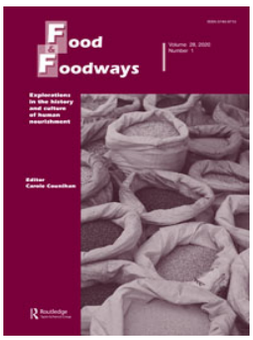

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Black boxing milk: Date labeling, quality, and waste throughout the Norwegian milk chain

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ABSTRACT

We confront the expiration date whenever we shop, eat or discard food. This label has changed our foodways in profound and unforeseen manners, on the one hand increasing food safety while on the other reducing our sensory ability to judge food, thus leading to an increase in food waste. Only by understanding how the quality and expiration date of a product are interrelated and co-constructed by different actors, technologies and practices throughout the food chain, might we gain a better understanding of the phenomenon and be able to find solutions to a growing food waste problem. Based on ethnographic research at different locations, I will open the black box of the date label to unravel its internal complexities. I will show how human and non-human actors are entangled and connected via the expiration date—on the one hand co-constructing the *double black box* that hides the properties of the product milk and on the other being strongly influenced by their own construction.

KEYWORDS

Black box, date labeling, food waste, milk, quality

Introduction

In pairs, the cartons swiftly move through the dairy, transported on a black conveyor belt. They are filled with fresh milk, have been closed and sealed, and now they are ready to pass to the printer. In a matter of seconds, the machine inscribes the expiration date, time of day and code for the particular dairy facility. In one apparently seamless movement, the milk changes from being an "anonymous, timeless entity" to a 'packaged, traceable commodity' and the natural life of milk becomes standardized and transformed into black boxed shelf life. Coined by cybernetics in the mid-twentieth century, the term 'black box' refers to the simplification of complicated systems, mechanisms or objects, by focusing only on their inputs and outputs. Bruno Latour (1987) applied the terminology to the studies of science, arguing that once knowledge is established it is accepted as true, while the

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complex processes involved in its creation are forgotten or neglected. The concept of the black box can also be applied to standardization processes like food packaging or labeling where "[…] ideas of quality and safety are condensed through material and semiotic connections and exist as a kind of shorthand reference to assemblages of persons, places, and production" (Tracy 2013, 440). In this article I analyze how the date label not only black boxes the product inside, hiding away complex processes and assemblages that have gone into its creation, but by doing so, the date label furthermore becomes the most determining quality parameter in the milk's life, incorporating and concealing several other properties and qualities that characterized the product before. This has great effects on all actors and locations along the whole food chain (before and after printing the date) until at the end the consumer is left with the dilemma: senses or standards?

The date label and food waste

In recent years, the date label has been identified as being responsible for a substantial part of household waste (European Union Committee 2014; Norstat 2016; Elstad Stensgård et al. 2018). I argue that this connection is neither given nor inevitable and that in order to address this issue, one has to understand how the expiration date is actively constructed and put into practice by different actors throughout the food chain. Many studies about date labeling and food waste have focused on the consumer (for example Evans 2012; Stilling Bilchfeldt, Mikkelsen, and Gram 2015; Aschemann-Witzel et al. 2015), others have shed light on the political and legal construction of the date label (Evans, Campbell, and Murcott 2012; Milne 2012; Yngfalk 2016; Plasil forthcoming). Less has been written about the effects of the date label at other locations of the food chain. Notable exceptions are Whitelaw (2014) on Japanese corner shops or Yngfalk (2016) on Swedish supermarkets. In this article, I expand the focus and will follow the construction, practice and consequences of the date label of milk throughout the whole food chain, literally from the udder to the gutter.

By doing so I will "de-naturalize" the current association between the date label and food waste. Using the Norwegian dairy industry as an example, I show that the date label by itself does not automatically lead to discarding food. At every location there is the possibility for waste due to the strictness of the date label, still there is enough flexibility inside the black box and within the human relations that there are ways to avoid it. By using an integrated approach and by looking at the processes and actors co-constructing the date label along the whole food chain this article adds to current debates about quality, value and waste in industrial food production.

Materiality, quality and black boxing

Food has a perishable and "biodegradable materiality" (Mattila et al. 2018, 2). The date label standardized these unruly properties of food. It has in a way standardized "freshness" (Freidberg 2009) and quality and made food products more manageable and less connected to individual bodies and their senses. But what does quality mean, and how is it determined and evaluated?

I take as a starting point the idea that quality is neither just a "subjective judgement" nor a "pure objective measure"; it is "produced within the relations of commodity consumption and production" (Mansfield 2003). Quality is not simply inherent in a product but constructed and then legitimized via standardization and certification mechanisms (Renard 2005). Callon, Meadel, and Rabeharisoa (2002) propose an "economy of qualities" and describe how products pass through a series of "qualification processes" in which qualities are "attributed, stabilized, objectified and arranged". "Intrinsic properties" (in the case of milk: fat, protein, microbes, etc.) and "extrinsic attributes" (measurement, evaluations and judgements) are combined to define the quality of a product. Building on these ideas, I argue that by printing a date label on a package, a whole set of other qualities, on which this date depends, are rendered invisible, and that from then onwards milk is evaluated mainly by its remaining shelf life with far reaching consequences for both our food chains and foodways. The product milk and its quality become black boxed and hidden from the consumer.

According to Bruno Latour (1987, 1999), black boxing renders the "internal complexity" of technologies "opaque and obscure" and the technical and scientific work gone into the black box invisible to users. In this article, I will show how the date label is a "double black box" working on different levels. The first level of black boxing is the setting of the date label in the laboratory. The second level is the above-described printing of the date label onto the milk carton. This carton then becomes a black box itself, hiding and protecting the natural product milk inside. It becomes a standardized entity with a standardized shelf-life.

Standards, a central feature of modern life, are very pervasive, as they are taken for granted in our everyday environment and completely embedded in everyday tools of use (Lampland and Star 2009). The expiration date has become such an embedded, everyday tool of use: It enables consumers to shop, and later eat, without making decisions within a wide array of topics—from hygiene and safety to legal and moral questions on value and waste. One notable example of how standards work is Dunn's analysis of the connection of botulism and food canning in post-Soviet Georgia. Dunn describes how consumers in the Soviet Union came to trust canned food as safe, "knowing vaguely that the state had standards for production, without needing to know too much about how, precisely, the food was made" (Dunn 2008, 247).

Consumers of modern, industrial food in the West have come to trust the date label as an indicator for food safety and quality in a similar way. The paradox with the date label is that even though it was put in place to enhance consumer knowledge, enabling buyers to judge the safety and quality of industrialized food (Milne 2012), over time it has muddled our (sensory) knowledge of food itself. Many scholars have pointed out that consumers have come to depend on it in such a way, that today the expiration date is often trusted more than one's own senses and therefore directly related to undesired food waste (see Evans 2012; Møller et al. 2014; Aschemann-Witzel et al. 2015; Elstad Stensgård and Hanssen 2015; Stilling Bilchfeldt, Mikkelsen, and Gram 2015; Yngfalk 2016; Aschemann-Witzel et al. 2018; Mattila et al. 2018). However, with the current discussion about food waste, cracks in the black box of the date label are becoming visible.

> Black boxes 'work' in so far as they are held together by contingent 'assemblages' of institutions, rules, social hierarchies and tacit understandings. Because of this, black boxes do not always travel smoothly from place to place or from one historical moment to another. Cracks may appear under the strain of new externalities, calling into questions what is inside (Paxson 2016, 269).

Here is where the empirical analysis contributes to our understanding of black boxes. Rather than taking the date label and its connection to food waste as a given, I open the black box of the date label and unravel the internal complexities inside the milk carton. I show how human and non-human actors are entangled and connected via the expiration date throughout the milk chain—on the one hand co-constructing the double black box that hides the properties of the product milk, and on the other being strongly influenced by their own construction. By better understanding how the ideas about food quality and the expiration date of a product are interrelated and co-constructed and by questioning the connection of the date label to food waste we might find alternative solutions to the problem.

Background: Norwegian dairy industry and the expiration date

I chose milk as an example for the exploration of the expiration date due to its importance in the human diet[1] in general and in Norway in particular. According to the Information Office for Dairy Products (*Opplysningskontoret for meieriprodukter*), total milk consumption in Norway was approximately sixty-nine liters per person in 2018, making milk a substantial part of the Norwegian diet.[2] The majority of the milk consumed is pasteurized, fresh, drinking or fluid milk, which comes as either full fat, low-fat, semi-skimmed or skimmed. In the reminder of the article I will focus on this product and call it simply milk. The use of UHT or powdered milk is rather marginal in Norway and will therefore not be part of this

article. Milk in Norway is literally sold in a black box—even though often white on the outside, the milk carton is generally dark on the inside to avoid the undesired sun-taste (see for example Airado-Rodríguez et al. 2011).

Norway is self-sufficient in milk production, and the amount produced is regulated to prevent over-production.[3] Only three different companies produce all the milk consumed in Norway. This means that Norwegians have a limited choice of just three brands and four different fat contents. Based on my findings, I argue that within these choices no other quality parameters are as guiding and determinant as the date label. Further, these choices are what I call "stable parameters for valuation" as they do not change during the lifespan of milk, while the shelf life is "dynamic," influencing production, retail and consumption to a much higher degree.

In Norway and in other parts of the world, ideas of milk being good food for health and growth, especially for children (Wiley 2016), have "endowed milk with its modern job of sustaining an aura of goodness and purity in Western society" (Valenze 2011). However, milk did not always have this pure and healthy image. Given the high perishability of milk, in the late 19th and early 20th centuries, it was commonly associated with disease and epidemics (Atkins 2016). Milk, due to its high nutritional value and water activity and a neutral pH, serves as "an excellent growth medium for different micro-organisms" (Claeys et al. 2013). The more time passes, the more the microbes multiply.

All food is unpredictable and ephemeral, and, therefore, to ensure product safety and quality, consumers were provided with a legally constructed and regulated cutoff date, after which they should consider products as not safe or at least not pleasant to consume. Date labeling, as a quality indicator, was first regulated in Norway in 1975 by the National Regulation of Labeling of Consumer Goods (*Forskrift om merking av forbruksvarer*) issued by the Ministry for Consumers and Administration. Today *EU Regulation 1169/2011* guides all the date labeling in Europe (even in EU's nonmember states, such as Norway).[4] The reason for this standardized expiration date was a change in foodways (industrialization, globalization and the supermarket revolution) during the 20th century (see Plasil forthcoming). The distance between *field and fork* (Sassatelli and Scott 2001; Poulain 2002; Eden, Bear, and Walker 2008; Zachmann and Østby 2011) became too vast for the consumer to understand and relate to. Imported, hitherto unknown food that was canned, frozen or vacuum packed and sold in impersonal supermarkets deprived consumers of their ability to judge the freshness and quality of products. The date label was put in place to enhance consumer knowledge.

Milne describes the historical development of date labeling in Great Britain (Milne 2012). However, when examining the legal documents, I

discovered that the Norwegian case differs from that in the UK as here the safety-based *use by* (with some laws about food safety and dates already existing in the 1950s) came before the quality-based *best before* (which dates from the late 1970s) (Plasil forthcoming). Today, both dates exist and are used depending how a food is categorized.

Originally, milk was categorized as a *highly perishable product* and therefore had a *use by* date, advising consumers to consider the product unsafe to eat after the expiration date has passed. However, on November 28th, 2008, the Norwegian Food and Hygiene Authorities (*Mattilsynet*), allowed the date label to be changed to *best before*. This told consumers that a product might not have the adequate quality anymore but was generally still safe to eat. Quality is a "hybrid of social construction and physical realities" (Feltault 2009), which "changes over time and is relative" (Atkins 2016). The re-definition of milk from a *highly perishable* to a *regular* product is in line with this thought. The physical reality of milk did not change overnight, but because of changes in the production technologies (for example better hygiene, stable cold chain and pasteurization), it was possible to handle the perishability of milk better and therefore to re-qualify milk from highly perishable to regular.

After a short description of the methods used, I will use the remainder of the article to show and analyze this interplay between the physical realities of milk and the technologies, decisions, and practices along the food chain. Human (producers, scientists and technocrats) and non-human actors (microbes, temperature, technology and machines) co-construct the expiration date that then becomes the defining quality parameter of the black boxed product milk.

Method

I followed milk along the whole food chain in Norway. The food chain is a "large system of mutually interconnected phases, links and locations" (van Otterloo 2005). According to her locations are places where "transformations" of raw material into food take place and individuals and groups are active in handling food. Building on this definition of the food chain, this article describes several locations: farm, truck, dairy, laboratory, printer, supermarket, home and waste bin/drain. To gather the necessary data, I did observations combined with interviews.

I conducted thirty-seven interviews in the period between May 2016 and September 2018. Informants were chosen particularly for their role in the Norwegian milk chain. All interviews were recorded, transcribed, color coded according to topic and reviewed to understand how the expiration date is constructed and practiced throughout the food chain.

I consulted the necessary legal documents on which date label legislation is built (such as the National Regulation of the Labeling of Consumer Goods of 1976) and practiced (for example ISO guidelines for milk testing) in order to be able to place the findings from the interviews in a wider context. I furthermore followed the coverage about developments in the milk sector, date labeling and food waste prevention (for example, about the implementation of an additional sentence to the date label) in local and national news; websites of the food industry, government or NGO's, and social media (for example Facebook pages by dumpster divers and anti-food-waste activists) to better understand how these issues are presented and discussed in public.

Together with NOFIMA (Research institute for applied research within the fields of fisheries, aquaculture and food),[5] I did an internet survey among consumers. From mid-September to mid-November 2018, 373 people filled in the survey. The data was then coded and analyzed, while the open questions gave wider insights about consumers' ideas around the date label. The data collection was aimed at giving the reader a broad and detailed picture of the role that the date label plays in today's milk chain in Norway (with possible parallels beyond).

Timeless milk? from the farm to the dairy

The first part of our journey concerns the time that milk spends without a date label— "timeless milk" so to say. Here the quality is less determined by the remaining shelf life but by the milk's intrinsic properties like fat content or number of microbes. However, what happens at the farm, during transport and at the dairy facility are of crucial importance for the final product and the length of its shelf life. During the interviews I learned that only the highest quality raw produce, handled with the utmost care and protected by the most modern technology, will become fluid, drinking milk rather than yoghurt, cheese, soured milk or powdered milk.

At the farm

The view over the bay at a farm in central Norway is breathtaking. The sixty cows are either grazing outside or feeding on fermented hay inside the stable. Lazily they look at the intruders and then continue with their eating and resting. According to the farmer, healthy cows are of great importance for the quality of the milk. The biggest danger are infections of the udder, which do not only lead to painful mastitis but also to milk that cannot be used for consumption.

Every now and then, one of the cows gets up and wanders toward the milking robot. Most cows will visit the robot about two to three times a day. The farmer tells me that using robots makes sense because robots guarantee efficient and hygienic milking, while at the same time providing the farmer with valuable data about every cow. He shows me the pages and pages of information he has gathered. They record not only the fat and protein content but also the number of bacteria, leading him to joke that his cows have more thorough health checks than most humans. Using this information, he can optimize his product, as this is crucial for all the following processes, including the length of the shelf life. Furthermore, his payment depends on these data. The price of milk at the farm is based not only on fat and protein levels but also on the number of bacteria in the raw milk.[6] If the bacto-count shows less than 100,000 units per milliliter, this "elite" milk achieves a higher price than basic milk (class 1). Higher amounts of bacteria in class two or three reduce the price per liter.[7] Proudly, the farmer shows me that his farm has produced elite milk every month since 2012.

When showing me the milking robot, the farmer explains how the udder is automatically cleaned before the milking process. The milking takes about eight minutes, while a computer continuously controls the quality of the milk. In case it is below standard, it will not enter the tank. Here, the automated technology ensures a constant quality inside the 6,000-liter tank. Still, the farmer told me that he regularly opens his tank to check the milk by looking, smelling and tasting. Inside the tank, the milk is rapidly cooled down to about four degrees Celsius to limit bacterial growth while it is waiting to be picked up by the dairy truck.

At this location, the quality of milk is determined by its physical realities (protein, fat, number of bacteria and cell count). These material properties then determine the length of the expiration date. The higher the quality, the longer the shelf life; therefore, delivering elite milk to the dairy is not only a question of personal pride and income but also determines the future fate of this milk.

The dairy truck

Early in the morning, the dairy truck arrives. This happens every two to three days. According to the farmer, this schedule is unproblematic for the quality and the expiration date of the milk as long as the milk is stored properly (i.e. cool). As the raw milk does not have an expiration date yet, the "freshness" of the product depends less on time itself than on the technology that protects it (Freidberg 2009).

Before allowing the milk into the truck, the driver climbs to the hatch of the farm tank to look at and smell the milk. Are there any impurities in the milk, and does the milk smell fresh? According to the dairies, this sensory testing is fast and secure. The drivers are not only trained in how to taste and smell the quality of milk, but they also follow a certain routine defined in the Dairy Analysis Book.[8] The human sensory ability to judge milk has been standardized and regulated to ensure uniformity in the product quality, which is necessary to guarantee the standardized shelf life.

If the milk smells and looks according to standard, the driver will take a sample for analysis at the dairy. The farmer receives detailed test results four times a month—this not only for justifying the payment but also to allow necessary adjustments to enhance the quality. Once all testing is done, the driver connects the pipe to the truck and starts the pump. During the pumping process, the temperature is constantly monitored - if the milk were to go above ten degrees Celsius, the pump would automatically stop. Keeping the temperature low during transport is crucial as well. Norway, with its cold climate, is ideal in that sense as the environment supports the technology. The trucks are insulated to keep milk from getting too warm in summer and from freezing in winter (Hagenes 2010).

Once the milk arrives at the dairy, it undergoes more tests before entering the large tanks (approximately 100,000 liters). Only if all tests prove satisfactory, can the milk enter the tank. The general view among the dairies was that the advantage of keeping the quality uniform by keeping all milk in one single tank was more important than the risk of one batch of contaminated milk ruining the whole tank.

The dairy truck not only transports the milk but also protects it, while the driver ensures that the milk has the necessary quality to produce a standardized shelf life. At this stage, (standardized) human senses and technology together make up the product milk that is now entering the dairy facility.

Inside the dairy facility

Dairies are not the easiest places to visit as hygiene is essential for milk quality and shelf life, and any contamination by outsiders could lead to the waste of milk. Therefore, during my visit I had to get dressed in a white lab-coat, wear hat and shoe protection, and have hands and shoes disinfected. The facility close to Oslo had very modern equipment, and most processes were fully automated. By regulation, milk can stay in the tanks for a maximum of thirty-six hours. The fresher milk is used for fluid milk and the older for yoghurt, but normally the milk is in and out of the facility within twenty-four hours according to management.

Within these twenty-four hours, the raw milk goes through several processes before becoming the milk most consumers know. Protected with goggles and earplugs, we walked under a labyrinth of shiny silver pipes, valves and tubes transporting the milk from one production process to the next. First, the milk is *separated* into skimmed milk and fat. The fat is then *homogenized* (broken up in smaller fat particles), so that the fat does not swim on top of the milk. Afterwards, it is mixed with the skimmed milk again in a *standardization* process, which gives full fat, low fat and ultra-low fat (skimmed) milk. Most dairies told me that they apply the same shelf life to all types of milk, regardless of fat content.

The next step is *pasteurization*. Both literature (Atkins 2016; Valenze 2011; Claeys et al. 2013; Lucey 2015) and dairy managers identify this process as most defining for the shelf life and safety of milk. Pasteurization has been obligatory in Norway since the 1950s to reduce the risk for diseases. The milk is heated to seventy-two degrees Celsius for approximately fifteen seconds. This is enough to exterminate most of the microbes. Afterwards, the milk is rapidly cooled down to about six degrees Celsius to keep the new bacterial growth low.

Atkins reminds us that quality cannot be taken for granted, as it is instable and vulnerable (Atkins 2016). As the natural product milk is prone to change its properties due to microbes even after pasteurization, constant checks are necessary to ensure the quality. Samples are tested physically (pressure, temperature and pH), chemically (fat, protein and dry parts), micro-biologically and sensory-wise. All informants put a strong emphasis on the sensorial test, stating that machines cannot replace the senses of humans. However, needing to produce a standardized product with a standardized shelf life, even the use of the senses has been standardized rather than being left to individual bodies (Freidberg 2009). "We have to follow the standard procedure. Everybody has to do the same here," I was told by one dairy manager.

A report about food loss along the production chain in Norway shows that in 2017 the food loss of dairy products was 2.1% during production (Elstad Stensgård et al. 2018). I was told that this loss was generally due to technical problems with the machinery (leaks, etc.) or due to necessary cleaning, rather than durability or quality. Older or lower-quality milk, not having reached the standard for milk, is turned into yoghurt or powdered milk or used as animal fodder (which, according to the dairies, is not seen as food waste in Norway). Here, the adaptability of the still "timeless" product milk helps to avoid food loss.

The last step milk has to undergo before becoming a standardized black box is to be filled into a milk carton. During this process, hygiene again is of utmost importance as the milk leaves an enclosed system for a short

time. All dairies stressed that recent improvements at this stage had an important influence on the prolongation of the shelf life. The most modern machines, called 'ultra-clean', give the longest shelf life. There, the milk is not exposed to water or air, and therefore the expiration date could almost be doubled compared to ten years before.

Once the milk is securely sealed into the carton, the expiration date will be printed onto the label. Before looking closer at this quality defining moment, I will sidestep into the laboratory to bring together all these different actors, properties and processes that together make up the date label.

Black boxing milk: from the laboratory to the printer

Laboratory

The construction of the expiration includes constant testing to predict what will happen in the future. During these tests, the milk is pre-incubated and left in warm conditions to simulate expiring milk. Furthermore, the dairy registers consumer complaints and uses this feedback to determine the shelf life of milk.

Milk generally has a shelf life of fourteen days in Norway. This standard can be adapted slightly by individual dairies according to circumstances. High temperatures in summer might lead to a slightly shorter shelf life. The producer is responsible for the date as, according to my informant from the food authorities, "the producer knows the raw material that is used, the production method and similar things." The expiration date is an assemblage of human and non-human factors and actors. It is humans that set the date, but as we have seen there are many non-human actors (such as bacteria or machines) that play an important role in this process. I identify five main pillars on which the date label rests. Three are based on the past: the *intrinsic properties* of the natural product (bacteria, fat, protein, etc.), *hygiene* along the food chain, and the *technology* used to handle and protect the milk (milking robot, dairy truck, etc.). The other two are future-oriented and include *predictions* based on the knowledge about the technological conditions the milk will encounter in the remainder of the food chain, and *risk assessments* based on assumptions about future human behavior. Or in other words, as the Food and Hygiene Authority states, "The shelf life should be based on customary, realistic transport, storage and sales times. It should also consider the usual way of storing the product, including a safety margin."

Let us look at the *predictions* first and take the average supermarket temperature as an example. While in Sweden, the average supermarket storage temperature of eight degrees Celsius allows a shelf life of only eight days, the lower four degrees Celsius in Norway allow fourteen days (Møller et al.

2014). Here, knowledge of the technological conditions which the milk will meet makes a prediction of the shelf life possible.

However, not all is predictable, and therefore a great part of the shelf life depends on *risk assessment.* Paxson describes this as "anticipating possible encounters between types of foods and types of eaters. As such, regulatory categories are designed to cast a wide net of possibility, wider than would circumscribe most actual encounters" (Paxson 2016). Yngfalk goes as far as to state that "food consumption is standardized to risk assessment rather than natural particularities" (Yngfalk 2016).

Based on what I described above, I would probably not go so far as to say that risk assessment weighs that much heavier than natural particularities. However, risk assessment and assumptions on consumer behavior play an important role. Research done by the Information office for dairy products (*Opplysningskontoret for meieriprodukter*) in 2016 showed that milk was still without detectable change in taste or smell thirty days after the expiration date.[9] Even though this test was done under standardized and monitored laboratory conditions and lower fridge temperatures, one could argue that producers are too cautious when setting the expiration date.

At this location, we can see how the different human and non-human actors assemble and co-construct the expiration date of milk. Once the date is set, it becomes black boxed and conceals the many different properties and processes that went in there to create it. From now onward this standardized information will be the most important parameter for the milk's quality determination with far reaching consequences for the evaluation, pricing and discarding of the product. This is the first level of black boxing. Let us now turn to the printer where the second level of black boxing happens.

Printer

After the first level of black boxing where the expiration date is constructed, this date is then printed on the carton which then in itself becomes literally and metaphorically a black box containing the now standardized product milk.

During my visits to different dairies, I learned that even though the labeling process is automated and controlled by a computer, humans change the product information each time a new product passes the printer. The operators consult the standardized manual to set the right date for the label. If they do not change the product code, milk could hypothetically end up with the expiration date of yoghurt (up to forty days). Therefore, the operators stressed that they controlled the labeled cartons every half hour. This is important as within a split second the date is irreversibly printed onto the packaging.

With this, 'real time' becomes 'set time', and the milk changes from having a life span determined by taste, smell or micro-bacteriological testing, to a product with a standardized, pre-determined shelf life. The standardized expiration date now sets the clock for transport, sale, consumption and discarding. It also sets the price, as milk too close to the expiration date is down-priced (both in wholesale and retail). The date label is also central to logistics as both the ordering and tracing of products are based on the expiration date. The remainder of the article will focus on the consequences of this double-black boxing of milk.

Standardized milk

Even though time plays also an important role at the previous locations, its influence is still of less importance than for example temperature. This changes once the milk is black boxed and labeled, as the next three locations will show.

Transport to the retailer

It is busy at the large transport facility on the outskirts of Trondheim, in mid-Norway. Trucks come in and out, loading and unloading their cargo, pallets of food are moved to and from the facility. Transporting packaged milk from the dairy to supermarkets is a race against time and highly competitive. Transportation time is a challenge given the length of Norway and its sparse population. Getting milk to the North of the country can be very testing. A representative of one of Norway's leading food transport companies told me:

> Delivering to the north of the country is just as if I would drive from Oslo to Paris.[10] The biggest challenge for us are products with a short shelf life. Then we sometimes have only two days for transportation—these disappear due to the long distances. We use the shortest time possible, driving through Sweden. This also gives us an advantage towards competitors. If the products come to the shop with many days of shelf life left, then that is an advantage for us.

Even though speed of transportation has increased in the last century, so have the distances. In 1900, there were about 800[11] dairy facilities in Norway, today there are fewer than forty. As stated above, Norway's milk industry is self-sufficient and protected; therefore, Norwegians generally consume Norwegian rather than imported milk, which then has to be transported Norwegian distances.

Furthermore, a specific regulation, STAND 001, regulates how many days of the shelf life are allocated to the producer, distributor/transport/whole-sale and the retailer/consumer. These regulations have to be followed

by all actors in the food chain. If the granted amount of days allocated to the supermarket is below agreement, this leads to a reduction in payment to the transport company. Supermarkets would normally not reject products that have come too close to the expiration date, but rather try to sell the milk anyway, as an informant managing a large supermarket told me:

> Yes, it happens that you get deliveries that do not have the necessary amount of days. We have some agreements with our main transport company on what shelf life we can expect. But, in many cases, there will be a dialogue between us and them, and we say 'Ok, then I try to sell as much as I can from this, but you have to cover my losses.

In the transport sector, the expiration date not only determines the conditions for work (as fast as possible) but also the price, as milk too close to the expiration date will mean losses in money for the transport company. This, however, goes unnoticed by the customer who is generally not aware of the logistics, agreements and dates behind the product.

In the supermarket

After a long journey, the milk finally reaches the supermarket shelves. Here, they sit cooled down to four degrees Celsius; energy loss is minimized by protective glass doors. Products are sorted by brand and fat content, but where in the queue a particular milk carton will be placed depends on the date label. Short shelf life is found in the front and longer in the back, which—undesired by supermarkets—leads to "shelf-digging consumers" (Yngfalk 2016) trying to find the milk with the longest remaining shelf life. Research shows that 76% of consumers will go deep into the shelves in order to pick out the milk with the longest remaining shelf life (Norstat 2016).

"We've come to see freshness as a quality that exists independent of all the history, technology, and human handling that deliver it to our plates" (Freidberg 2009, 17). Many consumers are unaware of the many properties and processes that have led to the date label, and, unable to smell or taste the black-boxed milk in the shop, supermarket workers and consumers can rely only on the date to determine the milk's (remaining) quality and freshness.

Authors such as Whitelaw (2014) and Yngfalk (2016) describe the uneasiness supermarket personnel has with wasting edible food only because the expiration date has passed. Also, all supermarket staff I interviewed agreed that keeping the balance between food quality and waste is a major challenge. This dilemma became clear as during one interview there was first talk about an excessive and often unnecessary obsession with freshness, but then my informant told me:" But let us not forget that if we

do not follow the expiration date and if we have a shop full of old food, it will be another chain that survives." Nobody wants to go to the old days when food quality in Norway was rather poor, as one retired informant told me: "In the shops out here, all was old. And the milk was just kept outside the store in the sunlight and nobody cared."

Therefore, all supermarkets agreed that they would not sell products after the *best before* date, but all do sell products that are close to the expiration date for a reduced price. However, supermarkets have to be careful with down pricing as at some point the balance between production costs and selling price is disproportionate. Selling an old product with a loss while a fresher one is not sold makes no sense from neither a market nor a waste perspective, as several supermarket managers explained.

Dairy products counted for 0.8% waste of the economic value in 2017, compared to 1.1% in 2015 (Elstad Stensgård et al. 2018). Most people I spoke to attributed this not only to new, automated buying procedures but also to the success of down pricing. However, this success at the supermarket level can cause more waste at the consumer level, as consumers cannot eat short-lived products on time (Aschemann-Witzel et al. 2015; Aschemann-Witzel, De Hooge, and Normann 2016).

The expiration date determines the placement, evaluation and price of milk at the supermarket level. Within the different choices (brand and fat content), it is the most defining parameter of quality for milk, and, in the tough competition for shelf space and sales, it is a defining attribute. It sets the spot where a product is placed and determines its price both when it comes into the supermarket and when it goes out. Supermarket managers admitted that they do not have a good solution for the dilemma of freshness versus waste and have asked for producers to set a date as far in the future as possible to prevent waste at the supermarket level. In this demand, they were joined by the Consumer Protection Agency (*Forbrukerrådet*) who argued that consumers need the longest shelf life possible as to prevent household waste.

The consumer

Every morning when pouring milk into my daughter's cup, I am confronted with the dilemma: senses or standards? And even when I use my senses and do not blindly trust the date I will most likely still be influenced by it. The anthropologist Sutton reminds us that "tastes are not separable from the objects being tasted" (Sutton 2010, 218). One quote from the answers in the survey makes this particularly clear: "I am one of those who throws out food once it is out of date. I know that I can smell it and I do, but, once it is over date, I find it tasting bad and the box blown up."

Consumers are a long distance away from where the milk has started its journey and therefore have come to trust the date more than their own senses. The black boxed expiration date, put in place for consumer information, has reduced consumer knowledge about food quality and safety. As our food chains have become longer, people have come to trust standards more than senses. "Thus, paradoxically, the same forces that seem to alienate the consumer from modern foods can work to produce trust in food" (Bildtgård 2008, 112). Bildtgård, moreover, identifies the food label as "the only actual contact between the consumer and the production process" (ibid: 117). The black box date label became very successful in that sense. 34% of our respondents said that they have thrown away food based on the expiration date alone. Furthermore, many wrote that they need better guidelines on how to judge food. How should it smell or taste? How do I determine that it is safe and pleasant to eat? How do I keep food once it is open?

As described above, assumptions about consumer behavior co-determine the expiration date. Producers' worries about transport, handling and household fridge temperature reduce the possible length of the shelf life substantially, and shorter shelf lives leads to more waste at the household level. This vicious cycle of cause and effect seems hard to overcome. All my informants agreed that it would not be useful to abandon the date label altogether, as food has become too complex for people to securely judge, and insecurity would lead to even more food waste. Still there are things to be done.

Today, there are campaigns in many countries[12] trying to reeducate consumers to reduce the waste of food. Since 2017, an additional sentence "often good after" reminds Norwegian consumers that food is not automatically bad once the *best before* date has passed. 57% of the respondents agreed that this addition explains the date label better, and 63% now feel safer about the quality of the product past the date. Still, there is more that should be done to help consumers reduce waste. Possibilities are reduced package sizes (in Norway most milk is sold in one-liter cartons) and more information on the package itself. Rather than quizzes or pictures found on the carton, producers could put information about handling and storage, recipes of what to do with old milk and encouragement to smell and taste the product inside (something that is planned to be done in Norway). This information printed next to the date label, rather than found on far away websites or in brochures, could help consumers handling the black box expiration date in a more sustainable way and ease the dependence of consumers on the date label as the main parameter for the evaluation of quality.

Expired—what now? Conclusive remarks

Behind the bright lights of the supermarket one finds the waste bins. Here the 'life' of the milk ends, once it passed the expiration date. According to

one interview partner the milk is tipped out and lost, while the carton is recycled. Most supermarkets I talked to, work together with the local food bank (*Matsentralen*), giving away products with a short remaining shelf life, but according to the manager of one food bank, once the expiration date has passed they will not accept a product anymore. Some retailers give away out-of-date products to their employees or use them in the canteen. The percentage of waste has gone down by 29% for dairy products in the last two years at the supermarket level (Elstad Stensgård et al. 2018, 38). There also has been a reduction in dairy waste caused by the date label from 44% to 16% at the consumer level (ibid: 47).[13]

To reduce these numbers even further there has been a concerted effort by the Norwegian government and the food industry. In June 2017 five ministries (headed by the Ministry for Climate and Environment) and twelve organizations representing food industry and trade signed the Trade Agreement about the Reduction of Food Waste (*Bransjeavtale om reduksjon av matsvinn)*[14] to reduce food waste with 50% by 2030. using a whole chain approach. By understanding the expiration date not as a given, static standard but as an assemblage of several intrinsic qualities, technologies and human decisions and by seeing the connection between the expiration date and food waste not as inevitable it might be possible to achieve this goal.

In this article I have shown how human (bureaucrats, producers, retailers, consumers, etc.) and non-human (microbes, packaging, cooling systems, trucks, etc.) actors co-construct the expiration date of milk while vice versa the expiration date governs the different production processes and technologies as well as the buying and consumption practices throughout the whole food chain. The milk that we consume is the result of two different black boxing processes in which the date label translates the complicated processes and qualities into a single parameter for price and quality and acts as a mediator between *field and fork*. In a competitive market, since neither producers nor retailers want to take any quality-risks, the shelf life is always shorter than the real life. At the same time consumers often trust the date label more than their own senses. Consequently, products are not sold and consumed until the last possible moment of their natural life but rather discarded when they reach the standardized end of their shelf life—leading to avoidable waste.

Like this the date label is constantly consciously made into a cause for waste. Throughout the article I have shown examples of these decisions: Farmers can avoid surpluses in winter by controlling calving. Producers can use older milk for making yoghurt rather than discarding it. Supermarkets can accept short lived products for reduced prices and donate food close to the expiration date to food banks. These could theoretically accept even older products than they do now (according to the

authorities in Norway it is legal to sell food past the best before date). Consumers could also take their responsibility by not choosing the easy solution of discarding products due to the date alone but could act sustainably in their buying, cooking and discarding practices. In this they could be supported by the government and the industry.

Most of my informants (even from within the food industry) agreed that it is the constant, easy availability of food, a throw-away mentality and the discrepancy between the perishability of food and the practices of consumers that are mainly responsible for household food waste. Here, both the government and its agencies and the food industry could be more active and in educating and informing consumers properly. They could start with school children and make them aware of their own senses while simultaneously discouraging wasteful behavior. The milk that we drink has come a long way. A lot of work and energy has gone into it, and all this deserves a better treatment than being thrown away prematurely.

Notes

1. http://www.fao.org/dairy-production-products/en/
2. https://www.melk.no/Statistikk
3. https://www.melk.no/Kosthold-og-helse/Skole/Fakta-om-norsk-melk
4. https://lovdata.no/pro/#document/NLX3/eu/32011r1169?searchResultContext=2032
5. https://nofima.no/en/about-us/
6. https://medlem.tine.no
7. TINE Råvare Produsentavregning, Melkepris og satser, 2018
8. TINE Råvare Produsentavregning, Melkepris og satser, 2018
9. Presentation Tine 2010
10. https://www.melk.no/Kosthold-og-helse/Melk-og-helse/Melken-er-holdbar-lenger-enn-du-tror
11. This is true according to google maps: Oslo—North Cape: 1,962 kilometers, Oslo—Paris: 1,698 kilometers.
12. https://snl.no/meieri
13. See COSUS and FUSION at a European level, Nordic Council for Nordic countries etc.
14. Note: the possible answers from the 2015 and 2017 research have unfortunately changed making it hard to directly compare the findings
15. https://www.regjeringen.no/no/aktuelt/avtale-om-a-redusere-matsvinn/id2558931/

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