future-orientation of practices. This study has made a conceptual contribution to future-oriented practice-based research (Mandich, 2020; Welch et al., 2020) by conceptualising three different dimensions of transformativity of practices.[5] It has thus developed one potential research approach to examine future social transformations and everyday practices. Previous practice-based work analysing social transformations has often adopted a retrospective and historical perspective when studying practices (for exceptions, see e.g. Welch et al., 2020). This line of research has examined, for example, how certain practices emerge, evolve and disappear (Shove et al., 2012), and explored social change through focusing on changes in different bundles of practices (Schatzki, 2019). The approach adopted in this article enables practice-based research to better acknowledge how different goals (see also Schatzki, 2002) and rationalities of practices guide the ways in which practices are oriented towards different futures. As the current study has shown, the CE future is 'not simply a neutral temporal space into which objective expectations can be projected' (Brown and Michael, 2003, p. 4). I suggest that the analytical approach employed in this article is especially useful in creating a better understanding about the politics entangled with everyday practices that enact societal transformations.

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[5] In addition to contributing to future-oriented practice-based studies, this kind of approach complements the viewpoints offered by previous practice-based research. For example, previous research has explored the involvement of various actors, including consumers and manufacturers, in innovating as an ongoing process through their practices (Pantzar and Shove, 2010). This study shows how different actors can transform practices and materials that are entangled with and within them (e.g. food waste), differently depending on the situation.

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