Providing meaningful waste feedback to larger grocery stores to promote sustainable development

SOFIE NYSTRÖM
Providing meaningful waste feedback to larger grocery stores to promote sustainable development

Visualisera meningsfull avfallsåterkoppling till större livsmedelsbutiker för att främja hållbar utveckling

Sofie Nyström
sofienys@kth.se

Degree project for Master of Science in Human-Computer Interaction
Supervisors: Hanna Hasselqvist & Cecilia Katzeff
Examiner: Leif Dahlberg
2017-06-15
Abstract
The role of the food retailer within sustainable consumption and production has been described as essential in the food production chain, with the possibility of affecting both producers and consumers to make greener choices. Logistic operations happening in the store are also important to ensure sustainable development, such as recycling. In the Swedish food retailer chain Coop, statistics on waste management in stores have been established recently, but are not communicated back to the stores. HCI have been used previously to provide environmental feedback, for example through persuasive technologies. This thesis set out to investigate how waste data can be presented to store managers and employees in a meaningful way, how this can contribute to sustainable development and provide motivation to improve the source sorting practice. Nine contextual interviews were conducted with a central facilities manager, store managers, employees and a representative from the waste collection company. Two mockups of web visualizations and two scenarios of interactive installations were designed and evaluated in two stores. Interviews highlighted the (lack of) knowledge, the economic compared to the environmental incentive for recycling and current feedback and comparisons. The design mockups were appreciated for the economic information and information provided, but scenarios being too interactive were discarded as too verbose. Resulting concepts are discussed in relation to interviews and evaluation feedback while emphasizing a holistic perspective on the practice of recycling. Using economic incentives through feedback to motivate sustainable development can facilitate recycling in stores for store managers, while other incentives may be used for employees. The potential use of environmental incentives should be further investigated. Mockups need further iterative development and more knowledge should be gathered on regular employees in future work.

Sammanfattning
Providing meaningful waste feedback to larger grocery stores to promote sustainable development

Sofie Nyström
KTH Royal Institute of Technology
sofienys@kth.se

ABSTRACT
The role of the food retailer within sustainable consumption and production has been described as essential in the food production chain, with the possibility of affecting both producers and consumers to make greener choices. Logistic operations happening in the store are also important to ensure sustainable development, such as recycling. In the Swedish food retailer chain Coop, statistics on waste management in stores have been established recently, but are not communicated back to the stores. HCI have been used previously to provide environmental feedback, for example through persuasive technologies. This thesis set out to investigate how waste data can be presented to store managers and employees in a meaningful way, how this can contribute to sustainable development and provide motivation to improve the source sorting practice. Nine contextual interviews were conducted with a central facilities manager, store managers, employees and a representative from the waste collection company. Two mockups of web visualizations and two scenarios of interactive installations were designed and evaluated in two stores. Interviews highlighted the (lack of) knowledge, the economic compared to the environmental incentive for recycling and current feedback and comparisons. The design mockups were appreciated for the economic information and information provided, but scenarios being too interactive were discarded as too verbose. Resulting concepts are discussed in relation to interviews and evaluation feedback while emphasizing a holistic perspective on the practice of recycling. Using economic incentives through feedback to motivate sustainable development can facilitate recycling in stores for store managers, while other incentives may be used for employees. The potential use of environmental incentives should be further investigated. Mockups need further iterative development and more knowledge should be gathered on regular employees in future work.

1 INTRODUCTION
The current food production system has a big negative environmental impact, contributing to climate change, biodiversity loss and ecosystem degradation. Consumption and production contributes to global warming, pollution and waste [35] where the retail store has a central position. Within research on sustainable consumption and production, the food retailer’s role in shaping a sustainable society is investigated [5]. Since the retailer has influence upwards on producers in the supply chain and also downstream towards consumers by promoting green products, they have a decisive role when it comes to establishing green practices in the food sector. Furthermore, due to large activities within the sector, the food retailer has a responsibility for store and logistic operations [3, 5].

Recycling is important because a long-term nationwide recycling action improves the use of and conserves scarce resources [27]. There are also many other benefits with recycling, but the most important are reducing the waste that otherwise would end up as landfill or incineration, to save natural resources and energy used in the production of new goods and lowering pollution levels [36]. While Sweden is usually considered to have a fairly successful recycling programme, this varies from region to region. In 2015, the average level of recycled material was 73 % for all kinds of packages in Sweden as a result from the producer responsibility ordinance [46].

In the last decades, sustainability and sustainable development have become more debated and special goals for sustainable development has been formulated by the UN [45]. Within sustainable development, the term sustainability is defined as environmental sustainability, social sustainability and economic sustainability [21] which all are related to sustainable initiatives and to waste management in grocery stores. Sorting waste in more categories increases the possibility for recycling different materials, which is environmentally better than producing material from virgin resources. Donating food to non-governmental organizations is also a common practice to reduce the amount of food waste in stores [8, 28]. An economic incentive also exists for stores to maintain a proper recycling system as some categories cost money (e.g. residential waste sent for incineration) while others generate an income for the store (such as cardboard and plastic).

Coop is one of the largest actors on the food retail market in Sweden with 20% of market share [8]. A waste management agreement was implemented during 2016 in approximately 300 Coop stores together with the waste collection company Ragn-Sells. The agreement generates statistics for amounts and costs per store and category. Although the statistics show that some stores sort more and better than others, this feedback is poorly communicated to the individual store manager unless it is specifically highlighted and brought up by the central department. Today, all Coop retail stores should sort their waste based on different categories (e.g. corrugated cardboard, plastic, packaged food waste and residential waste). However, some stores have an inadequate waste management system, possibly due to lack of space/time/equipment, low priority, convenience or lack of knowledge to make an informed decision.

The research project Sustainable practices and lifestyles in urban areas - Design and Opportunities for Change conducted at CESC, Royal Institute of Technology1 aims to collect data and design prototypes that can transform raw data to actionable data - data that through visualization and design can encourage actions that will make the food system more sustainable in households as well as in

---

1 The Centre for Sustainable Communications (CESC) is an interdisciplinary research environment which conducts research on ICT for sustainability, situated at KTH Royal Institute of Technology, Stockholm.
the grocery chain and among its suppliers. As a part of the research project, this thesis uses strategies within interaction design to develop concepts and mockups of visualizations which provide meaningful feedback to store managers and employees in larger Coop stores. Early research within sustainable HCI focuses on visualizing energy feedback on energy patterns, carbon dioxide emissions or other consumption data back to the individual. The feedback can for example be designed as historical or social comparisons to trigger behavior change and motivate people to behave in a more sustainable way, which sometimes is referred to as persuasive technology [12]. However, despite some influence on household consumption patterns, persuasive technology has also been criticized of being limited in duration and extent [4, 9, 22].

2 BACKGROUND

Sustainability within the retail sector has become central over the last years. Retailers experience pressure from governments, aware consumers, legislations and developments in ICT to take an increasing and visible interest in the social, economic and environmental impact of their activities [29]. The main incentives for Swedish retailers to engage in sustainability work are savings and financial potentials [5]. In terms of waste, it is generally up to the individual store owners to decide what investments to make and whether to improve the quality of waste sorting or monitor inventory and quality of food to minimize losses due to expiration dates [5]. Both Coop and ICA (the two largest market shares in Swedish food retail) have initiatives to reduce food waste by selling food about to expire to a lower price and donating food to charity [8, 28].

There are both drivers and barriers for retailers to implement sustainability initiatives, typically categorized according to regulatory, resource, market and social factors (see [6] for a typology). For example, a common resource driver for engaging with sustainability strategies is cutting costs, but also to promote reputation for the brand while a resource barrier can be lack of financial resources or lack of knowledge and expertise to carry out sustainable interventions [6]. Waste management is considered a part of the regulatory drivers, since waste legislations should be abided by retailers.

Previously, there has been a lot of research targeting domestic energy use [38] and few studies have focused on initiatives implemented in a work context. Contrary to households where constellations and culture differ a lot, a work place (including a retail store) have a more hierarchical structure where a manager usually is the one who governs the activity [31]. Sustainable interventions in work contexts are most likely to have an effect if the organizations provide appropriate physical facilities, employ tailored persuasive communication, and actively engage middle management in the intervention [33]. It has also been suggested that the structural context might be of greater importance to behavior in organizations than individual environmental beliefs and attitudes [7]. Multiple problems have been identified as faced by employees when wanting to change behavior through non-technical interventions, for example the uncomfortable feeling of having to “check up” on colleagues’ non-environmental behavior [24].

In addition to structural initiatives to alter behavior in organizations, it is important to address the motivational aspect of performance. Individual determinants have been identified as important factors of pro-environmental behavior change in organizations as these “bear a direct relationship with the individual respondent but do not refer to the organizational context” [33]. One of the earliest theories of changing behavior relates to changing attitudes and knowledge of the individual, while also proving that the individual has the power to change. The theory of planned behavior (TPB) [1] which claims to predict the link between beliefs and behavior and is a further development of theory of reasoned action [2] but including the perceived behavioral control. TPB has been popular in pro-environmental behavior change within the social sciences, although attitudes have been found to be moderately correlated to behavioral intentions but weakly related to actual behavior [33]. Similarly, values and attributes about recycling have been shown to not have a direct relationship on behaviors but rather on attitudes about the inconvenience and the importance of recycling [34].

According to social identity theory [26], people strive to maintain a positive self-image. In addition, social comparison theory [16] claims that individuals evaluate their own abilities and performance in relation to others. Studies have shown moderate effects of social norms of important individuals on intentions to recycle paper [29] and a significant correlation between descriptive norms and waste management behavior [44]. Comparative feedback has been shown to have an effect in organizations when presented in addition to information on how to conserve energy, goals and feedback [40].

Many empirical studies of energy feedback have been conducted since the introduction in the 1970’s [30] and the impact of energy feedback has also been measured, with an effect in general [10] but ranging from savings of over 20% [17] to increases in energy usage [15]. Direct feedback have been shown to have a higher effect in terms of savings [14] and to conserve and reduce peak load [47] compared to indirect feedback. Feedback can either be presented on a low level where detailed problematic actions are highlighted or on a high level which is more summative and improves performance towards a goal or in comparison to others [19].

A substantial amount of articles on eco-feedback uses approaches within persuasive technologies [4]. Within the genre of persuasive technologies, the common approach is to design systems that convince users to behave in a more sustainable way. The approach originates from Fogg’s theory that persuasive technologies are explicitly designed to change attitudes or behavior or both, without using coercion or deception [18]. While previous studies in persuasive technologies are not homogeneous in their approach, persuasive sustainability often aims to change behavior by reducing individual resource consumption but not necessarily specifying what the expected behavioral outcome is [4].

Previous studies focusing on HCI and recycling have been done with different perspectives, from robotic bins to social persuasion. User studies have suggested that the recycling system should 1) increase awareness around the environmental problem of recycling and 2) encourage day-to-day behavior around that problem [37]. It has also been suggested that users need to become engaged on a deeper level as concluded from a study of public waste recycling, suggesting a reward system for amount of recycled goods, improved visibility of recycling stations and shaped disposal holes in the bins for the correct items to dispose [48]. Social persuasion and aversive effects have been investigated on how waste is disposed in households with some effect in increased awareness.
and reflection about recycling as well as motivation to improve recycling skills [43]. A connection to the bins in question can also be relevant as redesigning and equipping waste bins with sensors through anthropomorphic design have been shown to affect people’s intentions to use them [42].

2.1 Objective
The objective of this thesis was to investigate how feedback on waste sorting can be presented towards store managers and employees at larger Coop retail stores in Sweden in a meaningful way. What meaningful means in this context was investigated in a prestudy where interviews were conducted with Coop and Ragn-Sells. The gathered knowledge was then used to develop design concepts on how data and information about a retail store’s current waste management can be visualized. The design concepts should provide knowledge to the store that is relevant in order to better understand their recycling practice while also motivating them to improve their waste management.

The research questions of this thesis are:

- How can data about a grocery store’s current source sorting practice be visualized in a meaningful way to store managers and personnel?
- How can the visualization be designed to contribute to sustainable development within the grocery store?
- How can the visualization be designed to motivate store managers and employees to improve their source sorting practice?

3 METHOD
The overall methodology of this thesis has been traditionally interaction design oriented and following the classic Double Diamond design framework2, which means combining divergent and convergent thinking in iterations. To discover the problem area, interviews were conducted in the prestudy to learn about the context and practices and to explore the core issues of waste management in stores. After collecting and analyzing the data, design problems were defined and targeted, and ideation could start. Concepts were then developed by quantity through divergent ideation methods which then were reduced to a few ideas through convergent assessment. Further refinements were then applied to selected concepts and finally evaluated with potential users.

3.1 Waste statistics and selecting stores
Coop and Ragn-Sells provided the project with waste statistics for each category and store which were the foundation for the starting interview with the central facilities manager. When selecting stores for contextual interviews, stores were first selected that showed a reasonably high waste production in total. This decision was made because smaller stores usually send their corrugated cardboard and plastic packaging in return with the delivery as their storage space is limited. The selected stores were further narrowed down to stores that had statistics for large categories such as cardboard, packaged foodstuff, residential waste and plastic. Among these, four stores were selected based on their potential to change. Two stores which did not reach the newly developed internal goal of less than 35% combustible waste were selected as these stores were potential target locations of the design. Two more stores were selected which already reached the target levels as these stores could be learned from to understand the difference in terms of behavior and/or infrastructure.

3.2 Contextual interviews
Nine interviews were conducted within the prestudy of the project. One interview was conducted with the central facilities manager at Coop, with the purpose of understanding statistics and material provided, while also exploring his responsibility within the waste management procedure. Another was conducted with a representative from Ragn-Sells, with the goal of understanding Ragn-Sells’ part of the agreement and their experience of the stores’ waste management practice.

Seven interviews were conducted in four different Coop stores with four store managers (SM) one employee (E) and two warehouse managers (WM) (see Table 1). The purpose of the interviews was first of all to explore the store manager’s knowledge in terms of categories, amounts and costs, their motivation to reduce (or increase) amounts of waste and investigate how much feedback, information and comparisons they receive (or would like to have) about their waste management. The interviews with employees were conducted to acquire a more practical view of the source sorting environment and what the path of waste looks like, the employees knowledge and view on how it works and could be improved, and finally what kind of feedback they receive on their source sorting. Conducting contextual interviews in an authentic environment is also necessary to learn about the context in which a design artefact or visualization might be placed in order to decide on ambiencty, granularity and other types of aspects. All interviews were recorded and transcribed. The interviews with store managers and employees lasted about 20 minutes, respectively. The data gathered during interviews was analyzed using codes and summative phrases of sentences according to the descriptive phenomenological method [20]. The summative phrases were then categorized and used for creation of themes and personas.

<table>
<thead>
<tr>
<th>Store</th>
<th>Interviewees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SM1, E1</td>
</tr>
<tr>
<td>2</td>
<td>SM2, WM1</td>
</tr>
<tr>
<td>3</td>
<td>SM3</td>
</tr>
<tr>
<td>4</td>
<td>SM4, WM2</td>
</tr>
<tr>
<td>5</td>
<td>SM5, E2, E3</td>
</tr>
<tr>
<td>6</td>
<td>SM6, WM3</td>
</tr>
</tbody>
</table>

3.3 Personas & Scenarios
The design part of the thesis work started by formulating the interview insights and learnings into themes and functions. In the beginning of the design process, two different strategies took place simultaneously. According to traditional interaction design practice, the qualitative data gathered during interviews was analyzed and formulated as themes and attitudes of decisive users. The data was then used to create personas in order to develop a fuller representation and concrete understanding of the user. Furthermore, context scenarios were formulated describing situations where the potential user will use the end product, as this assists the concept development and helps to prioritize among the ideas generated.

---

3.4 Concept development
To start off the ideation process, a workshop was held with three sustainability researchers at Royal Institute of Technology. The purpose of the workshop was to brainstorm around initial ideas based on the qualitative data, and start to sketch out ideas. The concept ideas were documented by sketches and notes on paper. The ideas from the initial workshop were then refined and written out more extensively to discover possible developments and functions. A few ideas were also generated based on ideation techniques such as forced association³. Since the persons identified a different need of information for store managers than for employees, the content of a visualization towards these groups may be different, which was also supported from the interviews in the stores. Therefore, the design concepts were quite early divided into two different ones in terms of content. Two concepts which illustrate a more interactive visualization were also created as these seemed to fit better with employees’ work pace. The concepts generated from divergent ideation methods were compared to align with needs from personas to be narrowed down. The selected concepts were then further refined into more detailed digital prototypes using Sketch, InVision and the Adobe Suite.

3.5 Evaluation
After further refinements, the final four concepts were evaluated with potential users. This was done by visits in two new stores and evaluations with two store managers, one warehouse manager and two employees (see Table 1). All four mockups were presented to the store managers and the warehouse manager. To the employees, the web visualization for employees and the two sketches were presented. They were asked on their spontaneous reaction to the concepts, whether they understood the information presented, how relevant the information was to them and if they deemed any parts as irrelevant or uninteresting. The evaluations were presented digitally on a computer and screen recorded (with audio). The recordings were roughly transcribed afterwards. The evaluations provided valuable feedback on the concepts for how they should further be designed and developed in future work.

4 RESULTS
The results from this thesis work are threefold. The initial interviews and store visits generated relevant findings and themes about the practice of recycling and waste management in the store. The gathered information is also the foundation for the concepts generated. The resulting four concepts designed with different purposes for different target groups also serve as one of the main results from this thesis. Finally, the results and reactions from the evaluations offers an estimation of how the concepts should be developed further.

4.1 Prestudy results
A substantial amount of knowledge was gathered from the nine interviews conducted with store managers, store personnel, central facilities manager at Coop and representative from Ragn-Sells. The most essential themes from those interviews are presented in this section.

4.1.1 Knowledge
Store managers reported varying knowledge about different parts of the waste management. Three managers reported that they lack knowledge about the waste management process. For example, store managers reported not knowing what happens to the material, the costs for the waste management, the names of the categories, what can be sorted where, the distribution between categories and whether restructuring the waste handling has had any effect. Two store managers also expressed a need for guidance and follow-up on the costs and the waste management, while one reported that even though he knows exactly how it works, there is no time to work with it. Warehouse managers also reported that it needs to be simple to sort waste, and that sorting wrong usually depends on laziness and lack of knowledge. The warehouse managers also try to educate other employees on the importance of recycling and how it should be done practically, but emphasizes that this should be done in an entertaining manner to ensure that people are listening.

4.1.2 Motivation and desires
Store managers reported varying motivation and interest in the waste management practice. Two store managers had been involved in the decision-making on how the waste system should look like in the store with bins and equipment. One store manager with a strong environmental ambition did not have a say in the design. The same manager expressed a will to sort more than what is currently possible, which perhaps would have cost more. One store manager reported that they are currently focusing on keeping order and tidy up around the waste bins. Another claimed to be more systematically solving one problem at a time, and that their motivations and goals today might differ in a year from now. A third store manager reported that they are more concerned with providing goods in the shelves and satisfying customers and have not been prioritizing the waste management although there might be possible monetary savings.

“Well I do pay these hills. To be honest, I don’t really look at them. And I am dead certain that we could earn more money on this. But I don’t have that time really these days. Or, I haven’t had neither the will nor the time.” (Store manager 1)

4.1.3 Economic incentives
Financial incentives is a central theme for the stores and the interviews. Store managers discussed both drivers and barriers relating to the financial aspect as well as considering economy versus environmental aspects. To three out of four store managers, money and costs were a central aspect of the waste management. Costs were reported as motivating, although the cost for waste management is relatively small compared to the daily revenue. All store managers reported that cardboard generates money and have some idea which kind of category that is most expensive. Only one store manager reported on having put up costs and incomes for the different categories on the wall in a previous store to be able to display it to the employees what difference it makes to put material in different bins. The category with packaged food waste was mentioned by all store managers as critical, since that is not only material but goods which the store pays for that is disposed. This category is important to follow up in their daily activities and is prioritized to be reduced, while there still needs to be goods in the shelves to shop.

“But as most others you tend to be along the edge anyways, there is that balance, that the customer needs to be able to shop goods as well, one can’t keep it too tight in the shelves because of fear of throwing it away. There must be goods to shop, so that balance is really difficult. Whatever you do it goes wrong” (Store manager 4)

³ Forced association is a brainstorming method where elements are forced together to trigger new ideas (Accessed 2017-05-17): http://toolbox.hyperisland.com/idea-concept-development
4.1.4 Economy vs. sustainability
All store managers discussed the financial aspects of waste management and sorting. The economic aspect was reported as motivating to reduce the amount of waste, and store managers believed there was a large potential for saving a lot of money. In some cases, store managers discussed the economy as an obstacle for sustainability initiatives relating to waste management while others claimed that they usually go hand in hand. One store manager claimed that source sorting more categories for example can lead to higher costs due to transport. Another store manager pointed out the difficulty with donating food to non-governmental organizations as not being able to sort food waste twice because of the costs. One warehouse manager reported how the company communicates in terms of sustainability and the tradeoff between sustainability and economy.

I expect that we will get some sort of feedback [...] one thing they say is that ‘this is really important because we should be good environmentally’. Money is all that controls and governs, I’d say. Little cynical, but that is often the case. (Warehouse manager 1)

Generally, store managers argued that economic and environmental incentives align when it comes to recycling and waste management. However, in those cases where there is an environmental incentive but not an economic one (or even an economic disincentive), they claimed to be less interested. One store manager highlighted how to take environmental responsibility when trying to run a supermarket, and the difficulty of trying to sell goods while simultaneously tackling overconsumption.

“Well in terms of sustainability [...] it is about keeping down those types of things and constantly work with selling away most of it, inform the customers about overbuying [...] But, it’s kind of contradicting to what I work with, if you’re a good seller then you want people to buy a lot but not buy so much that they will throw it away.” (Store manager 3)

4.1.5 Feedback and comparisons
Generally, store managers and employees experienced that they receive poor feedback on their waste management. They also expressed a need for feedback and follow-ups. Two store managers reported that they desired or thought they would get access to economic feedback. One store manager reported that feedback had been acquired once with percentages and variation in comparison with other stores. Two store managers reported that comparisons with other stores is a common strategy within other areas such as sales. Comparisons with others was expressed as desired and a positive feature since employees and store managers also described themselves as competitive. The warehouse managers also saw comparisons with other stores as positive and something that can be used to question one’s source sorting if the performance is relatively low. However, using comparisons was emphasized as highly risky from the waste collection company, as this could quickly become unfair and create a bad attitude between the stores. The main reason for comparisons being a bad idea is that stores have different conditions, such as number of compactors, equipment, warehouse space, location, proximity to nearest recycling facilities and so on.

“And then I received a question, wouldn’t it be interesting if they can compare themselves with other stores? And I say stop, that is really dangerous. If you begin to compare yourself, then it’ll soon be “I am better than you”, but it’s not the same conditions, and it is wrong. And then it might be a bad atmosphere, and then it’s a “you’re the worst”. No, it’s not fair. I don’t think that the store managers should be able to compare themselves to one another.

They should only be measured to a goal.” (Representative, Ragnar Sells)

4.2 Recommendations
Based on the interviews and the field visits, some general conclusions and recommendations could be drawn that facilitates recycling, waste management and source sorting in the store but does not have a clear HCI solution. One such recommendation is that clear signage should exist in the back of the store so that one easily can see which bin belongs to which category. When visiting stores it was discovered that signage for each category was not standardized, and some signs were even old and outdated. The other recommendation is that instructions or guides for how waste should be sorted, i.e. what goes in which category, should be visually displayed for easy consultation.

4.3 Design concepts
Four concepts were developed during the project. From the personas and scenarios emerged functions that would be most suitable for the store manager, these were then implemented into a sketch of a website. A lighter version was also created to display data to the employees in the form of a web visualization that would perhaps be placed on the screen in the staff room or in the warehouse close to the recycling room. The main reason for creating two different visualizations was that they target two different target groups with different characteristics. Originating from the workshop with sustainability researchers, two concepts were formulated that do not have the aim of visualizing data to the employees but to be more interactive installations creating awareness or providing instructions to the employees.

4.3.1 Avfallsportalen: for store managers
Avfallsportalen is a website divided into four sections: Overview, History, Costs and Tips & Goals. These are positioned as a static menu to the left. The main goal with the web visualization for store managers is to simply present relevant data in a graphical way to store managers. The website assumes that data about costs, kilos and revenues are accessible. In the Overview section (see Figure 1), a quick overview of the different categories and the distribution in-between is shown. Users can also see messages from the waste collection company regarding for example the purity of the categories by the time of last collection. Coop’s recently compiled internal goals for waste management are also visible in the Overview section.

Figure 1. The Overview section of Avfallsportalen.
In the History section (see Figure 2), store managers can dig a little deeper in the history of their costs, distributions and amounts to make sure that the development is going in the right direction. The purpose is to be able to gain awareness on how it used to look and follow developments over time. This might also be beneficial for new store managers to learn about the store’s performance.

Figure 2. The History section.

In the costs section are costs associated with the waste management visualized through four widgets (see Figure 3). In the first widget, the costs for each category are visualized to inform about how much each category contributes to the total costs and incomes of the waste management. The second widget shows the total costs for the waste management compared to the costs of disposing outdated or damaged goods during that time. The purpose of that comparison is to amplify the contrast between these two costs to demonstrate how important the food waste is to work with. In the third widget, store managers can see a comparison between the store’s current costs for waste management compared to the average costs for similar stores.

Figure 3. The Costs section, first page.

The idea of the widget was to offer a comparison of one’s waste management in relation to similar stores as competitive aspects and comparisons were desired from the interviews. Another reference point which was discovered in the interview with Ragn-Sells is the revenue calculation which exists for cardboard but not yet for other types of categories. The revenue calculation can estimate amounts of cardboard in relation to the store’s revenue, which is visible in the Costs section as the fourth widget. To the right are text boxes with information and tips in relation to the widget information.

The last section contains tips on how to improve and the possibility to set goals for the waste management (see Figures 5 & 6). Sorting instructions are visible and available for download and print. Where the different categories of waste end up (incineration, recycling, biofuel conversion) and to which recycling station they are driven today is also listed. To the right side of the page are best practices available, these are tips that come from other types of stores to inspire others to follow, for example initiatives to give away fruit and vegetables to schools that makes juice for the pupils or sell pallets. The second page (Figure 6) in this section provides a visualization of the three largest categories; cardboard, food waste and residential waste. These are visualized as arrows in a triangle resembling the recycling icon and are supposed to visualize how close the store is to current goals for each category by either being “filled up” or having animated fluids flowing faster depending on performance. The system is also supposed to offer suggestions for goals, perhaps if the amount of residential waste can be reduced to...
the average for similar stores. When deciding on a goal for the coming period (quarterly), this can also be shared with the employees in their version.

4.3.2 Avfallportalen: Employee version

A lighter version of the web visualization was created to visualize elements that only are interesting to the employees and more suitable to their work conditions. The visualization looks similar to the one for store managers, but with only two screens. The first one is similar to the overview section in the manager version (see Figure 1), and the second shows the triangle with the largest categories together with the current goal (see Figure 7). The sorting instructions are also available in the interface. This visualization could be situated as a touch screen near the recycling area or as a static visualization on the screen that always is situated in the employees’ coffee room.

Figure 7. The Goals section in the employee version.

4.3.3 Sketches of interactive installations

The sketches from the researcher workshop were narrowed down and further refined into two concepts. As the interviews showed that incorrect source sorting depends on lack of knowledge and motivation, these concepts were developed to be interactive installations which highlight and facilitate the activity of recycling for employees. The concepts are illustrated as comic strips where the first three images illustrate the idea and the fourth explains the purpose and the value of the concept. The concepts are called Melody buttons and Sound feedback. The idea is that these concepts easily could be realized using micro controllers, small computers and a few LEDs, buttons and speakers.

The concept Melody buttons is designed to instruct the user in the recycling moment rather than providing feedback of the last quarter. It is designed with the new employee or the visitor in mind which may not know where the different bins are located. Before stepping out on the loading dock, the user presses buttons for each category he/she will throw waste in. When stepping out on the dock, the bins light up to be more easily spotted by the user. When the employee is finished and comes back inside the building, a short melody is played as assessment of the selection of categories, where an environmentally better choice (e.g. cardboard) makes a happier tune than a bad choice (e.g. residential waste). A possible extension of the concept is to provide employees with personal logins which could generate more personal feedback and statistics and possibly change over time.

The second concept is designed to provide feedback of the current waste sorting goals to the employees, to make it more pleasant to throw waste in the right bin and also remind the user in the source sorting moment. A sound associated with the category (e.g. forest sound for the cardboard category) is played from the bin when the employee disposes of waste in it, where the sound varies in quality depending on how the store is performing in relation to their goals. In a bin where the store needs to reduce the amount of waste, the quality of the sound might be worse than in a category where the store should increase its disposal, making it more pleasant to dispose of waste in that bin.

Figure 8. Concept Melody buttons.

Figure 9. Concept Sound feedback.

4.4 Evaluation feedback

The evaluation with store managers and employees highlighted issues from fundamental flaws to adjustments of phrasings in the interfaces. Despite the very few participants in the evaluation, this still provides a hint for further development and what aspects that can be taken further. The general feedback on the different concepts and mockups are presented here as this is still highly relevant for further development.

4.4.1 Feedback on the web interface

The web interface for store managers received both detailed and general feedback. One store manager claimed the overview section to not be valuable in the everyday work for him, but that it might be beneficial to communicate to the rest of the employees. Another reaction from one store was that receiving feedback on the distribution between categories is useless since the amount of material received from producers cannot be affected by them. The historical section received no specific feedback. The costs section was most interesting to store managers, as they described costs to be the most important and motivating aspect for themselves. One store manager described the costs for waste management today as a “black hole” and even though it pops up as a point in the bills, it is nothing one works with actively. The costs for disposing of the residential waste was highlighted as interesting and a possible
behavior trigger for finding other types of solutions such as selling material (that otherwise would be sent to incineration) to local companies.

"And that I get the actual numbers for what I got back from the cardboard and what it cost to get rid of all the residential waste, because those are the triggers that are needed to change a behavior and reach out to a company which collect the wooden pallets, to find a routine for that." (Store manager 5)

Other types of desired information was to easily see how much it costs every time the store manager calls the waste collection firm and orders a collection, and what it would take in order to break even. Although the costs were highlighted as the most important aspect to store managers, a concern for how to engage the employees in this matter was expressed.

The Tips & Goals section received mixed feedback. The sorting instructions were perceived as interesting and valuable, especially to show to employees. Store managers did not see the relevance of knowing which recycling facility the waste is transported to, but that it was interesting to know what happens to it. Best practices were regarded as interesting and valuable. Setting goals was perceived as a valuable function as long as the numbers are relevant to the store and reachable. One store manager especially liked that the system suggested relevant goals itself but desired feedback on environmental impact instead of financial if it is as low as 3000 SEK.

4.4.2 Web visualization towards employees
One store manager liked the idea of having a screen which visualizes the waste data towards employees near the loading dock. Another store manager thought the visualization would be more suitable on the screen in the staff coffee room where other types of information also is displayed. The visualization was suggested to also include some sort of weekly tips or advice that changes more often, since a small shift in percentages in the distribution overview every quarter might not be incentive enough to look at the screen when updated.

When showing the interface to employees, some expressed no need for such feedback on how they sort the different kinds of waste. Another expressed interest especially if the data is compared to another store, as competition with a “sibling store” is a common motivator in other activities. To set goals together with the store manager was also questioned as this “demands the waste to be disposed of elsewhere” while others were positive but questioned whether they could affect the distribution between categories without putting pressure on producers. The warehouse manager argued that the interest in waste management increases if you have some sort of information and that setting goals together with the store manager would be fun since goals and follow-ups are common in other cases. The warehouse manager also expressed an interest in feedback on costs to be presented to employees.

“For example, today nobody thinks about the fact that it costs 8000 every time we empty the [food waste]. And the fact that we earn some money on [the cardboard], there’s probably no one who thinks of that. And if you get a realization then, okay. Then I think it gets in the back of your head.” (Warehouse manager 3)

4.4.3 Feedback on interactive installations
The concept Melody buttons was questioned for several reasons. Store managers claimed that nobody would have the time to press any buttons under the stress they experience all day, and that things taking time can’t be introduced. Furthermore, employees reported that it would probably not work as one does not have time to press buttons, and neither to listen to the melody afterwards. “You don’t have time to reflect upon it. I don’t think people will stay and listen.” Another suggestion was that it might work in an environment where a lot of different people move, and not in a store where there is the same people every week. One store manager also thought the concept to be depreciating as he claimed that the bins had proper signage, and questioned whether it would be used.

When presenting the concepts, one employee also suggested that it might be clearer with bar charts and graphs when one is about to sort the waste, as numbers, percentages and goals are used for other measures of performance. One store manager suggested that funny or pleasing sounds could be used for the categories where waste should be disposed. The other concept called Sound feedback received more positive reactions from managers and employees. Voice feedback was suggested instead of sounds, for example “thank you for disposing of old papers here” but that it should be positive and not give orders. Store managers and employees also made a connection to nudging and the Piano Staircase, and thought the idea of auditory feedback to be funny. One store manager questioned whether the sound would provide accurate feedback depending on clarity in the sound, but liked the idea of providing feedback whether you do wrong or right and using another sense than vision.

5 DISCUSSION
The interview learnings will be discussed here in relation to the concepts and evaluations. Methodological choices will then be analyzed with limitations and what could have been done differently. The discussion ends with recommendations for future research.

5.1 The results
The web interface for store managers presents static visualizations to provide knowledge and hopefully generate increased motivation to recycle, similar to eco-feedback [19]. This need for information was supported by the interviews with store managers, as this would help them to make informed decisions, similar to theory of planned behavior [1]. Furthermore, the interviews discovered that what store managers desire most are economic incentives and guidance which is why a lot of focus was put on the Costs section in the web interface. According to the evaluation this seems to be a fair design decision as store managers deemed the cost section to be most interesting.

Store managers also reported in the interviews that economic and environmental incentives align in the case of waste management in stores, although there are examples when they oppose each other, such as having more categories which costs more but is better for the environment. In the web interface however, only the economic costs are displayed although it would be interesting to also present the environmental costs and incentives. Store managers reported that cost savings motivate, but environmental savings could still be valuable to implement in the interface since the evaluation showed that sometimes the cost (if too low) might be uninteresting while the environmental saving could be motivating. It is also interesting to investigate what happens when environmental and economic incentives oppose each other. Furthermore, monitoring what happens when store managers gain increased knowledge about

---

costs and environmental effects from their recycling structure is critical, as this should not lead to a rebound effect [25] where an increase in efficiency leads to an increased amount of waste.

The web visualization adapted towards employees was designed to communicate the distribution between categories, some kind of assessment and store goals. However, when shown to some employees, the interface was deemed irrelevant since the employees didn’t understand how this information would help them. Two employees thought that source sorting could not be improved today without changing the incoming materials. This could be because the store, according to the statistics, already had a very good source sorting system, or because the employees don’t know how they could affect the sorting. One store manager thought the interface, if positioned on a screen, should change its information more often to maintain employees interest and not blend in with the background. This is valuable feedback that should be implemented in further iterations. To not include costs in the visualization towards employees was a conscious design decision as this information was regarded irrelevant for the employees. However, the warehouse manager interviewed in the evaluation wanted economic costs to be highlighted to the employees, such as how much it costs to empty the food waste or that cardboard generates money. The possibility of adding economic information should therefore be investigated in future studies where incentives and motivations of employees should be covered more in depth.

The interactive concepts received mixed feedback in the evaluations. The purpose of these ideas was to go beyond the traditional visualizations of screens and target the practice of recycling in the moment by questioning the everyday routine yet be fun and educational. The concept Melody buttons received mostly negative feedback, as the employees and store managers questioned the workload, the time and the presentation of the data as it does not align with their stressful work conditions. The feedback illustrates how important it is to not introduce something which will demand too much time or effort from the users. This might be why the Sound feedback concept received more positive feedback as this would only play a sound when the bins are being used and not demand activities such as knowing what type of waste is on the cart, pressing buttons and listening to sound when the activity is done.

As it was discovered in the early interviews, competition and comparisons are common strategies to improve the store’s performance in terms of sales, revenue and so on. However, as this was emphasized by the waste collection company as risky, comparisons where other stores could be identified were deliberately not used in the mockups. Early sketches explored how comparisons could be made with anonymous reference points, but referencing to a goal or average point for similar stores was valued as more relevant to the store. As employees in the evaluation mentioned how they compare themselves with “sibling stores”, and how they are triggered by that, the potential use of comparisons and competition, together with justified conditions, could be investigated in future research.

5.2 Answering research questions

The two web interfaces designed have included information that based on the interviews were expressed as interesting and meaningful. From the interviews with store managers, meaningful information was interpreted as economic information, comparisons, distributions and amounts, history and statistics which all were implemented in the mockups. However, due to limited number of interviews conducted with regular employees, no general design decisions could be made regarding the content presented to employees. The design decisions were based on the interviews with store managers and warehouse managers. It is therefore not clear what information that is desired from the employees. As the interviews revealed a previously unknown yet important role in the form of a warehouse manager, more knowledge should be gathered on what feedback this group desires. Since the warehouse managers reported that they educate employees in waste management, it is possible that the feedback should include motivational arguments highlighting the importance of recycling materials as well as an assessment on where sorting can be improved.

Implementing the waste management agreement was a part of the grocery chain’s sustainable development as it is better aligned with the chain’s environmental branding. However, motivating sustainable development does not necessarily demand environmental feedback. Since store managers reported that economic incentives are motivating and that economic and environmental incentives go hand in hand in terms of waste management, this opens up for the possibility to use economic incentives to promote sustainable development. Similarly, donating food to NGO’s contributes to the social pillar of sustainability but can also be motivated with monetary savings. As suggested by the store manager in the evaluation, costs are not always most essential as environmental savings can be more relevant to present when the savings are too low.

The mockup “Avfallsportalen” contains meaningful information which is meant to assist the store manager in the assessment of where the store can improve its waste management. The information should also motivate the store manager, mainly with economic incentives as this was deemed most interesting, to improve the source sorting practice. Examples of what can trigger motivation in the interface are distributions between categories and costs, best practices (if others can, so can we), comparisons and especially the possibility to set realistic goals for the store to reach. The goals which are visible in the employee version as well need to be further investigated whether they are really meaningful to employees. The design choices were also reported how they educate employees by for example explaining in an entertaining manner to maintain their attention. This was one reason for the more interactive concepts to be developed as they try to motivate by countering the everyday routine of disposing waste in the common bin, to be more attached to the actual practice and to be educational yet fun.

5.3 Methodological aspects

Several methodological learnings can be acquired from this thesis work. More interviews could have been conducted generally to gather more knowledge, and especially with more regular employees. As one employee reported in the evaluations that they experience limited possibilities to affect the waste distribution, more interviews could have been done with regular employees to explore their motivation and knowledge on this matter. This would hopefully uncover their desires, what kind of feedback they would be interested in and how this could be better implemented. Furthermore, the evaluation could possibly have been more structured and done with more employees. Stressed store managers and employees who had limited time to look at concepts and click through mockups led to all formulated questions not being asked. This however becomes a tradeoff of doing evaluations in the correct context and collecting answers for all questions where the former was valued as more important and feasible.

In this project, only larger stores and supermarkets have been visited and investigated. This decision was a conscious delimitation and the larger stores were selected as they were more homogenous.
and more likely to have a larger impact on sustainability, due to their size and revenue. However, this study offers very limited data on what information that needs to be presented to smaller stores, which is why this should be examined in further studies.

Costs were a main motivator and information provided in the interface towards store managers together with goals, distributions and comparisons. Sustainable measurements were left out of the design concepts, mainly because environmental valid measurements are extremely difficult to come up with. For cardboard and plastic it is relatively easy to calculate how many kilos of CO\textsubscript{2} or liters of oil that is saved by recycling. This however gets more complicated when measuring residential waste or packaged food waste, which are two of the three largest categories in larger grocery stores. The potential use of providing sustainable measurements should be investigated in future work.

5.4 Waste management as a practice

The mockups of web visualizations can be regarded as persuasive displays as they provide feedback on the store’s source sorting. However, using persuasive technologies in sustainability have been criticized of being top-down driven rather than bottom-up [4] as well as limited in duration and extent [9, 22]. Moving beyond persuasion is recommended by shifting from prescribing desired behavior recommendations to reflection while also shifting from targeting only behavior to practices in a broader cultural context [4].

An alternative to ordinary persuasive technologies are ambient visualizations, with the purpose of providing users with feedback increasing awareness readable by glancing at the design from a distance [12]. Examples of ambient feedback technologies are for example the Power Aware Cord visualizing electricity flow [23] and the polar bear application where the ice floe melts due to lack of commitment to environmental actions [11]. It would be interesting to investigate how ambient visualizations can be used for waste management feedback within a store, especially for employees as this might be a more suitable visualization for their rapid work pace. An example could be to create a more physical representation of the triangle (Figure 7) with flows that illustrate how the store performs in the largest categories.

In contrast to persuasive technologies which often targets individuals’ behavior, Social Practice Theory includes not only the skills and competences of the individual, but also the images (cultural norms) and the stuff (physical materials). Social practice theory has been used within sustainability before [24, 39, 41] and allows a more holistic view on the practice of recycling rather than just providing information or persuading people to behave in a more sustainable way. Practices are social in their definitions, spanning over people and culture, as no single individual can change a practice alone [32]. Within the practice of recycling, the images would be the shared expectations among people on how much that should be and can be recycled, the skills would be the knowledge on what materials to put in each bin and the stuff would be the actual bins and the material to be recycled.

Waste management can be regarded as a practice changing depending on the actor, the context and the equipment. In this thesis work, waste management and source sorting in stores have been investigated not only in terms of individual motivation and knowledge, but through contextual interviews with different user groups. Visiting stores to investigate the physical surroundings where the recycling activity takes place facilitates the development of design concepts. This allows for a broader exploration of the practice of waste management, although it is impossible to implement all gathered knowledge on the recycling practice in a design concept. This thesis work has made attempts to address aspects of the recycling practice through contextual interviews, HCI solutions and recommendations and evaluations. While the mockups can be regarded as persuasive feedback, they also provide knowledge (skills) on the store’s performance in different ways to different users. The possibility to set goals for the store is also a way for the store managers and employees to collectively agree on a target (i.e. an image) and how this should be reached. Although this thesis has investigated aspects of the practice, it is not enough to simply increase knowledge (and skills) as culture and/or physical conditions also might need to change in order to shift to a more sustainable behavior. The concepts developed should be positioned within the complex context of the waste sorting practice in stores and future studies should try to cover and investigate the practice from a holistic perspective.

5.5 Future work

Several suggestions for future work have already been mentioned. As discovered in interviews with the waste collection company, numbers exist for how much cardboard should be produced in relation to revenue. These numbers should be further developed for other categories to establish reference values. The environmental feedback in the mockups should further be investigated on how this can be formulated and what measurements that are understandable and relevant to store managers and employees. Although the mockups are only visual representations and images, they were designed to be easily implemented. Obviously, the concepts will need further iterations starting with adjusting and prioritizing according to the evaluation results. The design process should be iterative and the concepts presented in this project are merely scratches on the surface to explore how waste feedback should be presented to store managers and employees.

More interviews should be conducted with regular employees, as this group have more knowledge which this project failed to discover. More collaborative and participatory methods could also be used by for example conducting design workshops with employees. In addition, as this thesis has been focusing on larger stores and supermarkets, the waste management practice and routine will look completely different in smaller grocery stores. If and how such a visualization should be designed towards smaller stores, new interviews should be conducted as circumstances may differ. Furthermore, the study conducted within this project is specific for the grocery chain Coop and the Swedish waste landscape. It is therefore interesting to explore how these practices look like in other grocery chains and in other countries.

6 CONCLUSION

This thesis work has investigated the practice of recycling within larger grocery stores and how feedback on that practice should be presented towards store managers and personnel. Contextual interviews yielded themes relating to need for knowledge on waste management, economic incentives to recycle, environmental vs. economic incentives and need for comparisons and feedback. These interview learnings were implemented in two mockups of an interface and two sketches of interactive installations. The two mockups are targeting the store manager and employees, respectively. Evaluations with store managers and employees showed that economic feedback is valuable but that distributions are confusing when not suggesting concrete actions. Tips and goals for motivating improvement were desired. The sketch called Melody buttons was questioned as too heavy in terms of workload and time consumption, while the concept Sound feedback was more appreciated with connections made to increased awareness, positive feedback and nudging.
7 REFERENCES


