Green Shopping List

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Abstract

This paper is about the design of a mobile application interface that helps people to sustainable food consumption. Focus of the development lies within two areas: Sustainable Human Computer Interaction and Persuasive Technology. With the use of these frameworks we have worked towards creating an effective tool that could change people's attitude and behavior. The end product is an interface for a shopping list application that gives environmental friendly and climate smart food recommendations based on what the user intends to buy.

The paper also discusses future development strategies based on the problematic situation surrounding retrieval, aggregation and presentation of data together with possible solutions on how to trigger motivation and tailor the application for different user profiles.

Sammanfattning

Denna uppsats handlar om utformningen av ett gränssnitt för en mobil applikation som hjälper människor till en hållbar livsmedelskonsumtion. Fokus i utvecklingen ligger inom två områden: Hållbar människa-datorinteraktion och Persuasive Technology. Med hjälp av dessa framework har vi arbetat för att skapa ett effektivt verktyg som kan förändra människors attityd och beteende. Slutprodukten är ett gränssnitt för ett inköpslistsprogram som ger miljövänliga och klimatsmarta matrekommendationer baserat på vad användaren har för avsikt att köpa.

Uppsatsen diskuterar även framtida utvecklingsstrategier baserade på den problematiska situationen kring inhämtning, sammanställning och presentation av data tillsammans med möjliga lösningar på hur man triggar motivation och skräddarsyr applikationen för olika användarprofiler.

Table of content

1 Introduction

This thesis deals with food consumption from an environmental perspective and tries to answer how modern technology can change people's food consumption to become more sustainable. The technological environment we have focused on is mobile applications. The project was recommended to us by our supervisor Jorge Zapico at the Center for Sustainable Communications[1], on the Royal Institute of Technology[2].

1.1 Background

The surface temperature on Earth must not rise more than two degrees. If the border is passed, it means big problems for all living things, but if we can stay within the limits, we have a chance to reverse the trend. To preserve the nature and keep the environment and climate intact, 16 main objectives[3] were set up by the Swedish Parliament via the Swedish Environmental Objective Council. An overall goal is to stop the global warming, caused by emissions of greenhouse gases (Swedish Nature Conservation Agency official website, 2010).

The Swedes' greenhouse gas emissions answer to ten tonnes of carbon dioxide per person a year according to estimates by the Swedish Environmental Protection Agency (data from 2003). By 2020 we need to halve the emissions and by 2050 the figure must go down to a maximum of two tonnes if we are to achieve the objectives.

Food consumption and production has a major impact on the environment and the climate. Every year we eat about 800 kilos of food and beverages (National Food Administrations official website, 2010). Food stands for up to one third of a person's total emissions (Björklund et al. 2008). To change our food consumption habits is therefore a natural and important step towards a more sustainable society.

Figure 1 – Portion of carbon footprint for different areas caused by the average person in Sweden (Naturvårdsverket official website[4])

[1] www.sustainablecommunication.org

[2] www.kth.se

[3] www.miljomal.se

[4] www.naturvardsverket.se/sv/Klimat-i-forandring/Konsumtion-och-klimat/Konsumtionens-klimatpaverkan/

A comprehensive study made by Demoskop[5] in 2007 investigated what the Swedish people know and how they look upon the climate changes. According to the study it clearly shows that the Swedes highly value the topic and look at it with great seriousness.

A positive attitude towards organic food, among consumers, is shown in research from Konsumentverket (2006). However the organic products only stand for 3% of the total consumption in Sweden. The same applies for Fairtrade labeled products. The acquaintance of the fair trade brand has had an almost explosive increase the last couple of years (From 38% in 2002 to 84% in 2009). The sales volume has also steadily pointed upwards, with an increase of the turnover by 165% in 2007, 75% in 2008 and 25% in 2009. However the market share of Fairtrade labeled products is low. Both coffee and bananas, which are the top selling products, stand for just over 4% of the market[6]. This implies a gap between attitude and behavior.

Making sustainable choices is not easy. A study composed by the Swedish Consumer Agency (Dahlin & Källebring, 2009) shows that only one out of five think it is easy to act environmentally friendly. In the same survey 47% of the participants' answer that too many choices make it difficult to keep oneself updated and based on that make sustainable choices. Furthermore 48% say that making climate smart choices are too time consuming. As shown in the study by Dahlin et al. there is a big need to simplify the process for people to make sustainable choices, and so with food. In today's information society a big quantity of information on how to eat sustainably is available[7]. A big problem however is that the information seldom is accessible when the user actually needs it, i.e. at the time of consumption.

Today's mobile phones present a perfect technical environment to solve such a problem. They provide a ubiquitous access to information by at almost all times being connected to the Internet. They can perform contextual analysis with the use of GPS, accelerometer and clock. Their application software can be tailored dynamically to suit the personal needs of the user, partly based on contextual analysis and partly based on the user's own input and usage patterns.

[5] www.demoskop.se/?id=1197

[6] www.fairtrade.se/cldoc/168.htm

[7] When searching for *"Sustainable food"* on Google (www.google.com) one gets well over nine million hits. Most sites explain the effects of food production and consults people in how to get sustainable food habits.

1.2 Aim & objectives

The aim of this thesis is to design and evaluate a mobile application interface that helps people to choose sustainable food products. By doing so we hope to contribute to the development of applications that make people become more environmental friendly in their everyday lives.

To accomplish our aim the key objectives set up are:

- *Design a prototype of a mobile application interface with the purpose to help people to make sustainable food choices*
- *Evaluate the prototype and suggest future development strategies for such an application*

Parallel to the design process we will try to answer the following four questions that further substantialize the concept of our aim:

- *How do we help the users in their planning of what to buy before going- and while being in the supermarket?*
- *How do we provide them with accurate and truthful information about the everyday products that they buy?*
- *How do we present this information in an easy, interesting and interactive way at the right time?*
- *How can we furthermore influence the users to actively buy products that are better both from a climate- and environmental perspective and ultimately also for the benefit of their own health?*

1.3 Framework

This paper is a degree project report for a bachelor in Media Technology. It is written for the School of Computer Science and Communication (CSC) at the Royal Institute of Technology (KTH), Stockholm, Sweden. The result is part of the Persuasive Services Project[8] at the Centre for Sustainable Communication. The use of persuasive technology for sustainability is a part of sustainable HCI (Human-Computer Interaction). Its aim is to design systems that changes user's behavior and attitude to a more sustainable way (DiSalvo et al. 2010).

[8] www.sustainablecommunications.org/research/persuasive-services and www.persuasiveservices.org

2 Theoretical background

Everybody needs to buy food. Many people write down a list of what to buy in order to remember what to get while being in the store. There are already a number of digital shopping list applications on the market[9], helping the customer with planning what to buy. What we believe is missing is an application that specifically helps the customers to make sustainable choices[10]. That is how the idea of a green shopping list application was born. We will in this part of the thesis investigate the area further and build up a theoretical basis to refer to in the work towards our aim. The theoretical background consists of three main areas which are:

1. *Food consumption and its implications*
2. *From the consumers' perspective*
3. *Persuasive technologies*

2.1 Food consumption and its implications

To understand why a certain product is good or bad from a sustainable perspective we need to understand how the food is produced. We will in this section investigate the problematic and complex nature of food production, how it affects the nature and what choices we can make to reduce the impact.

2.1.1 Environmental destruction and climatic change

Food production affects both the environment[11] and the climate[12] negatively in a number of ways. Environmental destruction means that forests, oceans, fisheries, rangelands, fresh water systems (lakes, wetlands, rivers) and other natural ecosystems are degraded, threatened or on the verge of collapse because of human exploitation of the natural resources, in our case in the form of food production. Climate change refers to the effects of the global warming caused by emissions of greenhouse gases[13]. (European Commission official website, 2010).

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[9] When searching for "Shopping list" one gets 298 hits in the Appstore. Not all of these apps are specific shopping list apps, some of them are "to do" lists with shopping features, some deal with recipes etc, but the predominant part are specific shopping list applications.

[10] When searching for "Sustainable Shopping" in the Appstore one gets a single hit (Greenpeace Tissue guide). "Green shopping list" leads to two hits but none of them deals with anything that has to do with environment or sustainability. They are simply regular shopping applications with the word *"green"* tagged to them.

[11] Our planet's ecosystems and ability to sustain life

[12] The weather in some location averaged over some long period of time, defined by Princeton's lexical database WordNet. (Retrieved May 15, 2010 from http://wordnet.princeton.edu/)

[13] The three greenhouse gases associated with food production are methane (CH_4), nitrous oxide (N_2O) and carbon dioxide (CO_2)

Many factors lead to environmental[14] implications. Here are a few examples of key elements in food production that heavily contribute into affecting our nature:

Pesticides

Use of pesticides in agriculture to reduce weeds and parasites etc leads to damage of wildlife when the pesticides leak into ecosystems after rain. Residues of the toxic pesticide can also be found in the food we eat. (Björklund et al. 2008).

Fertilizers

Use of fertilizers in conventional farming causes eutrophication[15]. Production of artificial fertilizers causes high emissions of greenhouse gases and therefore contributes to global warming. (Krav, 2009)

Fossil fuels

Use of fossil fuels is a consistent element throughout the whole production chain of many groceries. Fossil fuels are e.g. used to heat up greenhouses causing air pollution and high emissions of greenhouse gases. (Björklund et al. 2008)

Transport

The import of food to Sweden has doubled in just over a ten year period from 3,4 million tonnes, in 1995, to 6,7 million tonnes, in 2007. A simple Swedish breakfast is an example of how global our eating has become. The milk and bread are usually from Sweden, the juice can be from Spain or Brazil, the bananas from Peru or Ecuador, the egg from Finland and the muesli is super international with coconut from Indonesia, raisins from the United States and palm oil from Malaysia (Bergman, 2008). Transport of imported products causes both air pollution and high emissions of greenhouse gases.

Deforestation

To make room for cattle pasture grounds and plantations of crops such as soybeans (partly used to produce animal feed) or palms (for production of palm oil), tropical rain forest is cut- or burnt down. This leads to erosion and animal species getting endangered (Bartholdson et al. 2010). Every year, Sweden imports around 44 tonnes of palm oil, 365 000 tonnes of soy and 27 000 tonnes of tropical timber. This correlates to 10 000 hectares of tropical ground for the palm oil, 200 000 hectares for the soybeans and 1 800 hectares for the timber. To put into context this means 233 square meters of devastated

[14] To avoid misunderstandings we will from this point in the thesis introduce the umbrella term "environment". When used it hereby refers to both the environment and the climate.

[15] A process where water bodies, such as lakes, receive excess nutrients that stimulate excessive plant growth. This enhanced plant growth, often called an algal bloom, reduces dissolved oxygen in the water when dead plant material decomposes and can cause other organisms to die (U.S. Geological Survey official website, 2010).

tropical ground divided on each Swede, as shown in WWF's information material *"Our ecological footprints"*[16].

Social implications

Heavy use of pesticides creates very poor working conditions for the workers at many plantations and also causes other social implications. Many Brazilian soybean plantations use pesticides that are banned in Sweden, the cattle farmers are exposed to a modern form of slavery and indigenous peoples of the Amazonas are displaced as the expansion continues, shown in a study from Swedwatch (Bartholdson et al. 2008).

2.1.2 Who are the villains?

As a framework to standardize the methods of finding a product's carbon footprint the LCA method was created. LCA stands for *"Life Cycle Analysis"* and it observes a product's whole life cycle. All emissions of greenhouse gases in the life cycle are retrieved, all the way from raw material extraction through manufacturing processes and use to waste management, including all transport. (Baumann & Tillman, 2004)

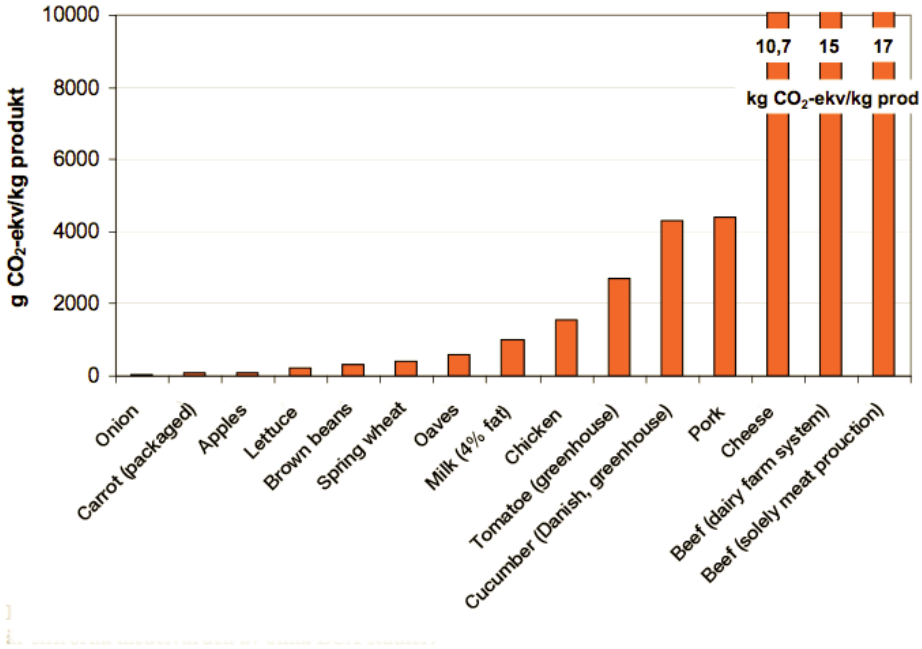


Figure 2 – Carbon footprint from the agriculture for different Swedish food products. For milk, pork and beef the numbers are mean values from different LCA studies (Naturvårdsverket, 2008).

Stated in the diagram above are the biggest villains when it comes to carbon footprint. But besides the emissions of greenhouse gases caused within a products life cycle, a tremendous amount of additional variables, need to be considered to determine a products overall environmental impact. Different variables need to be considered for different

[16] http://www.wwf.se/v/ekologiska-fotavtryck/1128707-ekologiska-fotavtryck-tidningen

product groups. Since there is no way to normalize and sum up the total impact we need to further investigate the matter to define the villains more precisely.

Due to the scope of the thesis we have chosen to focus on two main groups of products and these are Meat and Dairy products and Fruit and Vegetables. We have also decided to focus on fresh food and disregard finished goods such as Ketchup etc. Recommendations of more general kind can be found regarding fresh food while finished goods demand analysis of each single item which we unfortunately figured was to resource demanding.

We have defined the two main groups as the most influential groups based on information from the Swedish Agency for Nature Conservation [17], The Swedish Consumer Agency[18], The Swedish Environmental Protection Agency[19] and The National Food Administration[20]. These groups are part of our everyday food and depending on our choices we can affect the environment in a large scale. Fish (overfishing of red flagged fish species is a big problem), seafood (giant prawns cause high environmental damage in a number of ways) and rice (cause high emissions of methane) also deserve to get mentioned as other important groups but they lie outside the frames of our research for this thesis.

Meat and dairy products

Meat and dairy products are the biggest villains in the global warming context. Meat production stands for almost a fifth (18%) of the greenhouse gases emissions in the world. (Castel et al. 2006). Since 1990, Swedes have increased their meat consumption by over 50 percent. Today, we consume more than 86 kilograms of meat per person per year according to the Swedish Nature Conservation Society.

Ruminants such as cattle and lamb meat cause more greenhouse gas emissions than pork and chicken and therefore affect the global warming more. Breeding of cattle causes high emissions of methane while the cattle ruminate. Methane has 23 three times stronger impact on the global warming compared to carbon dioxide, another common greenhouse gas (Björklund et al. 2008). One kilogram of beef reared on feed concentrate can therefore affect the global warming up to ten times more than one kilogram of chicken. But the situation is more complex than that since it likewise is important that we preserve the ecosystems of our farmlands. The pastures where cattle and sheep are being naturally reared are kept open, which is not the case with pig and chicken, who make damage to the ecosystems in their surroundings. (Naturvårdsverket, 2008)

[17] www.naturskyddsforeningen.se/gron-guide/ata

[18] www.konsumentverket.se/mat/mat-och-miljo

[19] www.naturvardsverket.se/

[20] www.slv.se

Sweden imports half of all the domestically consumed beef and a big part is imported from Brazil and Ireland. As a whole, the breeding time of Swedish cattle is short. The Swedish cattle grow faster and are thus less damaging to the environment than cattle from the major exporting countries, Brazil and Ireland. In addition, the Swedish cattle give an open and diverse landscape with high biodiversity. (Kumm & Larsson, 2007)

Fruits and vegetables

When it comes to fruits and vegetables the season factor is of great importance. Because of the cold climate in Sweden we cannot provide ourselves with all the fruits and vegetables we buy, all year around. During the winter it is extra important to eat D-vitamins because of the lack of sunlight, and this demands import. Fruits of more exotic kind such as bananas and pineapple though need to be imported at all times.

Transportation of imported fruits and vegetables has a much bigger relative environmental effect compared to imported meat. The transportation impact in the life cycle of imported meat is small compared to the total emissions caused, but stands for the biggest part of the total emissions for fruit and vegetables. To make the right choice after season is therefore important. An imported apple from New Zeeland is 7 times more environmental incriminating than a Swedish apple and the French equivalent 3,5 times more (Svenskt Sigill and The Swedish Farmers' Association, 2010).

Bananas are one of the most popular fruits in the world and Sweden is no exception. With a consumption of 19 kg/person and year Sweden is one of the countries with the highest consumption amongst the countries without their own production (Fairtrade, n.d.). The vast majority of the bananas sold in Sweden are sprayed with chemical pesticides. Big amounts of pesticides are commonly used at the plantations; around 50 kilograms are spread every year on each hectare of farmland. This creates extremely harmful working situations on the plantations and the leaking of pesticides poison the surrounding ecosystems. (Swedish Environmental Protection Agency official website, 2010)

Vegetables grown in greenhouses are far more energy consuming than open field cultivated ones since the greenhouses must be heated. Swedish, Danish and Dutch salad vegetables (tomatoes, lettuce and cucumber e.g.) are to a big part grown in greenhouses while the equivalents from the Mediterranean countries are grown in the open at a much higher rate. Locally produced vegetables cause less emission from transport than long-range ones. But as discussed by The Swedish Nature Conservation Society, based on Möller Nielsen's study (2008) it is still better to choose Spanish or Italian outdoor grown tomatoes than buying tomatoes from Sweden, Denmark or Holland grown in greenhouses that uses fossil fuels, to be heated.

2.1.3 Why eat organic products?

In organic food farming there is no or very little use of pesticides and artificial fertilizers. In the meat production the animals are essentially fed with feed produced on the same farm. That the animals get to be kept outside in their natural environment is also important. Medicines such as antibiotics are used on strict grounds. If an animal needs to be treated with medicines the waiting period before the animal is slaughtered gets extended. Genetically modified organisms may not be used in organic production (National Food Administration official website, 2010).

According to a comparison study (Nilsson, 2006) by the Swedish Institute for Food and Biotechnology organic vegetables, such as potatoes and carrots, cause down to half the amount of emissions of greenhouse gases compared to non-organic. This is mainly due to the fact that organic farming takes place without usage of chemical fertilizers, which require much energy to manufacture.

However, organic products are not always better in a climatic context. There is normally a difference in efficiency between organic and conventional production methods, where organic manufacturing loses out. For example there is very little difference in emissions of greenhouse gases between organically and conventionally produced beef meat and milk. Cattle brought up organically grow slower and do not give as much milk per weight unit as conventional cattle. But they both emit the same amount of greenhouse gases such as methane and nitrous oxide, per weight unit, so even though the conventional cattle is brought up on imported feed, produced with the use of fertilizers, it all adds to zero difference in the end (Nilsson, 2006). To bare in mind though is that organic products leads to added values such as more bearable circumstances for the animals, locally produced items, better working conditions and, as previously stated, less or no use of fertilizers and pesticides (Krav, 2010).

2.1.4 Eating guidelines according to the experts

Our society is full of information on how to change our eating habit to become more sustainable. A seemingly inexhaustible amount of guidelines can be retrieved from environmental inspection agencies, nature conservation organizations and *"green"* grass root communities, all working for the cause of creating a more sustainable world. Much information is redundant between these types of sources and we have therefore assembled a summary, as objective as possible, based on the following recommendations and guidelines: *"Grön Guide"*[21] given out by the Swedish Agency for Nature Conservation, The *"Eat S.M.A.R.T."* brochure by The Swedish Consumer Agency, The report *"Eco*

[21] Green Guide in English

smart food choices" from The National Food Administration (2009) and matochklimat.se – a corporation between Svenskt Sigil[22] and the Swedish Farmers' federation[23]

There are a few general guidelines to follow for more sustainable food eating habits. Here is a small selection presented:

- *Eat organic and locally produced products.*
- *Adapt your choices depending on the season*
- *Reduce animal products and eat more vegetables*

Meat

Choose organic meat and Swedish meat reared on natural pasture, of beef and lamb. Reduce imported beef, reduce more of pork and chicken, which is what we eat most of. Choose fresh lamb in the fall and frozen lamb the rest of the year.

Fruit and Vegetables

Eat coarser vegetables (leguminous plants are the best). Swedish root vegetables are basically seasonal vegetables all year round. Buy concentrate for products like fruit juice.

2.2 From the consumers' perspective

"Should I take Krav certified potatoes from England or the Swedish locally grown? I cannot buy bananas, for although they are both organic and fair trade, they are transported in fridges with ships and of course it causes high emissions. But which fruit should I then take? We have to have C-vitamins. Are there any apples that come from this side of the earth? There is no meat available bred in pastureland - what shall we then have for dinner? Chicken, it is good for the environment, but then it has to be organic chicken, which off course does not exist. Do taco shells have palm oil in it? I would not like to help to cut down the rain forest in Indonesia. And so the fish are the fish sticks made of cod? Then it is perhaps the last one they managed to catch. And I cannot buy shrimps either, it can not be considered if you want to be environmental friendly. The hokifish is caught sustainably of course, but they come from across the world, is that wise?" (Björklund et al. 2008, p. 42).

These thoughts build up a typical scenario of an environmental conscious person trying to pick and choose what to buy while being in the supermarket. The scenario indicates of the problem from the consumers' perspective in their urge to make environmentally justifiable choices. A good way to help the customers, put pressure on the actors within

[22] Association that labels food and flowers. www.svensktsigill.se

[23] Lantbrukarnas riksförbund. www.lrf.se

the food production and consumption industry and increase the supply of environmental friendly products is through labeling.

2.2.1 Two types of labeling

The study *"Climate labeling of food"*, from the Swedish Environmental Protection Agency (2010), discusses the aspects of food labeling. According to the section *"Ongoing initiatives in climate labeling of food"* there are essentially two approaches when it comes to environmental labeling of food: Criteria based labeling and calculations of a product's carbon footprint. The criteria based labeling, often called qualitative labeling, is received when certain criteria are fulfilled. Calculations and compilation of a product's carbon footprint, often called quantitative labeling, refers to the emissions of CO_2 equivalents caused by a product and calculated through the LCA method. LCA is location and product specific, since calculations of a product sold in Sweden differs to a product produced and sold somewhere else. It is therefore an expensive and time demanding method. So-called PCRs (Product Category Rules) is one way to, within each industry, reach a common and credible method of common requirements for LCA studies and to determine which environmental declarations that shall be conducted and reported (Naturvårdsverket, 2010). There are pros and cons with both criteria based labeling and carbon footprint labeling.

Criteria based labeling

Criteria based labeling is positive in the sense that organs such as Krav and Svenskt Sigill already has developed criteria which constantly get sharpened. This enables labeling of many products in a short time period, which in turn leads to quick changes in the production. Reliable third party authorities that take multiple environmental aspects into consideration set up the criteria. Criteria based labeling provides good comparison within each product group and emphasizes the *"good"* products in front of the rest. On the contrary it does not enable comparison between product groups. The customer can therefore consider labeled products within *"bad"* product groups as justifiable. For example it does not show that vegetables in general are more environmental effective than meat products. The label does not show which environmental aspects that are taken into consideration, which on one hand might be irrelevant for the customer, but on the other hand might cause overconfidence on the label to cover all environmental aspects.

Carbon footprint labeling

Carbon footprint labeling gives clear cold figures on climate impact, black on white. It enables the possibility to show reductions made by a company over a period of time. Carbon footprint labeling also enables comparison between product groups providing that many products are labeled. Continuous improvements are made; regardless in which rate the criteria get sharpened. The penetrating power is however likely to be low if only a

few of the products are labeled. Comparison is not enabled until a majority of products are marked and brings a risk of low customer guidance initially. As more products get labeled, guidance increases. Another risk with carbon footprint labeling is that focus only is placed on CO_2 emissions and other factors such as use of pesticides and social implications in the production are overseen, unless used together with such facts. The method demands complete LCA data and the retrieval costs will be charged on the customer. It is of great importance that a standardized framework, interconnected with PCRs, is used in the calculations of LCA data, for truthful results and enabling of comparison (Naturvårdsverket, 2010). Other criticism towards carbon footprint labeling itself is that it makes great demands on consumers' knowledge as discussed by Zarah Ekman in the article *"Klimatmärkning av svenskt mat dröjer"*[24].

2.2.2 Initiatives

Several environmental labeling initiatives are made throughout the world.

Criteria based initiatives

Criteria based labeling is today wide-spread and made on both domestic and global level. Use of hazardous chemicals and fossil fuels leading to emissions to air, water and land, resource use and waste management are examples of criteria being controlled. Different regulation frameworks/protocols are stricter than others and also overlook different aspects. In Sweden as well as within EU a number of independent organizations or authorities perform elaborated criteria labeling. The Swan (initiative made by the Nordic countries) and the EU Ecolabel are two of the most demanding environmental labels in the world. Products marked by these have passed through tough environmental and climate requirements. Only in Sweden there are thousands of Swan labeled products, ranging from hotels and restaurants to the detergents and batteries[25]. Krav is the dominant marker of organic products in Sweden and has a demanding protocol. The European flower (EU Ecolabel) is labeled on organic products produced within the EU and MSC (Marine Stewardship Council) is a labeling for fish and seafood products[26].

Some private actors are also performing criteria based labeling. The Swedish grocery chains ICA and Coop perform labeling of organic products within their own product catalog, marked by *"ICA I love you"*[27] respective with the *"Coop Änglamark"* logo[28]. In addition to the abovementioned labels there are an abundance of other labeling systems within different product fields, used only in Sweden, which puts a heavy cognitive load

[24] http://svt.se/2.22620/1.1183704/klimatmarkning_av_svensk_mat_drojer

[25] www.svanen.se

[26] http://www.konsumentverket.se/kopa/Miljomarkning

[27] http://miljonytta.se/livsmedel/ekologiska-varor-och-miljomarkning/

[28] http://www.coop.se/Butiker-varor--erbjudanden/Vara-varor--varumarken/Anglamark/

on the consumers in the selection process. On the contrary it leads to competition which makes the criteria getting sharpened in a faster paste. (Naturvårdsverket, 2010).

Carbon footprint based initiatives

In a study by the Environmental Protection Agency (2006) the Swedish public welcomes a label showing which products that are produced with low carbon footprint. The vast majority (93%) of the respondents think it would be good to have such a label. Carbon footprint labeling is still in its starting holes because of the complexity surrounding LCA. (Neither common PCR protocols nor standardized ways of presenting the information are today clearly elaborated.) Exciting initiatives are however made. In some countries carbon footprint labeling has been initialized by government-affiliated organs such as The Swedish Environmental Management Council, ADEME in France and Carbon Trust in Great Britain. Also private actors such as the chain stores Casino and Leclere in France, Tesco in the UK, Aeon in Japan, Migros in Switzerland and Hofer in Austria have in different ways incorporated carbon footprint labeling on their products. The Swedish hamburger chain MAX has estimated how much CO_2 emissions their hamburgers and other food cause, which is presented on their menus.

Common criticism

An important confidence-building measure for any labeling system is that there is an independent and effective enforcement of the established rules. That the criteria and protocols are being followed needs to be controlled by objective third party investigators to ensure quality and reliance. The consumer can then rely on the label and therefore know what they get for your money. The accuracy and objectiveness of the labeling systems used by the private actors can by discussed. Common criticism towards the initiatives made today is that everyone uses their own climate labeling system. Since the labels are based on different protocols and methods of calculation, it is therefore difficult to compare products marked with different labels. But two international standards are under way and predicted to be defined in about two years time, the ISO and the WRI/WBSGD GHG Protocol. Standardization is thereby probably not going to be a major problem in the future.

2.2.3 Positive or negative labeling systems?

All the labeling systems on today's market are invariably showing that a certain product contains different types of positive added values. Grankvist (2002) have studied how the opposite would work, i.e. a negative labeling system that labels red flagged products. He finds that those with moderate environmental interests were affected more by a negative system than a positive one. The practical use of such a system would work if all products had to be labeled. Currently all labeling is voluntary and it is therefore highly unlikely that the producers would pay for a negative labeling system.

2.2.4 Personal gain important

As earlier shown by Konsumentverket (2006), there seem to be a gap between attitude and behavior in organic food consumption which is supported by Magnusson (2001), Padel et al (2005) and Makatounis (2002), all cited by Toivonen (2007). In the study by Padel et al it is explained that the biggest reason for the gap is that organic food is considered more expensive and that the majority of the consumers are badly informed about the organic meaning and it is advantages. Magnusson looks at the most important purchasing criteria, from the consumers' standpoint, and finds that the taste of the food and that the food ought to be healthy were in the top. The health aspect was also the most important factor shown in Makatouni's study of English consumers. This implies that the consumers want personal gain from buying the product. The lack of personal gain is probably the most critical element in green marketing speculated by Hartmann (2006). Hartmann's theory is proven by a survey made by Konsumentverket (2006), where almost 70% of the participants answer that they would consume more organic products if the personal gains were higher.

2.2.5 Other initiatives

There are also exciting initiatives directed at specifically helping consumers to compare products, based on different factors.

The project GoodGuide[29], created by Dara O'Rourke[30], provides users with information and comparisons of over 65000 products. Their main goal is to *"provide the world's largest and most reliable source of information on the health, environmental, and social impacts of the products in your home."* They do so in two different interfaces, as a website (goodguide.com) and as an iPhone application. An API[31] for external use is also under development. The health factor refers to the nutrition level[32] of the product and controversial ingredients such as aspartame etc. The social factor refers to the working conditions in the production cycle and the company's ethical policies and charity work etc[33].

PAN (Pesticide Action Network) [34] is a global network of 600 participating nongovernmental organizations working to reduce the use hazardous pesticides with eco-friendly and socially just alternatives. Their project *"What's on my food"*[35], provided as a

[29] www.goodguide.com

[30] A professor of environmental and labor policy at the University of California, Berkeley

[31] Application Programming Interface – used to communicate with GoodGuide. Main purpose is to retrieve data provided by GoodGuide

[32] Includes variables like saturated fat, cholesterol, sugar and sodium included in the product.

[33] http://www.nytimes.com/2009/06/15/technology/internet/15guide.html?_r=1

[34] www.pan-international.org

[35] www.whatsonmyfood.com

website and an iPhone application, compares organic fruits and vegetables with conventional equivalents based on residues of pesticides such as carcinogens and neurotoxins, found in the food.

2.3 Persuasive technology

This work uses mobile application in order to persuade people to a more sustainable food consumption. It is influenced by the research by BJ Fogg at the Persuasive Technology Lab at Stanford University. He coined the term *"captology"* which is where computer technology and persuasion overlap (Fogg, 2003).

2.3.1 Fogg Behavior Model (FBM)

According to Fogg (2010) behavior is a product of three factors: *motivation*, *ability*, and *triggers*. For a certain behavior to occur the person has to be *motivated* to perform the task, she needs to have the *ability* to do it and she needs to be *triggered* (notified at the right time) to do it. Each of these components has subcomponents.

Motivation

There are three subcomponents for motivation and each has two sides, a positive and a negative. Fogg calls them *Pleasure/Pain*, *Hope/Fear* and *Social Acceptance/Rejection*. In short you can be motivated to perform a certain behavior for the pleasure, the hope or the social acceptance you will receive or because you do not want to receive pain, fear or social rejection.

Ability

The ability factor has six simplicity subcomponents. They are: *Time*, *Money*, *Physical Effort*, *Brain Cycles*, *Social Deviance* and *Non-Routine*. The goal is to reduce these in order to make the target action simple. In short, the less time it takes to perform a behavior the easier it will become. Take money for instance, it is more motivating to perform a free or cheap action then an expensive one. Physical effort and brain cycles mean that: the less physical and mental effort you need in order to perform a behavior, the easier it will be. With Social Deviance Fogg means *"... going against the norm, breaking the rules of society"* and he takes wearing pajamas to a city council meeting as an example since it might take the least effort but there is a social price to pay.

Trigger

A trigger can happen in three ways, as a *Spark*, as a *Facilitator* or as a *Signal*. A Spark is used to enhance the motivation by in some way include the motivation subcomponents, for instance a video that inspire *hope*. A Facilitator is used to enhance the ability factor (reminding that the target behavior is simple enough). The last type, a Signal, is used

when the person both has the motivation and the ability to perform a behavior and only needs to be reminded at the right time.

2.3.2 Persuasive Tools

In his book *Persuasive Technology – Using Computers to Change What We Think and Do* (2003) Fogg lists a couple of persuasive techniques that can be incorporated into computer applications.

Reduction

With reduction it means you simplify a task in order to persuade the user to do it. The easier it is for the user to accomplish something the more likely it is that she does it. One example of this is the success of the iPhone Appstore. It is very easy to buy an application since you can do it from you phone wherever you are with only a few clicks.

Tunneling

Tunneling means that you lead a user through a predetermined process step by step and during this process persuasive techniques can be used. One example is when you install a new program on your computer. During this process you can have the ability to install other programs, register for newsletter, commercial etc.

Tailoring

With tailoring it means to provide information relevant to the individual. We tend to be more persuaded if the information is directed to us. Another concept Fogg talks about is tailoring information for context. Instead of tailoring information for an individual it is tailored for the context in which the individual happens to be in. Fogg calls it the "*next big step"* in tailoring technologies.

Self-monitoring

The self-monitoring technology monitors people in order to modify their attitudes or behaviors to achieve a predetermined goal or outcome. One example is devices that track your heartbeats rate while exercising. It tries to have the rate in a predetermined zone and makes sure you do not over or under exercise.

Conditioning

The conditioning technology means to give positive reinforcement or rewards in order to shape behavior and the frequency in which it happens. According to Fogg (2003), conditioning works best when positive reinforcement follows immediately after the target behavior. A study made by Fogg (2003), shows that people feel better about themselves and is more likely to perform the target behavior again if they receive praise.

Social Proof

The Social Proof principle is that people tend to do things that they see other people do (Cialdini 2007). One example of this is an experiment where people looked up to a window on the 6th floor. If one person looked up 42% of the passersby would also look up and 4% would also stop. If instead 15 people looked up 86% of the passersby would look up and 40% would stop (Milgram, et al. 1969).

Language

The way language is used in persuasive technology is very important. It can make the application more human-like and convey social presence to further persuade. It makes the user feel she is having a dialogue and it can give praise to make the user more open to persuasion.

3 Method

An iterative method has been used throughout the design process to develop the user interface. The mobile platform we have decided to focus on is the iPhone. Feedback from a focus group and a survey in addition to the theoretical research is ultimately the basis of our results. The collection of feedback data can be viewed as a combination of qualitative and quantitative method. A focus group gives more detailed information than a survey, which on the other hand gives a wider response range. Common to both methods is that a critical interpretation of the results must be made depending on the selection of participants and how the results are presented (Johannessen & Tufte 2003).

Conceptual Design Model

To develop the concept of our idea we defined it more accurately in a Conceptual Design Model (CDM) defined by Fogg (cited in Laurel, 2003, p. 201). The reason for this was to get a clear idea, in an early stage, of the Green Shopping List application. The CMD has later been improved and evaluated during the design process.

Analysis of existing application

The next thing we did was an analysis of existing shopping list applications in order to get ideas of important features as basis for an early mock-up.

Focus group

Focus groups are a common qualitative method used to systematize the information so far obtained and to examine how people interpret concepts. Using a focus group can create a broader understanding of how users interpret the plot of a program and how content can be effectively presented. Common questions asked to the participants can be: “What can be removed or edited?” and “What can be added?”. Room for interpretation and great flexibility for participants to express their views and opinions is given (Johannessen & Tufte 2003).

Our focus group was conducted in the form of a semi-structured interview in which the four main questions of a general nature lied as basis leading to free discussion of the overall concept. The data collection took the form of audio recording, along with notes, to obtain the observations of the respondents and their discussions.

Participants first observed the concept in the shape of mock-ups, and were subsequently interviewed. The group may be seen as homogeneous as they all had about the same age, had the same level of environmental consciousness and technology knowledge. Criticism of survey design is that the group was very small and not representative from a social perspective. Their responses thus function only as indicators.

Demonstration video

The mock-ups where developed further and a demonstration video was made. It showed a typical usage scenario with comments going through each step. The video was put up on YouTube[36] and Vimeo[37] in order to receive feedback from a questionnaire.

Questionnaire

Questionnaire is a type of qualitative method in which hard data is obtained. It gives rise to little flexibility among the participants and enables statistical generalization to be made. Criticism of the method is that it is limited to measuring the positive given (Johannessen & Tufte 2003).

We chose to make use of questionnaires for reasons of efficiency. In the short time you receive a lot of answers that can be easily processed and compiled. The reliability can be discussed, as our group does not reflect society. The questionnaire was sent out arbitrarily to other Media Technology students and was also spread among technically interested friends on Facebook. Except that, the level of environmental awareness is the only thing we know about the group based on the result of the first question of our survey.

50 answers were received at the time of compilation. The questionnaire included eleven questions, seven multiple-choice questions (some of filter type) and four of free text type. The answers from the multiple-choice questions are put together after each question in the Appendix B. Because of the low amount of answers and insufficient information on the composition of the group the result do not make up any good empirical ground and must be seen more as indicators.

[36] http://korta.nu/greenshoppinglistfilm

[37] http://korta.nu/greenshoppinglist_demonstration

4 Design process

4.1 Conceptual Design Model

Description

A smart shopping list application for the iPhone that gives environmental friendly shopping suggestions based on which products you add and later buy.

Persuasive purpose

We want to help people to buy more environmental friendly food and therefore reduce their environmental impact and in addition help them to find healthier products. We want to do this by triggering actions and creating/changing habits. By *"more environmental friendly food"* we refer to products causing low carbon footprint and secondly organic food opposed to conventional food. By healthier food we mean nutritious food containing low amounts of additives and residues of pesticides etc. Possibly we might also cover social justifiable choices (Fairtrade goods etc).

User description

Environmental conscious people interested in reducing their carbon footprint regarding food consumption and eat healthier. There is no fast, easy and interactive way to compare neither the environmental nor the personal effects of food products. The same applies for the carbon footprint of e.g. vegetables compared to meat. Therefore users may struggle in motivating themselves to buy environmental friendly food.

Features

- *Add products to the shopping list.*
- *Add additional products that are not stored in the list.*
- *Presentation of comparison of products.*
- *Tailored feedback based on user profile*
- *Tips of other choices for "red flagged" products*
- *Total result of certain shopping list, logged results*
- *Shopping list for usage in specific stores*
- *Share and mail function*

How do we trigger usage?

Share feature for social media (Facebook/Twitter etc) making it possible for the user to share part of the list or the environmental/personal effects gained by his/her choices.

How do we trigger changed behavior?

By giving immediate feedback in the input process based on products chosen by the user.

Storyboard

1. John performs an inventory of his fridge to see what he needs to buy.

2. He makes a shopping list in the Green Shopping list application.

3. From the application he gets recommendations on more environmental friendly products, which he chooses instead

4. He sends the list to his partner who stands for the shopping this week.

5. The partner performs the shopping.

Another possible scenario

Another scenario could be that the user actively checks the recommendation mode to find the best ranked product, of the ones provided in the store she happens to be in, and base her shopping on those.

Theoretical justifications

Our application is based on the Fogg Behavioral Model. It consists of three parts, motivation, ability and triggers to change people's behavior.

Shortcomings

Identified possible problems:

We see the collection and maintenance of data as our primary concern.

The shopping list needs to be effective and easy-to-use even if one does not use its recommendations. Simplicity in the interface must not be undermined.

Expansions

Possible future features:

- *The application can store more data like price, calories, vitamins and residues of pesticides etcetera*
- *Suggestions are made on those data*
- *People can add products and its data to a shared database like a Content Management System (CMS)*
- *The application can give more recommendations like environmental friendly recipes based on what you add to the shopping list. The users can rank these recipes and add their own.*

Inspirations

An initial inspiration has been carbon.to (created by our tutor Jorge Luis Zapico, Henrik Berggren and David Kjelkerud), which is a carbon converter that enables comparison of food, transport and electrical products (usage of) based on their carbon emissions. We were surprised by the carbon emission caused by food products and therefore chose to develop a mobile application that helps people to better sustainable food consumption. Two other interesting inspirations have been David Kjelkerud's applications fisk.cc and Gröna Recept. fisk.cc helps customers retrieve information on justifiable fish choices and Gröna Recept gives inspiration on sustainable recipes. They are evaluated in his thesis *"Lost in the Supermarket"*[38].

4.2 Initial guidelines

Soon we decided to expand the target group to also involve people that are not very climate conscious. We decided to do so after a small oral study where we spoke to our friends and family and asked them how environmental conscious they actually where. We discovered that most people cared about- and were aware of the climate- and the environmental effects of their food consumption but that they needed help to get

[38] www.sustainablecommunications.org/lost-in-the-supermarket

triggered to actually change their habits. Our goal throughout the design process has since then been to make an effective shopping list that is great to use either if you highly care about the environment, have a moderate interest in the area or do not care at all.

As shown in the theory section, there seem to be a gap between attitude and behavior in organic food consumption. One explanation is that the consumers want personal gain from buying the products. We therefore believe it is important to motivate a changed behavior also on a personal level. To help the user to find healthier food without hazardous additives and residues from pesticides or antibiotics is a good way of doing this we believe. By providing such information together with healthy choices in general the users can reduce the risks of future suffering from obesity, cardiovascular disease, diabetes and cancer.

By at firsthand create a solid shopping list application and in the second phase determine how to give the user sustainable recommendations, we strongly believed to cover our target group. Extremely important was for the application to be simple and not too demanding when it comes to previous knowledge about the environment. Neither did we want the application to be too pushy in triggering a better behavior, which can have negative effects on usage for those not so environmentally interested. At the same time more detailed information about the effects of choosing a certain product and being able to compare products more accurately was important for those users more interested.

The user should automatically get recommendations if she wants too. Important is for the recommendations to not worsen the user experience, but more work as a curiosity booster or as a simple way for the lazy user to retrieve fast recommendations. It is a wide spectrum to cover but if the user was not interested initially we hoped to still affect him/her in the direction of becoming so by creating curiosity through the recommendations mode.

4.3 Analysis of existing applications

There are many shopping list applications in the iPhone Appstore and the analysis of existing applications lead to many inspirational factors. We tested and analyzed about a dozen shopping list programs and in the end we strongly focused on three applications that we believed in:

- *Shopper, by MidCentury Software*
- *SplashShopper List Manager, by SplashData*
- *Shop (Handla in Swedish), by Rehserve IT*

Here we will shortly describe our findings from analyzing these three applications:

Shopper

In some programs you manually have to enter each product you want to buy. This is very ineffective and can be very tedious on the iPhone keyboard. In Shopper they solve this by having a list of all possible products and an index to the right from A-Z, for easy access to the first letter of the product you are looking for. This is good practice and recommended in iPhone Human Interface Guidelines (Apple Inc, 2010). Shopper has one drawback which is the view for searching by category. Each has its own view and there are many steps to go back and forth in order to change the category. An advantage is that all items can be found by the search function. It automatically filters down so one does not need to write the whole name and if the product is not found it can instantly be added instead. The drawback in Shopper is that the search function and product list is not in the same view and it takes time to switch between the views.

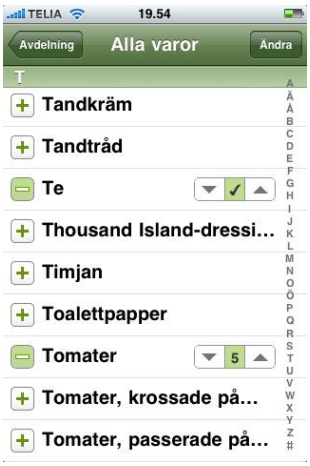


Figure 3 - Shopper

An interesting feature of Shopper is the ability to specify the amount, unit of amount and price of the product directly from the list. When you choose a product it is marked as chosen and 2 additional buttons (+ and -) appears where you can specify the amount. This seemed promising at first but when you add to the amount of the product it is easy to press the A-Z index to the right and come to a different letter in the list. It is advised to avoid elements near the right when an index is used (Apple Inc, 2010, p 103).

SplashShopper List Manager

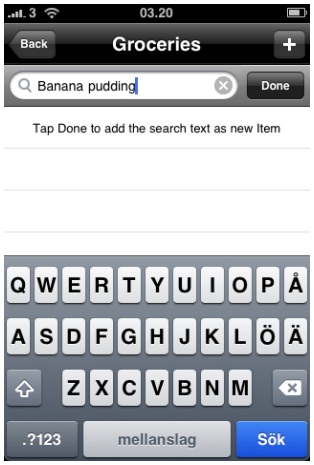


Figure 4 - SplashShopper

An interesting feature of SplashShopper is the total price of the items put into the cart and of the ones left to buy (filtering controls which price sum is shown) and user tailoring of the application in the form of many settings. The search function is available at all times. This is good if one can not find the items in the list. When searching for a product that is not listed a choice of adding the product to the database pops up instead. The drawback of the search function in SplashShopper is that one needs to clear the text manually after each item is found. The filtering of products is quite time demanding and unnecessarily complex. Being able to log certain products to a specific store is a smart feature.

Shop (Handla)

In Shop you have to add all the products to the database yourself. This makes it time consuming to use. After a couple of uses a small database of products is built up that is tailored for the user since it only contains products that the user is specifically interested in. Shop also has a Favorite mode where one chooses to mark items as favorites for easy access later. The problem here is that the items need to be marked as favorites by the user herself. It could be automatic by the application marking the most bought items as favorites and reducing the user's unnecessary usage of the application.

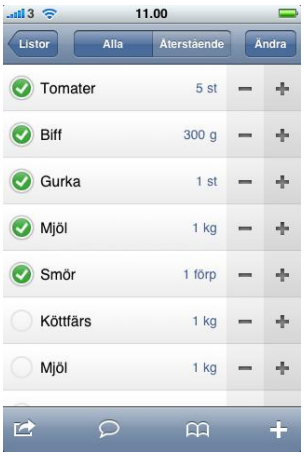


Figure 5 – Shop (Handla)

Summary of key features from the existing application analysis

Tab bar with key views

- *Sort by A-Z or by Category*
- *An index to the right for easy scrolling*
- *"Favorites" mode with products most bought*
- *Sorting of the order in which the products lie in the store*
- *A search option that automatically filters the products. If the item does not exist a choice of adding it is shown*
- *The ability to mail the list to a friend/partner*
- *A badge on the icon in the tab bar to know how many products left to buy*
- *The possibility to add and manage multiple lists*
- *Specify shops and link products to them*

4.4 Early interface

Based on the analysis of existing applications and initial findings we developed mock-ups using Photoshop. To explain the interface developed in the first iteration we will explain how the shopping list works through a scenario. A person wants to buy food and uses the Green Shopping List to do so. She opens the program and is met by the following view:

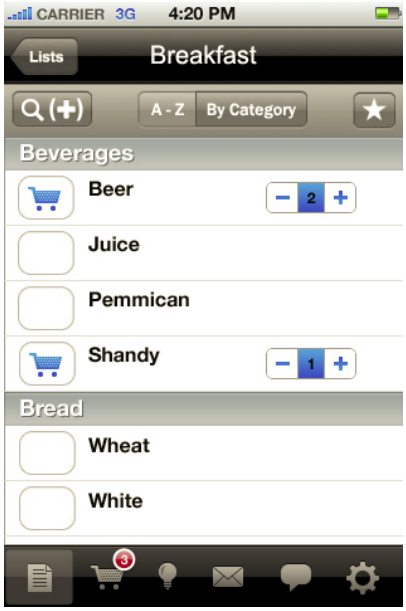


Figure 6 – Early Interface, Add mode

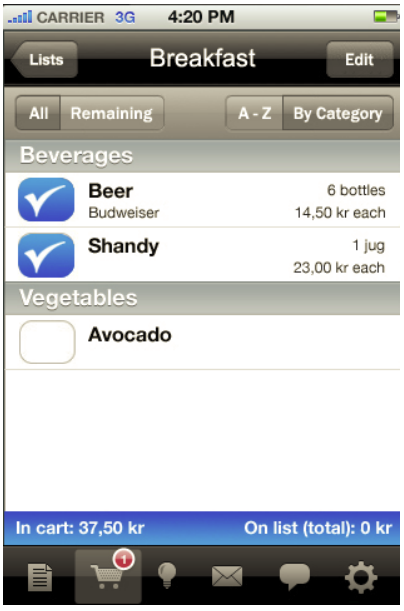


Figure 7 – Early Interface, Shop mode

To add a product she clicks once in the empty field to the left of the product. A shopping cart icon fills up the box. To deselect the product she clicks on the shopping cart icon and the box gets unfilled. A red badge gets placed over the Shopping mode icon in the tab bar as she adds the first product. It is filled with the digit *"1"*. As she adds more products to the list the number increases. The digit *"2"* for two products, *"3"* for three and so on... After choosing a total of ten items she is finished with creating her list and closes the program. A red badge with the *"10"* has just been placed over the Green Shopping List Icon. This indicates that she needs to go to the store and that the shopping list is ten items big. While being in store she opens the program and goes to the Shop mode. She unchecks the products in the same order she finds them by clicking in the empty box to the left of the product. Just like before the digit changes in the badge, but this time in decreasing order to indicate how many products that are left to buy.

4.5 Feedback from focus group

To get qualitative feedback on the work so far we assembled a focus group. Our idea was presented to the participants by designed mock-ups of the shopping list. Most important was to get ideas and feedback of how to present the recommendations. We first let the users freely draw how this could be done. Since they felt a bit stuck and overwhelmed by

this we instead showed them mock-ups of our own ideas, so far, of how this could be done. We then discussed the best way of presenting these ideas which gave much useful information.

A very interesting idea that came up from one of the participants was to have a feature that automatically chose the most sustainable products available from the product database, for each of the product groups chosen by the user. That way the user would save a lot of time. "I am too lazy to check which products that are good or bad and therefore want to get helped" he argued. The other participants thought this was a very good idea as well and on the question if they would trust the program to make the right choice for them they all said yes.

A possible usage scenario, because of this added feature, could be that the user first uses the best green choice feature to determine what to buy. She then goes to the store and tries to find these products in order to be as sustainable as possible.

From the result of the user interviews we found great ideas of ways to present different amounts of information based on the level of the users' interest in environmental issues. The less interested user seem to only have a need to be presented with rankings of the products while the more interested probably wants to know why the rankings are in a certain order. To see comparison between products (i.e. a diagram based on carbon footprint e.g.) was interesting to the users though.

4.6 Feedback from questionnaire

To get an idea of the environmental interest and awareness among our participants we asked them: *"Just how environmental friendly do you think you are?"* Four choices were given to pick from. Based on the answers we have determined three profiles among the participants. The first profile can be considered as highly environmental conscious and received 12%. The second profile we consider as moderately conscious and this profile received 86%. The third profile consists of the participants who do not care about the environment at all and it received 2%. To take into consideration is that people have a tendency to exaggerate their own behavior in questions like these, why the numbers probably are a bit to high for especially the first and possibly also the second profile.

The aim of our questionnaire was to see how the idea and concept of the application was received, if the participants would like to use the application and if they thought it could help them to environmental friendly food consumption. We also wanted to see which features the users found important, what they thought about the recommendations in the application and if they could consider sharing their usage on Facebook/Twitter. We where very pleased to see that 98% cared about the environment and 74% could consider

to use the application. 80% thought that the application could help them to become more environmentally friendly, in terms of food choices, we think this indicates that the demand for an application like this is fairly high. The most common reason that was given among the people who would not consider to use the application was that they did not have an iPhone or that they did not use a shopping list while shopping (they simply picked and chose depending on what was available in the store). Many of them saw it as too time consuming and troublesome to add the products to a list, physical or digital. However some of them could consider using it while being in the store in order to look up some product's recommendations. One user gave a very interesting definition of a problem. *"From experience I know that some stores use poor displays, it would then be frustrating to make a list that cannot be followed while being in the store."*

Among the features we asked the participants to rank the four pure environmental related features selected were all shown to be of great importance. The most important feature was the Favorites feature, i.e. the ability to quickly select products you normally buy. The two least important features were the ability to share the list to a friend or partner by email and to share the applications suggestions on Facebook/Twitter. We see the possibility to email the list as an extra feature and probably not used among most people but the Facebook/Twitter feature we see as very important. Off course it is not important for the users own benefit but it is important as a way of marketing the application and increases its usage. In the next question 40% answered that they were willing to share information about their usage on social media like Facebook, which we see as a pretty high number. Among the no-sayers consensus was almost reached in their opinion that it is their own business of what they buy and do in their lives and it is therefore unnecessary to share this type of information on Facebook.

5 Result

The result of the design process is an interface for Green Shopping List which is a shopping list application for the iPhone focusing on sustainable food consumption.

5.1 Retrieving prototype data

We have chosen to focus our data retrieval for fresh food products to studies and research that deals with food from a Swedish perspective. The reason for this is that the data used in our prototype strictly will deal with products available in Sweden. The product data shown in the interface will deal with tomatoes. We believe that tomatoes would illustrate a good example of a typical product (group) that many users normally buy.

Carbon footprint data on Tomatoes was retrieved from the study *"Energin & koldioxiden i svensk växthusodling"* (2008). Data which showed greenhouse gases emissions caused by Swedish, Danish, Dutch, Italian and Spanish tomatoes was retrieved from the report. However this data is to be looked upon with indulgence since the numbers used in the calculations all were retrieved from different years[39].

Concluded from the study was however that consumers primarily should choose Swedish, open-grown tomatoes, for lowest climate impact possible. However the open-grown tomatoes are not available all year around. If not available, the second best choice would be to choose tomatoes grown in Swedish greenhouses using renewable energy (In March, April and October). During September to May the second best choice would be open-grown tomatoes from Spain or Italy. The rest of the year the study recommended replacing the tomatoes with carrots so the consumer still got her vitamins. Important was to stay away from Dutch and Danish greenhouse tomatoes.

Health data (residues from pesticides) on tomatoes was retrieved from the iPhone application *"What's on my food"* from the Pesticide Action Network[40]. The data in the *"What's on my food"* application is in turn obtained by the USDA Pesticide Data Program.

[39] The data for heating and use of artificial fertilizers were dated to 1992/1993 for the Spanish and Italian tomatoes e.g. compared the average Swedish tomatoes where calculations were based on numbers retrieved 2008

[40] http://www.whatsonmyfood.org/food.jsp?food=TO

5.2 Interface and functionality

Compared to the first iteration a number of features have been added. Our main focus in the second iteration was to add information of the environmental and personal effects related to the products and provide the user with a ranking of the products based on this information. The interface of the application has two main views. One to manage all the users' lists and the stores the user buys her food in. Managing a list works like before with a few improvements. Tomatoes are used to illustrate the concept. To avoid misunderstandings Tomatoes is seen as product group and the terms products/items are more specific and refer to e.g. Swedish open grown tomatoes or Dutch greenhouse grown tomatoes.

Lists and Stores mode

The Welcoming view of Green Shopping List looks like the figure to the left:

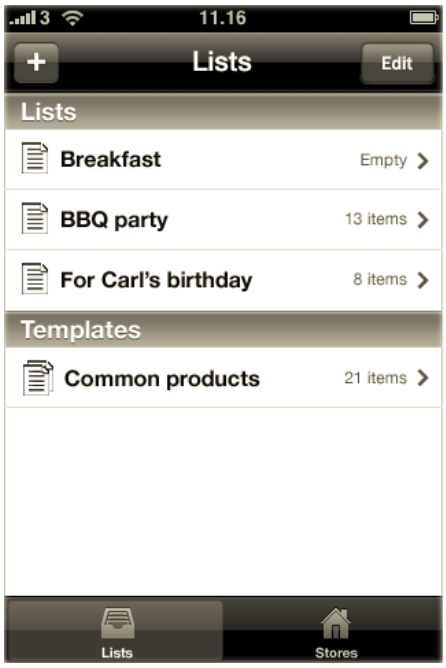


Figure 8 – Lists mode

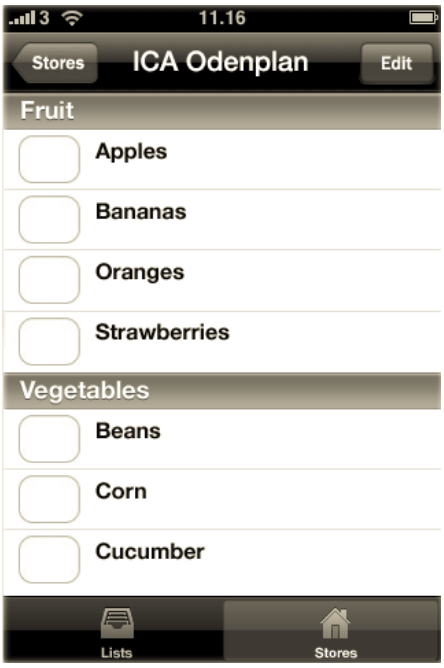


Figure 9 – Shops mode

It has a tab bar view two modes: *Lists* and *Stores*. The purpose with Lists is to create a new list and manage already existing ones. A new list can either be created from scratch or be based on a template. The template feature helps the user to quickly create new lists based on the products they often buy. The *Stores* mode is used to manage the stores one shops at. In this view the user can customize the aisles (categories such as Fruit and Vegetables, Dairy Products etc) in the right order they show up when entering the store. Products linked to the store can also be managed in this view. (Ability, Time)

When you have created and chosen a list you arrive at the second view which is called the *Chosen List* mode.

The tab bar at the bottom has five main modes: *Add Items*, *Shop*, *Recommendations*, *Export* and *Share*. *Add Items* is for adding the items you plan to buy. In *Shop* you see all the items you plan to buy. In *Recomm.* feedback is received based on what you have chosen. In *Export* you can mail the list to or synchronize the shopping list with a friend or partner and *Share* is for publishing on Facebook/Twitter.

Add Items mode

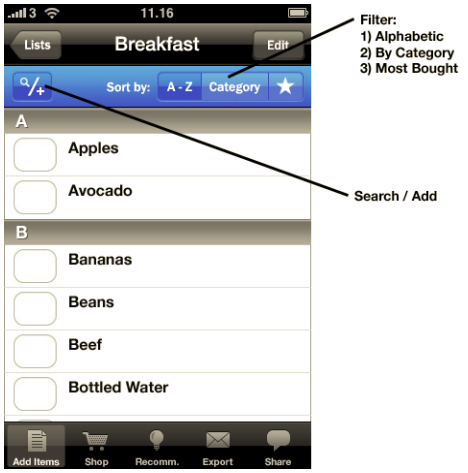


Figure 10 – Add Items start view

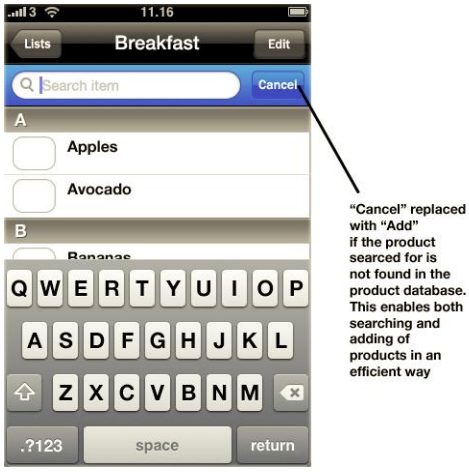


Figure 11 – Search/Add

The Add Items view, from the top down, consists of a status bar, a navigation bar, a filter bar and a content section. The *Lists* button, on the top left, takes you back to the *Lists view* and the *Edit* button, on the top right, is used to manage, delete and add new products to the list. It can also be used to link a certain product catalog to a specific store (after an inventory is performed of the store). That way a user will know which products a certain store holds the next time she shops there. The position of the *Lists* and *Edit* buttons is standard according to the iPhone Human Interface Guidelines (iHIG) (Apple Inc, 2010).

Much work has been done in order to improve the effectiveness (Time), compared to the other shopping list applications tested. As few clicks as possible reduces the process of finding and adding items (Ability). The user can sort the items alphabetically or by category. The Star button (of the filter) is used to show the products most bought. The search/add button to the left in the filter bar is used to search for items. When pressed, the standard keyboard pops up, and filters the products as you type. This is very effective since only the first few letters of each item has to be typed to find it. If the item does not exist the *Cancel* button changes to a *Create* button and you can instantly add the new product to the database.

Figure 12 – Adding items

To add an item the user intends to buy she simply clicks in the empty box to the left and it gets filled with a blue icon and a shopping cart icon inside. This is later referred to as *"adding of an unspecified item"*. If the same area is clicked again, the blue button becomes green and the application automatically chooses the most environmental friendly available in the database (specified item). The reason for this is to quickly retrieve the highest ranked product within that product group. The product is specified under its name (*"Swedish, Outdoor grown"* under Tomatoes in the example below). We call this function the *"Automatic generation feature"*. Click a third time and the product will get deselected.

If an unspecified product is chosen, a red badge will appear over the *Recomm.* bar icon. The reason for this is to trigger the user to retrieve the recommendations for that product group. The importance of *triggers* is to show them at the right moment and here it is given the instant the item is added. The user can now choose to see the recommendations by pressing on the name of the product group in order to see its recommendations and specify a product within that group. The user can also press the *Recomm.* button in order to see the recommendations for all items added to this point. The red badge has a number inside (just as when adding products to the list) in order for the user to see how many recommendations that are given by the application at a certain point. The number increases in the same order the user adds products from the red flagged product groups and decreases as she specify better choices than the initial ones.

Shop mode

The Shop mode is used while being in the store in order to check the products found and easily see which are left to buy. The red badge on the *Shop* mode icon indicates how many products the user previously has added to the shopping list. The blue filter bar contains a filter for sorting of the content alphabetically or by category. The custom button sorts the items in the order they can be found in the store for easy shopping. This feature was wished for by participants in our questionnaire. You can easily change the order of the aisles for a certain store from the edit button or from the *Stores* mode previously described. When checking an item a blue icon with a check mark fills out the empty box. One more click and the box is unchecked. Each product category can also be minimized and expanded to create more space for faster scrolling in the content section. When all the items of a certain category are checked the header of that category turns green in order to see which categories that are done and which that are left. The *Check out* button in the filter tab is used when the user is done shopping. The user is then provided with three choices:

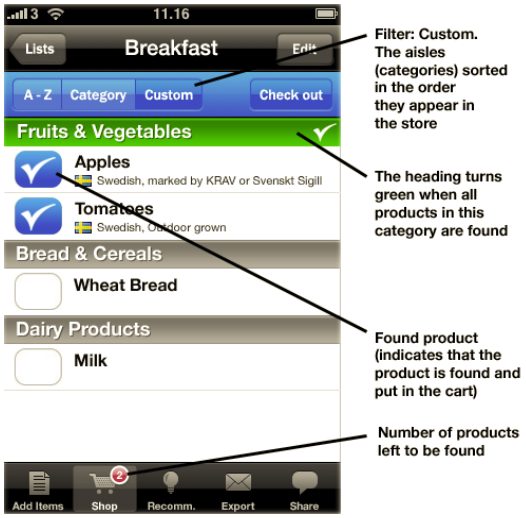


Figure 13 – Shop mode

- *Save list as template*
- *Delete list*
- *Publish recommendations (explained below)*

In all of the above choices the products that just got bought are logged in the *Favorites* list (Most bought items) in the *Chosen List* mode. The more often a certain product is bought, the higher rank it gets in the Favorites view.

Recommendations mode

Figure 14 – Ranking of items

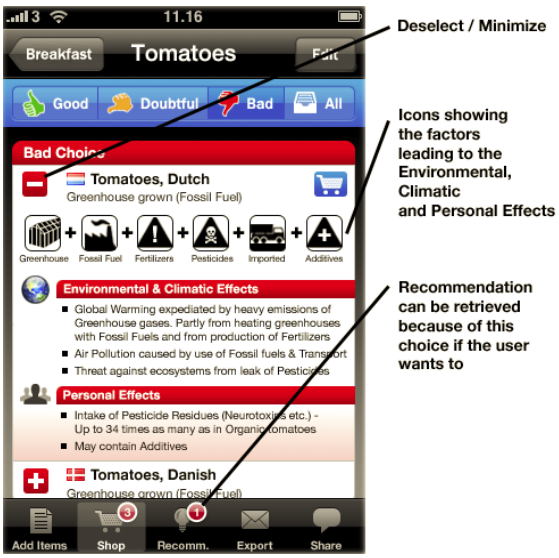


Figure 15 – Information on item

The recommendation mode is used to get feedback based on what you have chosen to add and to specify the products. By pressing on the *Recomm.* icon one receives recommendations for all the items intended to buy and *only*, on what she intends to buy (tailoring). One can also come to the recommendations for a particular product just by pressing on its name from either the *Add Items*- or the *Shop* mode. The reason for this is to quickly specify and get recommendations for that product or to change to a different one if the store does not have the one you are looking for. The recommendations are first presented by a ranking of the products as in the left figure above. Specific information can also be retrieved for a certain product by clicking on the *plus* sign, as done in the figure to the right.

When the plus icon is pressed the item is added to the list and a blue icon of a shopping cart appears to the right. The plus sign is changed to a minus sign in order to know that it can be taken away just by pressing again. The view of the item is also expanded with information on that particular product. The reason for this is that it should not be justifiable to choose an item ranked as bad or doubtful without receiving information about the effects of doing so. At the same time it simplifies the usage to only have one button for both adding an item and simultaneously expanding it to receive more information about it. If the user only wants to receive item details without adding it to the shopping list she simply clicks on the minus button. If an alternative does not exist it can be added by pressing the *Edit* button. If a good product is added the user is presented with praise from the application. The reason for this is to *condition* the user's behavior to choose the good products.

The ranking system and the related color codes in shape of traffic light colors is influenced by David's prototype fisk.cc which in turn is influenced by WWF. *"Good"* products are marked with green, *"Doubtful"* products with orange and *"Bad"* products with red as a simple metaphor to help the user. By scrolling down one finds further information on the product group.

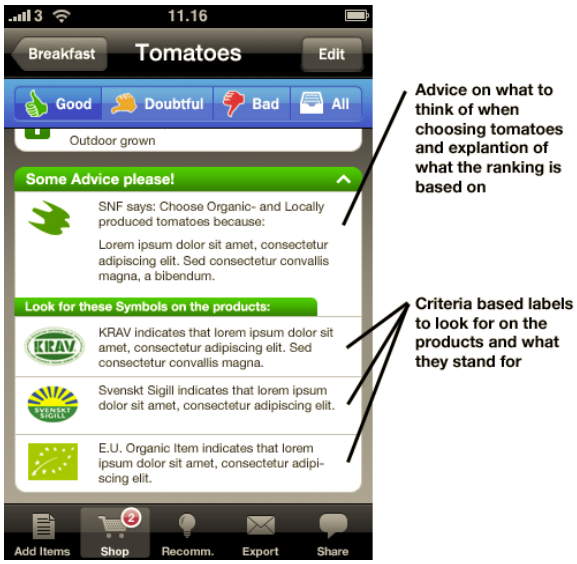


Figure 16 – Advice and labels

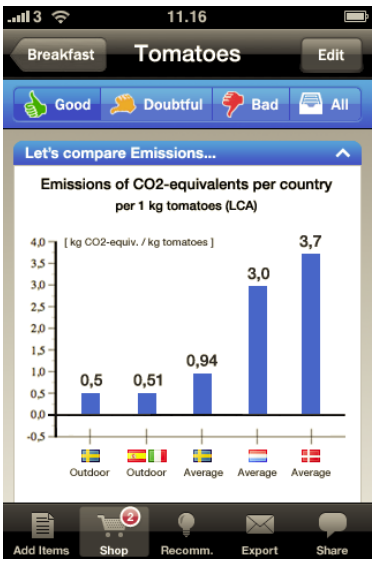


Figure 17 – Comparison of CO_2

Comparison on carbon footprint can be made and tips of what types of labels one should look for can be presented here. The information of the products is intended to help the user in her shopping and to trigger her motivation.

There is an important reason why you can come to the recommendation for a product, both from the *Add Items*- and the *Shop* mode. If the store does not have the alternative one likes to buy it should be quick and easy to see the application's other recommendations. This is also the reason why we choose to first present the alternatives on the top and under it the information.

Export mode

The Export mode is used to export/send the list to a friend or partner by the means of email, SMS, MMS etc. If the friend or partner has an iPhone /iPod and Green Shopping List the list can be synced between them. A good feature of the red badge on the application icon is that your friend or partner will see if you have added products that need to be bought.

Share mode

The Share mode is used to publish about the application on ones Facebook and/or Twitter page. One can recommend the application, publish the whole shopping list or publish a *"quote"* based on the users' smart decisions. An example of what can be published is:
"*John just got helped to act more environmentally friendly through the use of Green Shopping List. Test the app yourself by clicking here"*

There are two reasons for this feature. One is to provide it for the people who like to publish things on their Facebook/Twitter page. The second reason is as a way to enhance the usage of Green Shopping List by promoting it with viral marketing. We are more likely to be persuaded to find out more about a product if a friend recommends it compared to reading or watching traditional types of advertisement (Cialdini 2007).

From our questionnaire we noticed that most people (60%) would not like to publish about their usage on Facebook/Twitter and the reason that was most given was that their usage was their own business. That is why one of the things that one can publish is only to recommend the application and nothing about the user's usage. A text is also shown in order to persuade and trigger the user to publish. An example could be: *"Help you friends to become more environmental friendly by recommending Green Shopping List on your Facebook page"*. It is also very easy to do (ability) since the only thing that needs to be done is to provide one's user id and password. This only has to be set ones and the application will take care of the rest.

6 Discussion

In our discussion we will give suggestion on future development and highlight the major problems.

6.1 Theoretical justification

With support from both the theory section and the result of our focus group and the questionnaire, we believe we have good support for the design-related choices we have made so far. From our focus group we received feedback saying that it was important that the amount of information concerning climate and environmental impact was limited, unless the user specifically wanted to see it. All participants in the focus group can be considered to belong to profile 2 defined in the questionnaire portion, which also is the largest group. They were satisfied to just see the ranking of products within a product category and also *"trusted"* the program to choose the best sustainable product for them when using the automatic generation feature. They were simply interested in the qualitative data (ranking). The conclusion that most users are interested in qualitative data rather than quantitative is supported by David Kjelkerud (2009). He found this when he evaluated his prototype, *"Gröna Recept"*. Ranking based on personal effects seem to be slightly more important than environmental based rankings, implied by the result of the questionnaire.

In order to build credibility, we believe that it is also important to present qualitative data, however. For the more interested the user, it is important to find out why a product is considered to be good or bad. This is supported by the result of our questionnaire where 78% thought this was important or very important. We have to a large part based the ranking of the tomatoes on the carbon footprint data which is data of qualitative type. The importance of credibility within a carbon footprint based labeling system is considered extremely important among consumers as demonstrated by Toivonen (2007).

We have also created added value by providing both the climatic, environmental and personal effects surrounding a product. What type of qualitative information that can be presented depends entirely on what data one manage to access. There are currently no standard methods for either retrieval or presentation of a product's total impact why the credibility of what we present is questionable. One source has been used for the qualitative data and another for the qualitative.

The approach we have chosen creates tailoring. Depending on the user's own curiosity and desire to know more, she is guided through the system. If the user has a very low environmental interest and just wants to use the program as a regular shopping list

application, she does so. If she wants to make sustainable choices quickly she uses the automatic generation feature. If she wants to compare products she just goes one step further and checks how the products are ranked. If she also wants too find out why a product is rated as good, doubtful or bad yet another step in the system is taken. This way we believe to have tailored a solution which fit most users.

The main challenge is to *"convert"* those who still do not care about the environment. For this there are two solutions which currently are used in our interface. One is to create a shopping list that can be used regardless of initial interest in the environment, and by enticing them to try to change this attitude. By using the badges that are shown for less smart choices, we hope to create curiosity. The user can then enter the recommendation mode and receive information tailored just for her profile based on past usage patterns. A second solution might be to also provide the user with information about the personal effects of choosing a particular product.

Ability is increased by giving guidance towards smart sustainable choices. The user receives tips on which labels she should look for. In addition, short tips are given on what to keep in mind within a given product group and short explanations on what lie as basis for the rankings. According to a similar idea from the Environmental Protection Agency (2010) and influenced by the presentation form of the previously described *"Carbon Footprint Toolkit"*, we show the factors in the production chain leading to the result of the climatic, environmental and personal effects of choosing a certain product.

6.2 Future development

Added features

One of our goals with the Shopping List was to cover a broad target group, not solely people environmentally conscious. We believe this is important for our idea to not be deprecated among all the other shopping list applications on the market. We want to get it as wide-spread as possible to persuade more people to sustainable food consumption. To succeed we need to make future development on the interface and to add more features. More development can be done on the persuasive part of the application. One way of doing this is to further investigate how the recommendations should be presented to best persuade the users. Another way of doing this is to investigate how to tailor the application for different user profiles.

Two features we initially decided to include were the ability to specify the price and amount (5 apples, 200 gram of beef etc) of products but later decided not to, since the process of doing so is very ineffective. It also takes the focus away from the sustainability due to simple design issues. There might not be enough space to include both environmental information and price and amount in the interface. Simplicity has been a

key guideline in our design and to manually add the price and amount might have a negative effect and making the user less productive. One way that the price problem could be solved is if the data is accurately tailored for context. The application gets the price automatically from the store one happens to be in. The benefit of the amount feature is that the application better can monitor the user's food consumption overtime and give recommendations and statistic based on that (self-monitoring). The statistics is logged into a database and can later be presented in a number of ways. For example diagrams of the users shopping behavior, how many times a certain product has been bought or changes over time in the consumption pattern. After the application has been used for a while more user specific information can be given. This is good since we can give praise and warnings based on the user's pattern. For instance, *"Great Job! You have decreased your meat consumption and by doing so lowered your carbon footprint and cholesterol level"*.

From our questionnaire we found out about other features people where interested in. One of them was recipes and the possibility to automatically add products that is needed in the recipes to the shopping list. By doing so we would incorporate David Kjelkerud's application by giving Green Recipes. This could be a good way to persuade people who like to cook and they would get more help from the shopping lists recommendations while being at the store.

Trigger Motivation

A discussion arose if the application could motivate people who were not already environmental conscious. One way we do it is by giving additional information on healthy food together with environmental recommendations. As explained in the theory section, people are more interested in personal gain (good and healthy food) rather then environmental food (Konsumentverket, 2006). This is one of the motivation factors (pleasure) and we use this in the recommendations mode. Another way would be to motivate people by the Hope/Fear motivation factor. That would be possible if we could provide information on the effects that climate change and global warming has in order to encourage the users to take actions. An easy way this could be done is to have a link to a text with information, like a brochure. The problem here is that we do not trigger the motivation. A more subtle way we came up with is to give small sentences of facts while the application or a new screen is loading. For instance, when an application is loading it takes a short while to initialize all the variables and during this time a very short text can appear just long enough so the user has time to read it. This text is different each time and one example could be, *"If the earth average temperature raises by 2 degrees it would have devastating consequences"*.

Tailoring for different user profiles

There are many types of users, some might be very environmental conscious and some might not care at all. In the above section we discussed how the application could motivate the people who do not care. These motivation triggers can be unnecessary for people who are already motivated and we find a need to tailor the application based on a user profile. Let suppose we categorized the profiles in to three groups. Profile 1 already makes environmental choices, profile 2 has moderate environmental interest and profile 3 does not care at all. To find out which profile a user belongs to it could be manually filled in to the application-settings and/or automatically analyzed by the application based on the user's usage. For instance if the user pattern is to chose good products (little or no meat etc) she might belong to profile 1. If she initially add any products and later follow its recommendations she might belong to profile 2 and if she does not follow the recommendations at all she might belong to profile 3. Recommendations and triggers are based on which profile is determined. To profile 3, triggers are given to strengthen motivation and the presentation of the recommendation is more based on personal gain. For profile 2 focus is on showing the bad products which studies has shown has better effect for those with moderate environmental interest (Grankvist, 2002). Profile 1 can be given praise and triggers to share on Facebook/Twitter. Other variables can occur based on profile like how often recommendation and praise is given, which type of quotes is suggested for sharing, how to present the recommendations (language) and so on. Two things to bear in mind is the ethical aspect of persuasion profiling and that it can backfire if the profile is not accurate (Kaptein & Eckles, 2010). Further studies are needed to best determine how to implement this and get to know its effect.

6.3 Retrieval, aggregation and presentation of data

The major problem we have faced is retrieval and aggregation of the data to be used in our intended application. As previously stated, there are currently no standardized way to neither obtain nor present data that describes a product's overall impact on the climate, the environment or the health and social effects it causes.

Retrieval of data for food products and their climatic, environmental, health and social impact is a very complex matter, especially LCA data, as shown by (Naturvårdsverket, 2010). Since the data are based on the season and the user's position within the country, the amount of data will be tremendous. Aggregation of both qualitative and quantitative data is an extremely time consuming matter. To put it into context the GoodGuide's office, in Berkeley, has 12 full-time and 12 part-time employees, half scientists and half engineers. They use nearly 200 sources for data aggregation including government

databases, studies by nonprofits and academics, and the research by scientists on the GoodGuide staff. They constantly try to fill the gaps in the data that GoodGuide provides.

Data based on LCA and PCRs work as a very good basis for comparison, both between products and product groups, since all steps in the production chain are included. But to be able to compare products with each other it is required that a large majority of the goods are labeled. LCA is still a new phenomenon and has also proven to be a very expensive and clearly more complex approach than many first thought[41].

For environmental data criteria labeling is used. However, it prevents the comparison of products from two different labeling systems. This system also prevents the comparison of different product categories since different frameworks lie underneath the labels within the given product categories. Criteria labeling is, in today's food business, the most elaborated system and is to the largest part associated with the labeling of organic foods. Not to forget, however, is that organic consumption only represents a tiny market share. This implies the difficulties when it comes to comparison. Organic products can be looked upon as *"better"* than the other products but exactly what is the difference between them? Different criteria are used for different product groups in the labeling process which demands a high amount of knowledge from the consumer.

Criteria-labeling today exclusively has a positive approach and funding is therefore on the producing companies. This makes the consumers' power to choose the overall green products limited. A customer must be extremely well informed to be able to determine what each brand stands for and if she wants to take several aspects into consideration, this leads immediately to a substantial puzzle solving to finally find what she is looking for. To transfer the power to consumers probably requires laws which say that all foods must be labeled. If and how this would be implicated and how the funding would look like, only time can tell.

Food production is highly global and there are major differences between countries. It is not fair to compare a tomato grown in Africa with a tomato grown in Sweden, where production methods in developed countries are much more sophisticated and thus can limit the environmental impact at a higher degree. Food production is also surrounded by heavy politics which makes the situation even more complex. Some countries' economies are strongly influenced by the country's exports of food so the labeling of food is therefore a very sensitive issue in many cases.

[41] Tesco promised in 2007 to put labels showing the carbon footprint on all of their products but this commitment was proved very difficult and expensive. Also ICA jumped on the train but also experienced major obstacles soon. Today the debate seems to have subsided. Retrieved from www.miljorapporten.se/585.html

Today it is almost impossible, to find fully updated and normalized data. Reliable comparison demands standardized methods of both retrieval and presentation of data. Let us play with the idea that a fully functional overall labeling system was in use. The utopia makes data on all of the four factors of environment, climate, health and social aspects available. An operational carbon footprint labeling is in full use. Moreover, it is completed with a criteria labeling and complete information about a product's content and nutritional content as well as marked with social labels. How would this information be presented in the best way for the consumer?

An interesting solution would, according to the study from Naturvårdsverket (2010) be, to use a combination of criteria based labeling and carbon footprint labeling (a CO_2 digit). The digit could also be marked on a scale, showing the emissions relative to other food products. Furthermore the same scale ought to be used by different actors and for different product groups. That way, an overall labeling is achieved that enables comparison between both products and product groups. The study concludes that the communication of environmental information needs to be based on the consumers' need rather than from the food producers' and distributing actors' perspective as today. More concrete today's *"label jungle"* needs to be narrowed down to enable for the consumers to get a better overview and ease the guidance into sustainable choices (Naturvårdsverket, 2010).

Another approach might be to show the carbon footprint caused in each part of a product's life cycle, which recently was investigated by the Swedish Environmental Management Council, in cooperation with the Italian company Lifecycle Engineering. The goal of this project, assigned by EU, was to develop an assessment and presentation tool for a product's total greenhouse gas emissions and thus climate impact from a life cycle perspective. With the use of standardized impact factors and carbon footprint caused by each factor comparison between products from different product categories is made possible. This *"Carbon Footprint Measurement Toolkit"* was initially to be used in addition to the EU flower (Naturvårdsverket, 2010).

One solution of data maintenance from where we stand today would be to create a wiki for the product catalog of the application. That way, users are given the possibility to update environmental data linked to both new and existing products. This could be done both from the application itself and from a website. The mobile application could retrieve the latest changes of the data in the product catalog from the website and that way be kept updated. To use the API of GoodGuide for data retrieval would be another idea and highly beneficial if it was not for the fact that they only deal with American products. Highly questionable is how truthful the data put in by the users would be. The food producers would probably stand pretty quite critical towards such a solution. A need for

third party enforcement would be obvious and the idea is already proven naive but at least worth to mention we believe. A similar initiative to GoodGuide made in Sweden would be appropriate.

7 Conclusions

Supported by our results from the prototype section and the discussion above we will now try to explain what we have learned in the process of trying to fulfill our aim.

The purpose of our application interface is to help people change their food habits to become more sustainable. People's food consumption is the environmental aspect in focus with certain villains highlighted.

We hope to engage the users by providing an interface to a user-friendly shopping list application. We furthermore hope to trigger the users to change their behavior in a number of ways. In the first step this is done by providing them with rankings of items within a product category. Partly by provide the users with rankings of good, doubtful and bad items from an environmental and climatic perspective and partly from providing information on personal health effects, related to the products. In the second step additional information such as comparisons of carbon footprint or the difference between organic and conventional products are provided for the more interested. For the highly interested data for specific items can also be explored. Parallel to this we present tips of what to think of in the process of choosing the sustainable products provided in the stores, all to help the user.

We also try to trigger a changed behavior by connecting the application to social media to spread the curiosity through viral marketing by the use of social cues. This is a pretty sensitive issue for many users, we discovered in the analysis of the prototype, and is a subject that deserves more attention. There are no simple ways to come up with solutions around this problem but we know for a fact that people affect each other (social proof etc) and we therefore see this as an important aspect. The infrastructure of social media and Internet creates a fantastic channel for spreading a vision. The form of presenting the concept is important. To present our product without making it look like advertisement we need to further explore and get to understand the social media from the user's perspective.

The gathering of data is by far the biggest problem to solve if a future implementation is to be performed. We did not think of this as too much of a limitation in the process of designing the interface though. We simply gathered what we could find and tried to make the best out it. What felt more important than providing the user with exact and quantitative data, was to determine how the data was to be presented. With the use of diagrams, color codes and icons in the interface and by increasing the efficiency compared to other similar application (by letting the user use fewer clicks) we hope to have created an understandable and easy to use interface that also creates curiosity.

The reason for starting off the project by putting a lot of energy into defining and developing an interface for a great shopping list application which we then applied environmental and personal health information to, was that we felt a need to provide a service that suited as many as possible, no matter of the user's level of environmental interest. We initially struggled a bit with defining the context of where the environmental part was to be put. To get the users involved and engaged we have learned that one needs to provide additional value (personal gain in our case) and sometimes almost fool users into becoming more sustainable. How to retrieve and present data based on personal gain deserves future research. GoodGuide can here be used as a good influence. The way GoodGuide ranks each product on a scale one to ten based on three major factors: environment, personal effects and social aspects, is interesting. This is a way of making data easier to interpret and possibly also making it more appealing.

Something that also needs further investigation is how to tailor the interface of an application like ours to fit different user profiles. We believe our recommendation mode is a good gateway. How could the recommendation mode be used more efficiently? Which sort of recommendations should be given? When and how often should they be given? For whom should they be given? What should be presented to the user? To be able to tailor we also need to define the user profiles accurately. How is this best done? Logging the usage patterns would be appropriate but this demands complete access to the users' food consumption. Other behavior could also be interesting to log, such as transportation usage etc to get a better overall picture.

Today we stand in a bit of a dead end however since the user manually has to enter the products that she buys. She might not use the shopping list every time shopping which makes the logged data unrealistic. Food consumed by the user needs to correlate exactly to the logged data for a maximized result. RFID tags is an interesting approach as a possible future solution. The utopia would be that the user's whole consumption is logged. We would then be able to present the user with statistics on changes in her patterns. Let us say that the user reduces her consumption of meet over a certain period of time. She could then be praised for this behavior.

Mobile technology will help us consumers to receive proper information at the right time, in our case the time of consumption. Environmental issues are very complex matters and we strongly believe in the need of simplifying these issues so that everybody gets a better understanding. There are clear evidence of gaps between attitude and behavior when people are making their food choices. To discuss the problem and gain knowledge, is something different opposed to actually change the behavior through active choices. First when awareness is at such a high level that it is not anymore social acceptable to make

non-justifiable environmental choices the big mass will get triggered to actually change their habits. Unfortunately not enough pressure is yet put on the food production companies, importers and grocery firms. Our interface to the intended application could be a small step of getting there in the end. It might be an almost microscopical step, but it all has to start somewhere. We hope that our research, in this thesis, will lead to a better understanding for the problems, limitations and possible solutions surrounding the design of a green shopping list. Hopefully the research can be used as a basis for a future development of a prototype with a sustainable purpose. Maybe it might also work as an information source of a more general kind. If we get a reader or a future user to stay off the very worst villains and instead buy the next worse one, at least we have had a bit of success!

8 References

Bartholdson, Ö, Brandão Jönsson, H and Brydolf, J. 2010. Mer kött och soja – Mindre regnskog. Ansvarig utgivare: Viveka Risberg, Swedwatch I samarbete med Latinamerikagruppen och Miljöfördbundet Jordens vänner. Retrieved 15 May, 2010 from http://www.swedwatch.org/sites/www.swedwatch.org/files/Kottsojarapport.pdf

Baumann, H and Tillman, A. 2004.The Hitch Hiker's Guide to LCA. Studentlitteratur AB

Bergman, L. Published April 11, 2008. Fördubbling av importerad mat. Retrieved May 15 2010 from http://www.fokus.se/2008/04/fordubbling-av-importerad-mat/

Björklund, J, Holmgren, P and Johansson, S. 2008. Mat och klimat. Värnamo: Medströms Bokförlag. ISBN: 978-91-7329-018-0

Castel, V, Gerber, P, Haan, de, C, Rosales, M, Steinfeld, H and Wassenaar, T. 2006. Livestock´s long shadow. FAO report.

Cialdini, R. 2007. Influence - The Psychology of Persuasion. New Yourk: HarperCollins Publishers

Dahlin, I and Källebring, N. 2009. Vardag och miljö (Everyday life and the environment). Swedish Consumer Agency and Synovate. Retrieved May 15, 2010 from http://www.konsumentverket.se/Global/Konsumentverket.se/Pressmeddelanden/2009/Dokument/vardagen_och_miljon.pdf

DiSalvo, C. Sengers, P. Brynjarsdóttir, H. 2010. Mapping the Landscape of Sustainable HCI, [Online]
Avaiable at: www.cs.cornell.edu/~hb47/landscape_of_hci.pdf
[Accessed 27 May 2010]

European Commission official website, 2010. Retrieved May 15, 2010 from http://ec.europa.eu/environment/climat/campaign/what/climatechange_sv.htm

Fairtrade. n.d. Schyssta bananer – Fairtrade och bananindustri. Retrieved May 15, 2010 from http://www.fairtrade.se/obj/docpart/8/888b70dff02dca06418fae527c68759b.pdf

Fogg, B.J. 2003. Persuasive Technology - Using Computers to Change What We Think and Do. San Francisco: Morgan Kaufmann Publishers

Fogg, B.J, 2009. A Behavior Model for Persuasive Design, [Online]
Avaiable at: http://bjfogg.com/fbm_files/page4_1.pdf
[Accessed 27 May 2010].

Fogg, B.J. 2003. Conceptual Designs - The Fastest Way to Capture and Share your idea. In B. Laurel, ed. Design Research Methods and Perspective. Massachusetts Institute of Technologypp, 2003, pp. 201-211

Grankvist, G. 2002. *Determinants of choice of Eco-labeled Products*. Dissertation, The psychological institution, Göteborgs universitet, pp. 38-48. Retrieved May 15, 2010. http://gupea.ub.gu.se/bitstream/2077/15694/3/gupea_2077_15694_3.pdf

Hartmann, P and Apaolaza Ibanez, V. Green value added.
Marketing intelligence & planning, Vol 24 No. 7, 2006, s. 673-680. Retrieved on May 15, 2010 from
http://www.emeraldinsight.com/Insight/ViewContentServlet?Filename=/published/emeraldfulltextarticle/pdf/0200240701.pdf

Johannessen, A, Tufte, P. 2003. Introduktion till samhällsvetenskaplig metod. Liber

Kaptein, M. Eckles, D. 2010. Selecting Effective Means to Any End: Futures and Ethics of Persuasion Profiling, [Online]
Avaiable at: http://www.persuasion-profiling.com/downloads/
[Accessed 3 June 2010]

Konsumentverket, 2006. Ekologiska livsmedel – ett strategiundersökning för livsmedelbranschen. Konsumentverket, rapport 2006:13

Kumm, K and Larsson, M. 2007. Import av kött - export av miljöpåverkan.
Naturvårdsverket, rapport 5671. Retrieved May 15 from
www.naturvardsverket.se/Documents/publikationer/620-5671-9.pdf

Krav. 2009. Kravs marknadsrapport 09. Uppsala.

Krav official website. 2010. Retrieved May 15,2010 from www.krav.se

Matochklimat.se official website, drifted by Svenskt Sigill and The Swedish Farmers' Association. 2010. Nio goda råd. Retrieved May 15, 2010 from
http://www.matochklimat.se/Konsument/Klimatsmart/Nio-goda-rad/

Milgram, S. Bickman, L. & Berkowitz, L. 1969. Journal of Personality and Social Psychology.
American Psychological Association

Möller Nielsen, J. 2008. Energin & koldioxiden i svensk växthusodling 2008 – TomatLCA. Retrieved May 15, 2010 from http://www.svensktsigill.se/website2/1.0.2.0/466/Sammanfattning%20Tomat%20&%20energi.pdf

National Food Administration official website. 2010. Organic food. Retrieved May 15 2010 from http://www.slv.se/sv/grupp1/Markning-av-mat/Ekologisk-mat/

National Food Administration official website. 2010. Retrieved May 15, 2010 from http://www.slv.se/sv/grupp1/Mat-och-miljo/?WT.ac=Mat/Ext./Klimatsmart%20mat

Naturvårdsverket. 2008. Konsumtionens klimatpåverkan. Retrieved May 15, 2010 from http://www.naturvardsverket.se/Documents/publikationer/978-91-620-5903 -3.pdf

Naturvårdsverket. 2010. Klimatmärkning av livsmedel. Retrieved May 15, 2010 from http://www.naturvardsverket.se/sv/Nedre-meny/Webbokhandeln/ISBN/6300/978-91-620-6355-9/

Nilsson, K. 2006. Jämförande studie på miljöverkan från ekologiskt och konventionellt producerade livsmedel med avseende på växthuseffekt och övergödning. SIK. Retrieved May 15, 2010 from www.konsumentforeningenstockholm.se/.../SIK_%20Eko-Konv_rapport%20med%20logga.pdf

Svenskt Sigill and The Swedish Farmer's Association. 2010. Klimatsmarta matråd. Retrieved May 15, 2010 from http://www.matochklimat.se/Konsument/Klimatsmart/

Swedish Nature Conservation Agency official website. 2010. Retrieved May 15, 2010 from http://www.naturskyddsforeningen.se/gron-guide/klimatkontot/

Swedish Environmental Protection Agency official website. 2010. Välj rätt bananer. Retrieved May 15, 2010 from http://www.naturskyddsforeningen.se/gron-guide/ata/frukt-och-gront/bananer/

Swedish Nature Conservation Society official website. 2010. Svenska tomater klimatvänligare. Retrieved May 15, 2010 from http://www.naturskyddsforeningen.se/gron-guide/ata/frukt-och-gront/tomater/

Swedish Environmental Objective Council. 2009. Sweden's 16 environmental objectives. Retrieved May 15, 2010 from http://www.naturvardsverket.se/sv/Nedre-meny/Webbokhandeln/ISBN/8300/978-91-620-8377-9

Swedish Nature Conservation Society official website. 2010. Bättre biff på tallriken. Retrieved May 15, 2010 from http://www.naturskyddsforeningen.se/gron-guide/ata/kott/

Swedish Environmental Protection Agency official website. 2010. Målet år 2010 – Från tio till två ton. Retrieved May 15, 2010 from http://www.naturvardsverket.se/sv/Klimat-i-forandring/Konsumtion-och-klimat/Vad-kravs-pa-sikt/Malet-ar-2050--fran-tio-till-tva-ton/

The Swedish Agency for Nature Conservation. 2010. Grön Guide. Retrieved May 15, 2010 from http://www.naturskyddsforeningen.se/gron-guide/ata/

The Consumer Agency. 2010. S.M.A.R.T. – Formula for better food. Retrieved May 15, 2010 from http://www.konsumentverket.se/mat/mat-och-miljo/SMART---formel-for-battre-mat/

The National Food Administration. 2009. Eco smart food choices. Retrieved May 15, 2010 from http://www.slv.se/upload/dokument/miljo/reviderad_version_milj%c3%b6smarta_matval_nov2009.pdf

Toivonen, A. 2007. Konsumenternas syn på klimatmärkta livsmedel - En enkätundersökning om konsumentintresse, betalningsvilja och förväntningar. Retrieved on May 15, 2010 from http://www-mat21.slu.se/publikation/pdf/Publ%20242.pdf

U.S. Geological Survey official website. Retrieved May 15, 2010 from http://toxics.usgs.gov/definitions/eutrophication.html

Världsnaturfonden WWF, Våra ekologiska fotavtryck. Retrieved May 15, 2010 from www.wwf.se/source.php?id=1117109

Zapico, J. Turpeinen, M. Brandt, N. 2009. Climate persuasive services: changing behavior towards low-carbon lifestyles. Proceedings of the 4th International Conference on Persuasive Technology, ACM

Pictures (Creative Commons)

The work fridge: http://www.flickr.com/photos/lollaping/2615696677/
iPhoneInHands: http://www.flickr.com/photos/williamhook/2431704208/
iPhone in the Woo: http://www.flickr.com/photos/tswartz/980692208/
groceries in transit http://www.flickr.com/photos/qmnonic/218410335/

Appendix A: Demand Specification

5 Modes:

- Add Items
- Shop
- Recommendations
- Export
- Share

Add items:

- Top Bar
    - At the top left a back button, *Lists*, to go back to all your lists
    - At the top right an edit button for add/delete new items
- Blue header
    - To the left a Search and Add button that filters as you type. If the product does not exists it changes to an add product
    - To the right a Sort option for alphabetic, category or most bought
- Index to the right for easy scrolling
- One click to the left of product to add it, one more click to choose the best choice of that product and a third click to take it away.
- A click on the product to specify it and get recommendations and information.

Shop:

- Top Bar
    - To the top right and edit button to delete, make a custom order and specify shop for that order.
- Blue header
    - To the left a sort option to see the products in alphabetic, category or custom order
    - To the right a checkout button for when you are done at the shop
- One click to left of product to mark it as bought, one more click to change it back to not bought
- A click on the product to change it and see the other recommendations if it is missing. For instance if Swedish tomatoes is missing to change to Spanish or Italian etc.
- The Tab Bar icon for Shop has a number indicating the number of items left to buy.

- The Icon of the program also indicates the number of items left to buy

Recommendation:

- Further recommendations on everything you bought.
- The Tab Bar icon for Recommendations indicates the number of critical recommendations

Export:

- Export the list to a friend/partner by the means of email, sms, mms etc
- If the friend/partner has an iPhone /iPod and Green Shopping List the list can be synced between them.

Share:

- Recommend the application on Facebook/Twitter
- A list of *"Quotes"* based on ones climate smart decision to publish on Facebook/Twitter
- Share the whole list or parts of it on Facebook/Twitter

Other features:

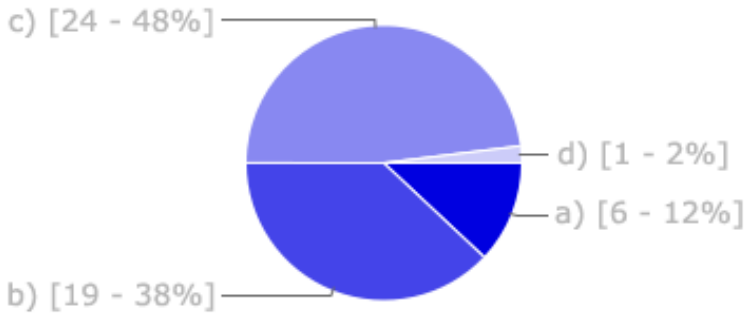
- Multiple languages
- Recommendations is given based on the season
- Recommendations is given based on your position
- If new views needs time to load a small sentence can appear as a trigger to spark motivation
- Incorporate David's application Green Recipes and the ability to automatically add the needed ingredients to the shopping list.
- Give feedback on the recommendations and the possibility to make your own recommendations can be shared to a community

Appendix B: Questionnaire and Results

Translated from Swedish. We created a demonstration video and put it up on YouTube (korta.nu/greenshoppingfilm) and Vimeo (korta.nu/greenshoppinglist_demonstration) to explain our concept. We sent out a questionnaire, with a link to the video, via Google spreadsheets and asked the target group to answer eleven questions, after having watched the video. Here are the questions with the result attached under respective question:

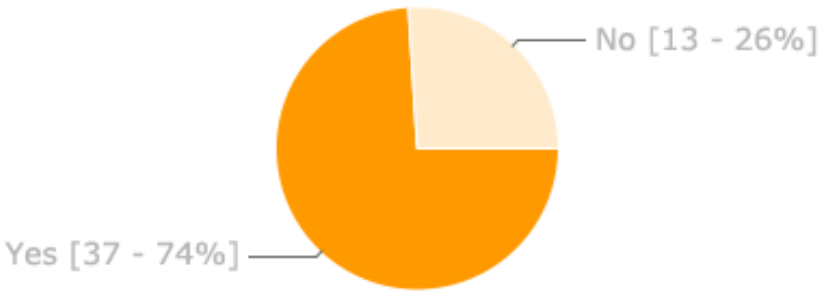
1) Just how environmentally friendly do you think you are?

    a. Make active eco-friendly choices in life, such as buying organic products, fly only if I really need to, etc.
    b. Care about the environment and want to learn more, but feel pretty well-read already
    c. Care about the environment but do not actively seek information
    d. Do not care at all



2) Would this kind of app be something you would consider to use? See answer to question 4 for inspiration on fields of uses

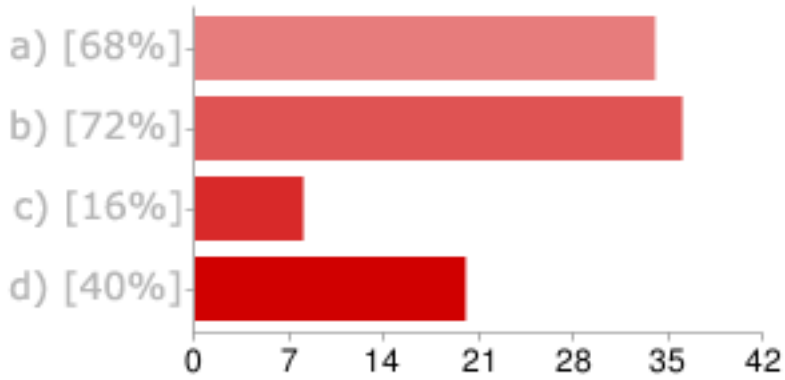
    a. Yes
    b. No



3) If no, explain briefly why? If yes, proceed to question 4. Free text answer

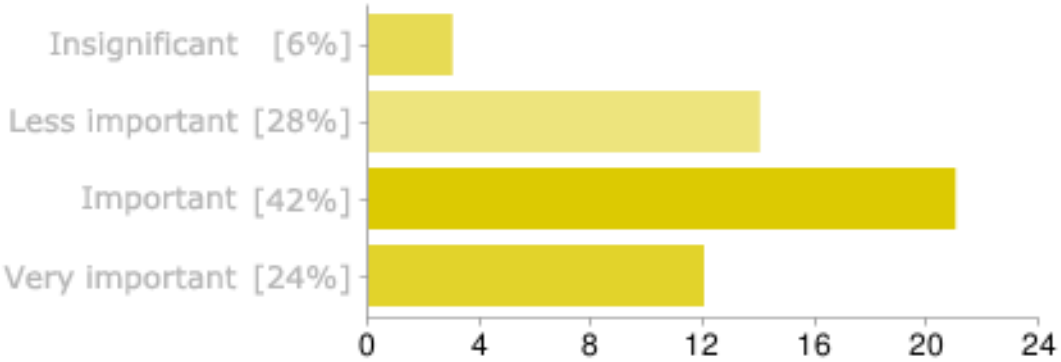
4) Which of the following uses for the app do you think best describes you?

a. Get help to shop more environmentally friendly
b. Use as a shopping list
c. Show for friends and family, use as a basis for discussion about the environment and climate
d. As a fun thing I would probably test once and never use again

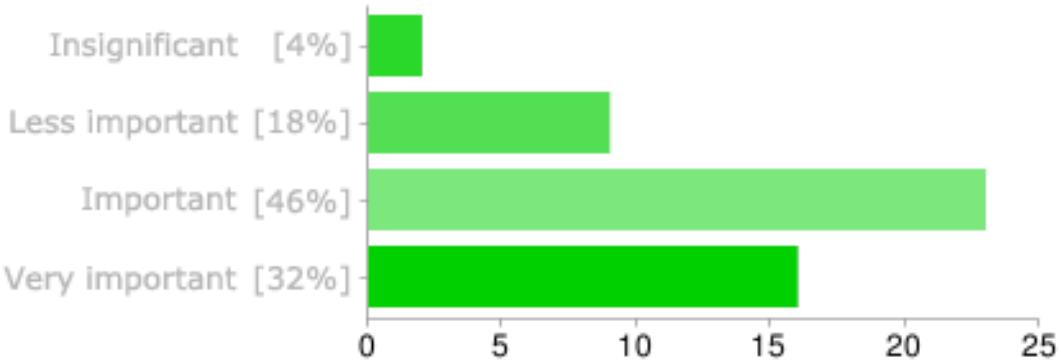


5) How important are the following functions in a digital shopping list? For you, as the user?

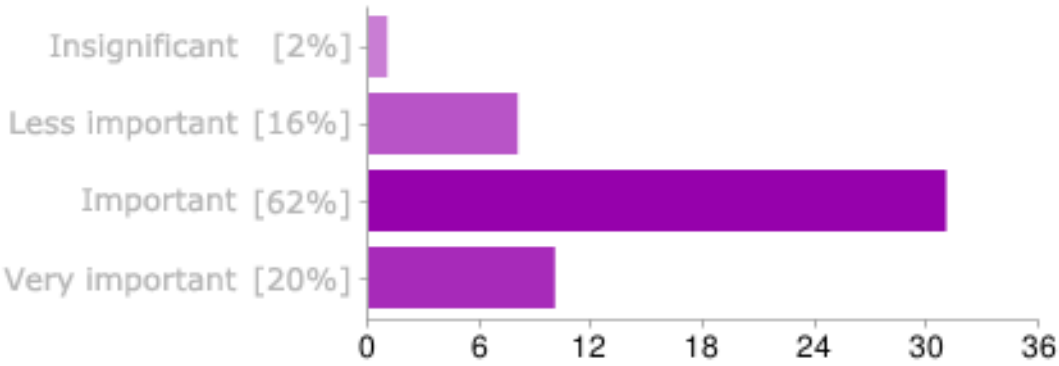
a. Ranking of good / bad products environmentally



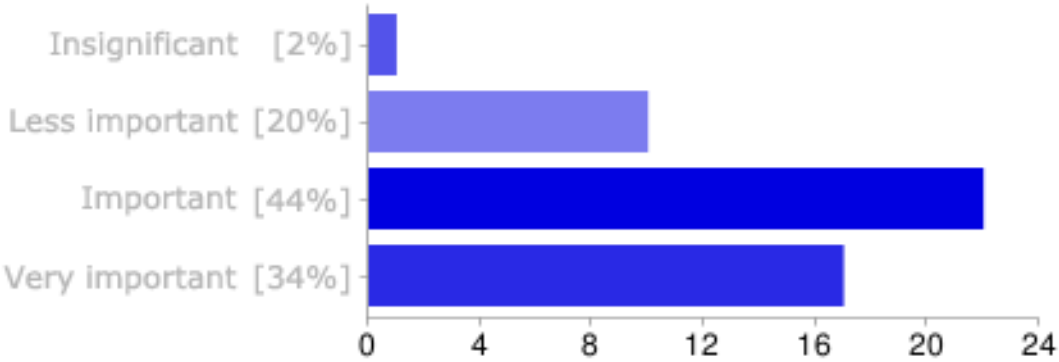
b. Ranking of great / bad products from a personal standpoint (whether the products are useful, containing additives and hazardous substances, cholesterol, etc)



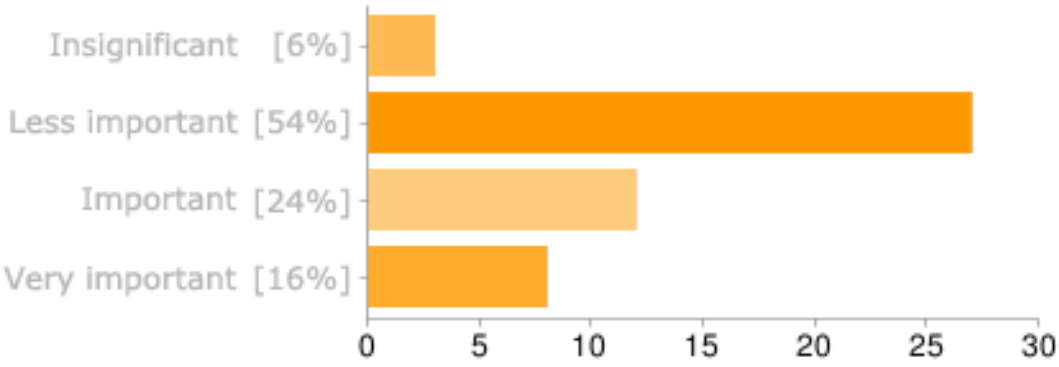
c. Recommendations for better products



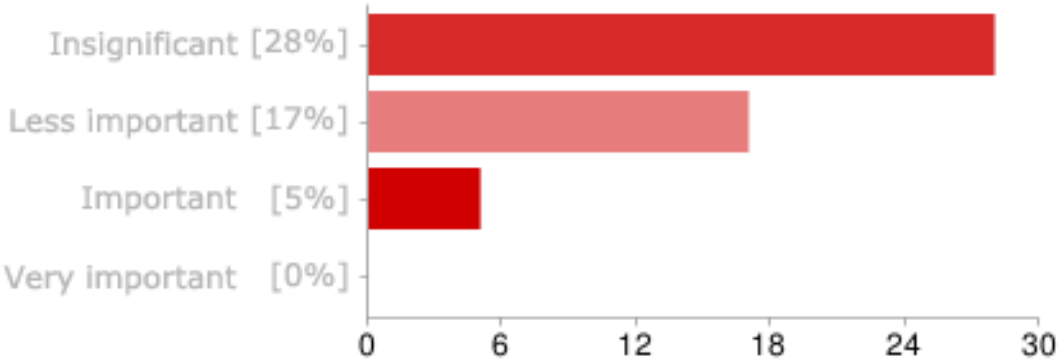
d. Information on why the products are good / bad



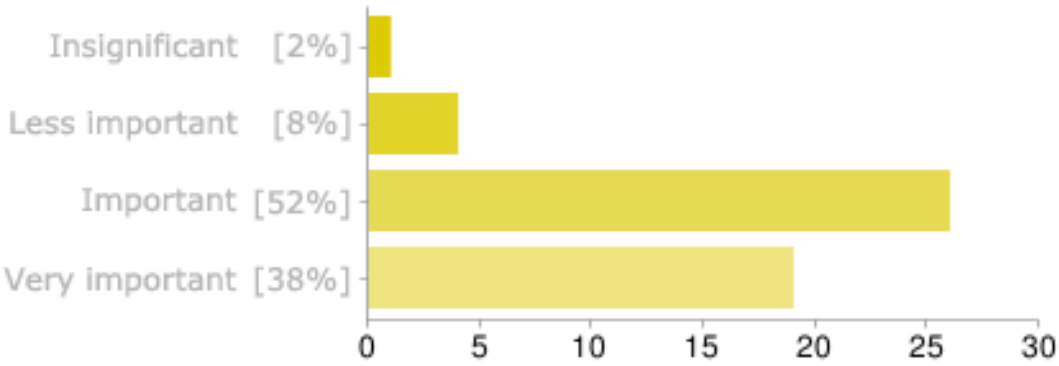
e. Sharing (e.g. email, text messaging etc) shopping list with your partner



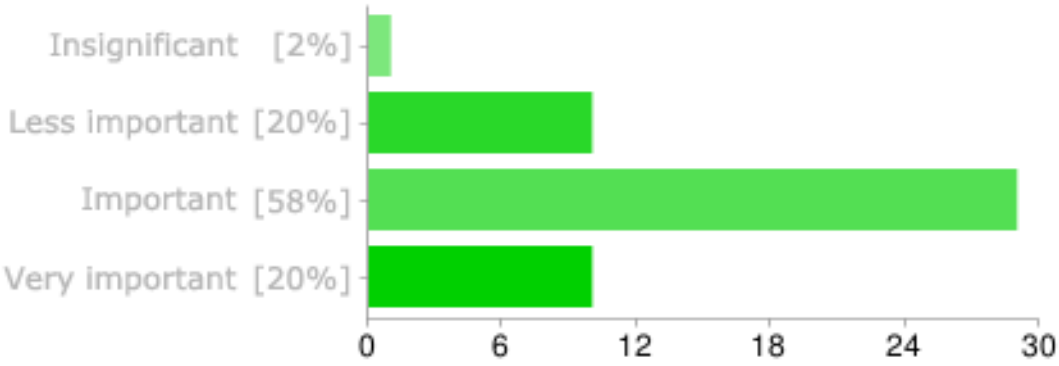
f. Share your choice of products with others on Facebook or Twitter



g. Quick selection of what you usually buy in a *"Favorites"* mode

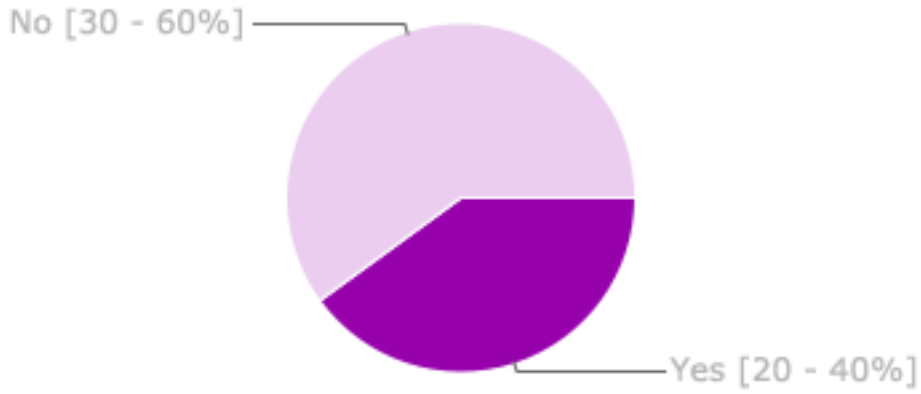


h. Sort the product aisles (e.g., *"Fruit & Vegetables"*, *"Freezer Cabinet"* and *"Dairy Products"*) in the same order they are placed in the store, in the Shopping view.



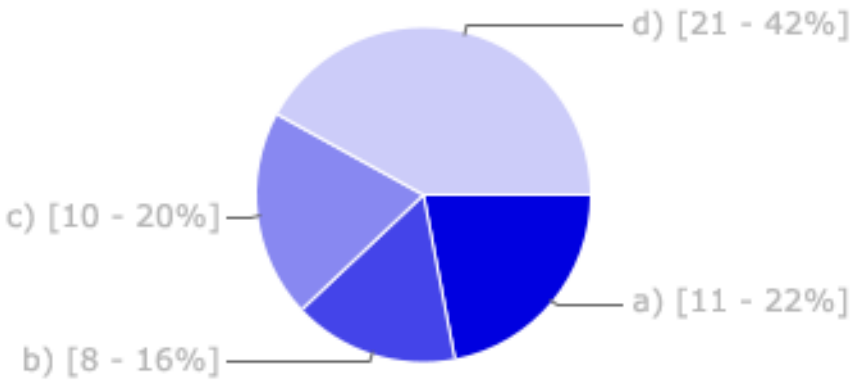
6) Will you be willing to share information about your usage on social media like Facebook? See selections to question 8 for examples of how this might look like.

a) Yes
b) No.



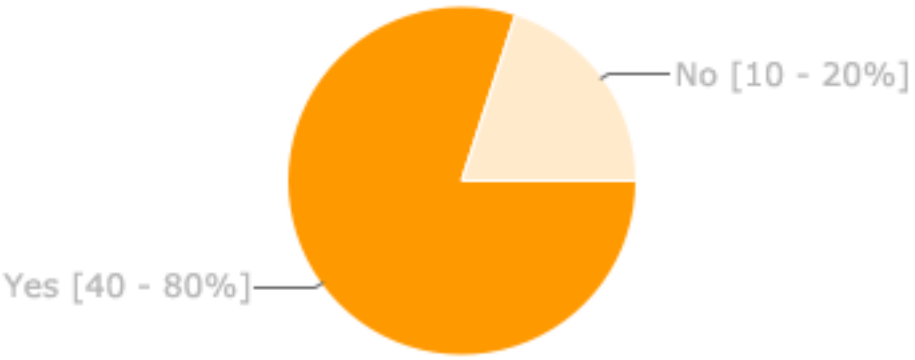
7) If no, explain briefly why? If yes, proceed to question 8. Free text answer

8) What sort of information would you be willing to share on, say, Facebook / Twitter? Fill in your own suggestions in *"Other"*
   a. *"John just got helped to act more environmentally friendly through the use of Green Shopping List. Test the app Green Shopping List yourself"*
   b. *"John chose to buy Swedish open-grown tomatoes instead of the Dutch greenhouse tomatoes and therefore saved on the environment. Get eco-friendly recommendations while shopping via the Green Shopping List as well."*
   c. *"John has in the last three months reduced his meat consumption by 30% compared to the previous quarter (the number of times he bought meat). Get similar statistics on the food you buy and their impact on the environment through the app Green Shopping List"*
   d. Own answer



9) Do you think the app could cause you to become more environmentally friendly in terms of choice of food?

   a. Yes
   b. No



10) If no, explain briefly why? If yes, proceed to question 11. Free text answer

11) Finally, do you miss something in the app? For example, something that would make it easier to use, etc. Free text answer