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BACHELOR THESIS

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# The potential of Persuasive Technology in the field of sustainable food consumption

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*Author:*

Alicia FRADERA

*Mat. Nr.:*

34351

*First examiner:*

Prof. Dr. Sabiha

GHELLAL

*Second examiner:*

Tobias SCHNEIDER

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Alicia FRADERA



## *Abstract*

Climate change is one of the greatest societal challenges of our time. The global food production alone accounts for 26% of global greenhouse gas emissions. Without dietary changes, the challenges of climate protection can hardly be achieved in the food sector. Technology has the ability to significantly change society and it can be used to change people's attitude or behaviors.

The current study investigated the potential of using Persuasive Technology for guiding consumers to implement sustainable food choices. To evaluate its impact, an online grocery store was designed and prototyped using the Persuasive Systems Design model according to Oinas-Kukkonen and Harjuma. The intended target behavior was to adjust food choices and make sustainable consumption decisions. The target group consisted of individuals between the ages 20 and 34 years.

The iterative approach of the empirical study was divided into four parts: First, the requirements of the target group were analyzed. Then a concept of the grocery online shop was developed using the design principles of the Persuasive Systems Design model. The concept *Foodprint* was prototypically implemented and consequently, evaluated via A/B testing with target users. Two high-fidelity prototypes were similarly structured with the only difference that Prototype A contained persuasive elements. Prototype B was intended to collect comparative data in the user tests. Ten individuals of the target group evaluated the prototypes and their impressions of the concept and food choices were examined to assess the impact of the Persuasive Systems Design model.

The data were analyzed qualitatively as well as quantitatively. Prototype A – with the persuasive elements – showed a more positive user experience. The evaluation of tests A and B revealed that the persuasive elements were able to influence users to identify sustainable food options.

In general, it can be concluded that testers from both tests, A and B, rated the grocery online store as helpful and would be willing using it in the future. However, it became also evident that the target group lacked knowledge to make informed decisions about the environmental impact of their food

choices. As observed in the current study, the participants considered it difficult to assess the sustainability level of foods when grocery shopping. Their purchasing decisions relied on labels and erroneous assumptions. These observations indicate the need for more support in making sustainable food choices.

The Persuasive Systems Design model had the potential to influence the users in their food choices, suggesting that it may be an option to contribute to environmental protection in the food sector. Over time, consumers may even become more aware of the impact of their food choices and hence, could adjust their purchasing behavior in stationary retail stores.

# Kurzfassung

Der Klimawandel ist eine der größten gesellschaftlichen Herausforderungen unserer Zeit. Allein die weltweite Lebensmittelproduktion ist für 26% der globalen Treibhausgasemissionen verantwortlich. Ohne Ernährungsumstellung sind die Herausforderungen des Klimaschutzes im Lebensmittelbereich kaum zu bewältigen. Technologie hat die Fähigkeit, die Gesellschaft signifikant zu verändern und sie kann genutzt werden, um die Einstellung oder das Verhalten von Menschen zu verändern.

Die aktuelle Studie untersuchte das Potenzial des Einsatzes von Persuasive Technology, um VerbraucherInnen zu einer nachhaltigen Lebensmittelauswahl zu bewegen. Um dessen Wirkung zu evaluieren, wurde ein Online-Lebensmittelhandel entworfen und mit Hilfe des Persuasive Systems Design-Modells nach Oinas-Kukkonen und Harjumaan prototypisch umgesetzt. Das beabsichtigte Zielverhalten war es, die Lebensmittelauswahl anzupassen und nachhaltige Konsumententscheidungen zu treffen. Die Zielgruppe bestand aus Personen im Alter zwischen 20 und 34 Jahren.

Das iterative Vorgehen der empirischen Studie gliederte sich in vier Teile: Zunächst wurden die Bedürfnisse der Zielgruppe analysiert. Dann wurde ein Konzept des Lebensmittel-Onlineshops unter Anwendung der Designprinzipien des Persuasive Systems Design-Modells entwickelt. Das Konzept *Foodprint* wurde prototypisch umgesetzt und anschließend mittels A/B-Testing mit Zielnutzern evaluiert. Die zwei High-Fidelity-Prototypen waren ähnlich aufgebaut, mit dem einzigen Unterschied, dass Prototyp A persuasive Elemente enthielt. Prototyp B war dazu vorgesehen, in den Nutzertests vergleichende Daten zu sammeln. Zehn Personen der Zielgruppe evaluierten die Prototypen, wobei ihre Eindrücke vom Konzept und ihre Lebensmittelauswahl untersucht wurden, um die Wirkung des Persuasive Systems Design-Modells zu beurteilen.

Die Daten wurden sowohl qualitativ als auch quantitativ ausgewertet. Prototyp A - mit den persuasiven Elementen - zeigte eine positivere Benutzererfahrung. Die Auswertung der Tests A und B zeigte, dass die persuasiven Elemente es ermöglichten, die BenutzerInnen dahingehend zu beeinflussen, nachhaltige Lebensmittel-Optionen zu wählen.

Generell lässt sich feststellen, dass die ProbandInnen aus beiden Tests, A und B, den Lebensmittel-Onlineshop als hilfreich bewerteten und ihn in Zukunft nutzen würden. Es wurde jedoch ebenfalls deutlich, dass es der Zielgruppe an dem nötigen Wissen fehlte, um bewusste Entscheidungen über die Umweltauswirkungen ihrer Lebensmittelauswahl zu treffen. Wie in der aktuellen Studie beobachtet wurde, empfanden die TeilnehmerInnen es als schwierig, beim Lebensmitteleinkauf den Nachhaltigkeitsgrad von Lebensmitteln zu beurteilen. Ihre Kaufentscheidungen verließen sich auf Etiketten und fehlerhafte Annahmen. Diese Beobachtungen deuten darauf hin, dass mehr Unterstützung bei der Auswahl nachhaltiger Lebensmittel benötigt wird.

Das Persuasive Systems Design-Modell hatte das Potenzial, die NutzerInnen bei ihren Lebensmittelentscheidungen zu beeinflussen. Dies deutet darauf hin, dass es eine Möglichkeit darstellt, zum Umweltschutz im Lebensmittelbereich beizutragen. Im Laufe der Zeit könnten sich die VerbraucherInnen sogar der Auswirkungen ihrer Lebensmittelwahl bewusster werden und somit ihr Kaufverhalten im stationären Handel anpassen.

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# List of Abbreviations

<b>FBM</b>	<b>Fogg Behavior Model</b>
<b>E-Food</b>	<b>Electronic Food</b>
<b>CO<sub>2</sub>-e</b>	<b>CO<sub>2</sub> equivalent</b>
<b>PSD model</b>	<b>Persuasive Systems Design model</b>



# Chapter 1

## Introduction

Climate change is one of the greatest societal challenges of our time [1]. While the world's population consumes more resources than the planet can provide [1], sustainability problems caused by food systems will likely worsen [2]. The global food production alone accounts for 26% of global greenhouse gas emissions [3]. It is important to address how the population's needs can be met in the future [4]. Without dietary changes, the challenges of climate protection can hardly be achieved in the food sector [5]. Introducing new incentives for sustainable behavior could be a measure to fight climate change [6].

The emergence of the Internet showed that technology has the ability to significantly change society [7]. Technology can be used to change people's attitudes or behaviors. BJ Fogg was a key contributor to developing this science, called Persuasive Technology [8]. In the course of this development, the Persuasive Systems Design model was introduced by Oinas-Kukkonen and Harjumaa, and it is used for the development, design and evaluation of Persuasive Systems [9].

The current study deals with combining these two topics and investigating the possibilities and effects of Persuasive Design for implementing sustainable food consumption. The aim of the study is to examine the following questions:

- How can Persuasive Design be used to influence purchasing decisions?
- Is the Persuasive Systems Design model by Oinas-Kukkonen and Harjumaa suitable for changing behavior in the area of sustainable food consumption?
- To what extent can Persuasive Design help to guide consumers' food choices toward sustainable options versus other products?

The study does not include the investigation of long-term behavior change or actual purchasing behavior. To evaluate the impact of Persuasive Technology in the field of sustainable food consumption, an online grocery store for mobile devices will be designed and prototyped using the Persuasive Systems Design model according to Oinas-Kukkonen and Harjumaa. The development of a persuasive concept was carried out by means of the model. The intended target behavior is to adjust food choices in a sustainable way and make conscious consumption decisions.

At the beginning, the methodology of Persuasive Technology as well as the theoretical background of sustainable food consumption and online grocery shopping in Germany are presented. Subsequently, the procedure of the empirical study to investigate the topic is explained.

The requirements of the target group were analyzed and collected by means of an online survey. These results and assumptions about the users were illustrated in two personas. Furthermore, a domain analysis of online grocery stores was conducted to get an overview of the state of the art as well as mental models of the target users.

In the next step, a concept was developed using the design principles of the Persuasive Systems Design model. The persuasive concept was then evaluated by means of user interviews in order to obtain feedback from the target group.

The concept of a grocery online shop was prototyped with the help of the software Adobe XD. The prototype was evaluated with target users using the Think Aloud method as well as the UEQ questionnaire and conducting interviews. Their impressions of the prototype and food choices were examined. Finally, the results of the study are presented and discussed.

## Chapter 2

# Theoretical background

## 2.1 Methodology

### 2.1.1 Persuasive Technology

BJ Fogg, a professor at Stanford University, defines the terminology Persuasive Technology as „any interactive computing system designed to change people’s attitudes or behaviors“. The first computing systems with this focus emerged in the 1970s and 1980s and were designed to promote health and increase workplace productivity. In the late 1990s with the coming of the Internet, a few people started creating persuasive computers. Fogg invented the term „captology“ which is an acronym composed of the sentence „computers as persuasive technology“. It refers to the design, research and analysis of persuasive computers and covers the area where technology and persuasion overlap [10]. Captology and Persuasive Technology will be used as synonyms in this work.

Persuasive Technology focuses on how people are motivated when interacting with computing systems, the human-computer interaction (HCI). The computer can source the persuasion and apply strategies that influence its users. By contrast, in so-called computer-mediated communication (CMC), people interact with each other through rather than with technology, such as through e-mail or social network systems. This is a separate area of research and design where the computer acts as a channel of communication [11].

In Captology, there are two levels where technology can be used to persuade - micro and macro. The first approach is called microsuation, which can contain persuasive elements, but was designed to achieve a different overall goal. Products on this level don’t mainly have a persuasive intent and can

apply microsuasion elements in interaction patterns, for example. In contrast, products of macrosuasion have the sole reason to persuade and motivate their users. It describes an overall persuasive intent of a product [11]. In this work, the main focus is on human-computer interaction (HCI), where computing systems represent the persuasive origin. Moreover, emphasis was placed on aspects of microsuasion.

Furthermore, Fogg states the importance of the distinct difference between persuasion and coercion or deception. These terms are sometimes confused. Coercion assumes force with which the behavior or attitude is changed. However, persuasion implies voluntariness. An example of coercion could be a dialog box, that won't go away before personal information is provided. Similarly, persuasion and deception can be mistaken. Deceptive examples would be ads that misinform the user by reporting false emergencies and hence, influencing what users think and do. Coercion and deception are not part of Capotology because these terms don't depend on persuasion [11]. Persuasive Technology demands intentionality which discerns its planned effects from its side effects. Unintended outcomes are not covered by the research field. Attitude or behavior changes intended by the designers of persuasive computer technologies could be, for example, buying a certain product online or convincing people that smoking is unhealthy. Moreover, Captology focuses on endogenous intent which is designed into the persuasive system. Exogenous intent, on the other hand, is attained by users or external sources and occurs when a product is used for a persuasive goal that wasn't planned by the system's designer. For instance, people buy computers to motivate themselves to do their homework more regularly [11].

Furthermore, Fogg defined three roles computers can play which show how people use or respond to technology: tool, media and social actor. This represents the so-called functional triad. When functioning as tools, computing technology can persuade users in different ways, for example by making a target behavior easier to perform or providing motivations for it. In the role of media, it can exert influence by simulating compelling experiences. Finally, as a social actor, technology uses persuasion principles in order to alter the attitude or behavior of their users. These principles are typically used by humans to persuade others and can be applied as a reward with praise, for instance [12].

Captology highlights psychological principles that can influence and motivate people in different areas [8]. Designers make use of the disciplines in any field requiring a target group's attitude or behavior change. However, traditionally, they are frequently used in e-commerce, organizational management and public health [13].

### **Cialdini's principles of persuasion**

Social psychology plays a central role in the field of Persuasive Technology. It explores persuasive power of different media and its messages and how attitude and behavior change occur [8]. Robert Cialdini developed six key principles of persuasion which can be used to influence people.

**Reciprocity** The principle describes the need to reciprocate: people will want to pay back what they have received from others. For example, if a person does somebody a favor, they're likely to return it. People respond likewise to kind behavior. Giving before taking can help building trust and motivating engagement with the own product. This social psychology law can be used in the area of Interface Design by being nice to the users and minimizing their interaction cost [14].

**Social Proof** The principle Social Proof says that people reference the behavior of others in order to guide their own [15]. This herd mentality is a powerful force across humanity, especially when there is insufficient information presented. It involves the tendency of individuals to follow the lead of a group and the natural desire to behave as expected in most situations [16]. When designing computing systems that should persuade the users, the principle can be used by presenting opinions of the crowd [15].

**Liking** Liking uses the perception of similarity, safety and belonging in communication. People tend to be attracted or agree with someone, when they make them feel good about themselves or they are similar to them. Liking uses the perception of similarity, safety and belonging in communication [16]. User research can help applying the principle effectively by anticipating what kind of techniques will have a positive effect. Furthermore, it can contribute data in order to get to know the target group [17].

**Scarcity** This social-psychology phenomenon causes people to attach high value to things that they identify as being limited. People want what they can't have. This can convince users to take action sooner and without careful thought of possible consequences [18]. Reminding users what they could gain as well as what they could lose, can encourage them to move quickly towards purchasing a product [16].

**Authority** Since humans tend to use judgement heuristics, they rather comply with people in positions of authority, such as government leaders or experts in different fields. They assume that such people have greater wisdom and power and thus, trust them that their decision will lead to an advantageous result. People will choose the easy decision rather than the accurate, but more effortful one. Applying this principle to persuasive technologies can simplify the decision-making process of the user. A system can increase confidence and empower users by reducing the effort of deciding and reaffirming that decision [19]. Revealing expertise can also help gaining credibility. This principle implies referencing creditable expertise and valuable insight to the user [16].

**Commitment and consistency** The principle of commitment and consistency is also a judgement heuristic that is used to ease a decision. People lean towards behaving in a way that matches past decisions. Allowing the user to make small, low-cost commitments and to follow up on them can increase engagement with content and persuade the users to fulfill their goals. The key statement of this principle lies in facilitating the decision-process and trust of the users [20].

### 2.1.2 Frameworks and methods of Persuasive Technology

Since the mentioned psychological and social theories are very general and not adapted to design practice, suitable methods and frameworks are constantly developed in order to support the design of persuasive systems [13]. However, it is important to consciously select persuasive methods that work on the target group. Applying all persuasive design principles at once will result in persuasion clutter, overwhelm the user and make them feel manipulated. Designers aim at identifying the simplest action leading to the desired behavior change and uncovering barriers and motivators of the users [21]. The following methods were not applied in the study, but should give an

overview about other existing frameworks.

Fogg also introduced seven tools of Captology that apply different techniques to change attitudes or behaviors. The first tool is reduction, which makes target behaviors easier by transforming a complex activity into a simple task. The tool tunneling simplifies the process of achieving the target behavior. It is particularly effective since people appreciate consistency. By means of the tool tailoring, the only information shown is the one that is relevant to the user. The fourth tool, suggestion, is based on existing motivations, for instance, to be healthy or financially stable. Self-monitoring is a tool that enables individuals to learn about themselves in real time, for example, their progress on a task. At last, the tool conditioning applies principles of operant conditioning on computing systems [22].

### **Fogg Behavior Model**

One of the developed frameworks is the Fogg Behavior Model (FBM). It describes that behavior is a product of three factors: motivation, ability and prompt. The person must be sufficiently motivated, be able to perform the target behavior and lastly, be triggered to behave in a certain way. In the FBM, these elements must converge at the same time, otherwise the target behavior will not occur [23].

Each factor has sub-components, such as Core Motivators (motivation), Simplicity factors (ability) and different types of prompts [24].

The Core Motivators consist of the elements sensation (pleasure and pain), anticipation (hope and fear) and belonging (social acceptance and rejection). Manipulating ability is more complex. Either the users learn new skills or the target behavior is simplified. This may be achieved by the six simplicity factors time, money, physical effort, brain cycles, social deviances and non-routine. However, in most situations the desired behavior is performed when it is easy to do [8].

The FBM can be beneficial in analysis and design of persuasive technologies, since it gives people a shared way of thinking about behavior change in general [23].

Understanding these concurring factors while designing persuasive products, enables designers to achieve the desired behavior without the need for tactics such as coercion or deception [13].

If the target group lacks motivation, the focus should be placed on the factor motivation. If the ability is restricted, the Persuasive Technology solution should concentrate on facilitating the behavior. However, if the target group lacks both motivation and ability, the design may have to be adjusted. The Stanford Persuasive Tech Lab appeals to designers not to manipulate motivation, ability and prompt at the same time. Impacting motivation should be considered last, followed by ability. Manipulating triggers should be considered first, since it is the simplest to implement [8].

### **Fogg Behavior Grid**

BJ Fogg developed the so-called Fogg Behavior Grid that contains 15 ways a behavior can change. The grid should help people to understand behavior change better. Each type is based on different psychological strategies and persuasive methods. Furthermore, he introduced the Behavior Wizard, which allows matching target behaviors with respective solutions by classifying behavior change goals into one of the 15 types of the Fogg Behavior Grid. After the classification, possible triggers for the target behavior and relevant techniques are presented. The methods for persuading people to change a certain behavior depend on the behavior type. For example, buying a product online (BlueDot Behavior) or quitting smoking forever (BlackPath Behavior) require different persuasive approaches [25].

**Example: PurplePath Behavior** PurplePath Behavior is described as a behavior increase in future. The key characteristic of Purple Behavior is the increased performance of a familiar behavior, such as doing the behavior longer or with more effort [26]. The behavior has been achieved before and no surprises are to be expected, since the target group has already acquired knowledge about the costs and outcomes of the behavior [8].

Path Behavior implies a permanent change and stresses the ongoing nature of this type of behavior change. Examples for PurplePath Behavior are eating only vegetarian foods or running a kilometer faster than usual. For this kind of behavior change to occur, it has to be triggered regularly to form a habit or routine. Path Behaviors are one of the hardest types to provoke and call for an identity or lifestyle shift [26].

According to Fogg, Blue and Purple Behaviors are most suitable for mobile persuasion, especially in combination with Span and Path Behavior [8].

### 2.1.3 Persuasive Systems Design model

According to Harri Oinas-Kukkonen and Marja Harjumaa, psychological and social theories were developed to predict the user acceptance of the software solutions instead of providing analysis and design methods for developing persuasive computing systems. They argue that Fogg's framework and principles are useful for understanding Persuasive Technology, but they may be too limited for designing and evaluating persuasive systems [9].

Furthermore, they state that Persuasive Technology makes use of either human-computer or computer-mediated persuasion. Their definition differs from the above-mentioned definition by Fogg [27].

Hence, Oinas-Kukkonen and Harjumaa conceptualized a development framework for persuasive systems (Fig. 2.1): The Persuasive Systems Design (PSD) model. Before implementing the software solution, the first step is understanding the key issues behind persuasive systems. Next, an analysis of the system context takes place while considering the intent, event, and strategies for the use of a persuasive system. In the third phase, system qualities for the persuasive software solution can be designed or the properties of an existing solution can be evaluated [9].

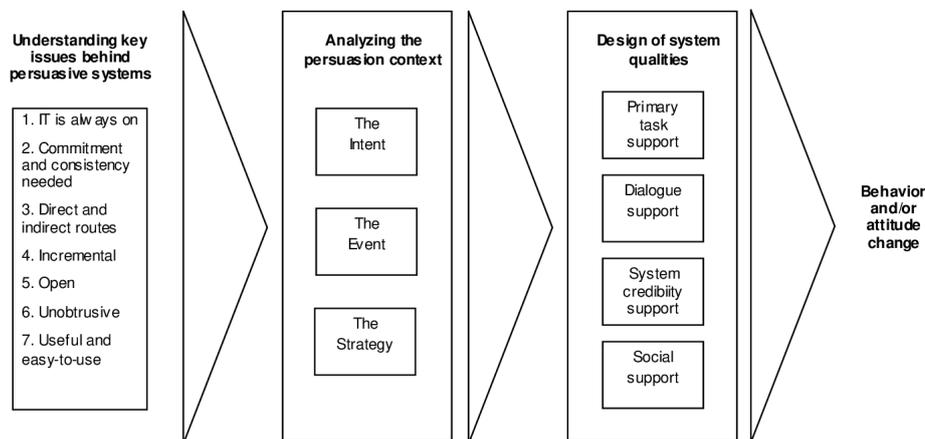


FIGURE 2.1: Phases of the Persuasive Systems Design model

In the current study, a mobile application of an online grocery shop will be developed based on the Persuasive Systems Design model. The process will be described in more detail in the following paragraphs.

### **Understanding key issues behind persuasive systems**

Oinas-Kukkonen and Harjumaan defined seven postulates that need to be considered when designing or evaluating persuasive systems.

The first assumption is that information technology is never neutral. It always has an effect on people's attitudes or behaviors. Furthermore, persuasion can be considered as a multi-phased process. Persuasive technologies should be able to adapt to different factors, e.g. the user's goal, since they may change during the process.

The second postulate is based on the principle of commitment and consistency: People like to have their views about the world to be organized and consistent. Persuasive Technology should support making commitments for the target behavior since it will be more likely to persuade the users. In addition, cognitive consistency plays an important role. Inconsistencies can motivate the user to think about the presented information and adjust their attitude or behavior accordingly. However, people have to feel commitment before inconsistency creates dissonance.

The third postulate implies that direct and indirect approaches are key persuasion strategies. A direct approach is most suitable for individuals that carefully evaluate the presented, persuasive message and are highly motivated. People, who are less thoughtful, evaluate information using simple cues or stereotypes and may be influenced through the indirect route. Both strategies can operate simultaneously and can be supported by numerous system features. Even though direct persuasion has been proven to be more enduring, individuals are constrained to use indirect cues more often in times of information overflow.

The fourth postulate suggests that persuasion is often incremental. A persuasive system should support incremental steps for achieving the target behavior. This approach initiates people more easily into performing the desired behavior than a onetime suggestion. Furthermore, it is important to clarify the overall goal at every incremental step.

Persuasion through persuasive systems should always be open. This is the fifth assumption. The designer's intention behind the persuasive system should be transparent. False information doesn't match with the goal of a

user's voluntary attitude change.

The sixth postulate is based on the principle of unobtrusiveness and says that persuasive systems should avoid disturbing users during usage. The appropriate moment for a certain situation should be carefully chosen.

Persuasive software solutions should be useful and easy to use and, hence serve the user's need. The seventh postulate is a general software quality rather than a persuasion-specific aspect [27].

While designing and evaluating the persuasive concept and the implementation of the online grocery shop, these postulates were kept in mind and considered closely.

### **Analyzing the persuasion context**

In order to design persuasive technologies, the persuasion context needs to be explored.

**The intent** Fogg introduced three sources of intentions: endogenous - those who create interactive technology; exogenous - those who distribute interactive technology; and autogenous - those who use interactive technology. People use autogenous technologies to change their own behavior or attitude, therefore the user experience of these systems needs to be rewarding enough for them to use it over a certain timespan. Exogenous technologies should enable users to personalize the assigned goals, since their effects are mediated by self-set goals. Finally, endogenous technologies should reveal the designer's bias behind the persuasive intent (the fifth postulate in section 2.1.3). It should be developed considering the users' voluntariness towards attitude or behavior change [9].

In the current study, the intent type of the system prototype will be endogenous. The prototype will be designed with the notion of the users' voluntariness towards behavior change.

Considering the change type is a central feature of the analysis, i.e. whether the persuasion intent is focused on attitude or behavior change. Attitude change implies modifying a person's evaluation of values. Attitudes can be, for example, based on emotions or past experiences that may be consistent or ambiguous. However, persuasion-in-full only takes place when the user's

attitude changes. Achieving attitude change that drives behavior may be harder than develop or strengthen an attitude. It can be assumed that attitude change will occur, if the person's behavior changes first [9].

The before mentioned online grocery shop will primarily aim at a behavior change of the target group.

Furthermore, persuasive systems can potentially have three different outcomes: reinforcement, change or the shaping of attitudes and behaviors. The reinforcing outcome describes an enhancement or increase of current behaviors and/or attitudes and thus, making them more resistant to change. A changing outcome implies a change in the user's reaction to an issue. Finally, a shaping outcome means a formation of a behavior or attitude pattern that did not exist before [27].

This study deals with changing the outcome regarding sustainable food consumption. The target users should choose sustainable food options over other ones and make conscious consumption decisions.

**The event** When analyzing the persuasion event, the use context needs to be considered. In the case of unfitting behavior, persuasive systems should intend to reinforce appropriate behavior and make it easier to perform, even in challenging situations. The use context focuses on the information presented to the user in a certain situation [9]. The use context of the target group occurs when they want or need to purchase groceries.

Individuals have different ways of processing information and, thus, it is essential to analyze the user context. The persuader needs to understand the user's goals, including their current progress and past experiences. Persuasive Technology should enable users to set specific goals and to achieve them in an orderly manner [9]. This data will be collected via an online survey in the phase of requirement analysis.

The technology context is also an important feature. Technological platforms entail strengths and weaknesses as well as risks and opportunities. These aspects should be analyzed in the specific field [9]. In chapter 3.2.1, an analysis of the domain will be conducted to examine the technology context.

**The strategy** An important step of defining persuasion strategies is analyzing the message that is intended to be conveyed. In many cases, the persuasive software solution is trying to convince its' users of something. While persuasion is based on symbolic methods triggering emotions, conviction is

based on strategies of logical proof and aims at the users' reason and intelligence. Hence, it is difficult differentiating between the two terms [9].

The persuasive message in this case is to make sustainable food choices and consume with consciousness.

Furthermore, in order to reach the user, the route for persuasion has to be defined. It depends on the persuadee's ability to evaluate the content of the persuasive message thoroughly. If they are able to do that, a direct route may be most suitable. People, who are less thoughtful in evaluating information, use simple cues or stereotypes to make decisions and may be influenced through the indirect route [9]. The third postulate (in section 2.1.3) should be considered when analyzing the persuasion strategy.

The direct route will be used in this study to reach the user. Even in times of information overflow, this route is more enduring and appeals to the user's reason and intelligence.

### **Design of system qualities**

For designing and evaluating the persuasiveness of a software solution, it is important to understand both, the information content and the software functionalities [9]. Oinas-Kukkonen and Harjumaa developed 28 design principles which are mostly based on Fogg's functional triad. They established persuasion principles mainly as requirements for software qualities [27]. These requirements describe how the system is supposed to behave, what kind of nonfunctional qualities it is supposed to have and the constraints in the design and development processes [9].

When designing persuasive systems, the priorly presented postulates need to be considered, including for example, responsiveness, ease of use, information quality, positive user experience, attractiveness, and simplicity [9]. The two researchers Oinas-Kukkonen and Harjumaa recategorized and adapted Fogg's seven tools of Captology with the intent to make them more practical for system development [27]. The categories for the persuasive system design principles are primary task, dialogue, system credibility, and social support. The specific principles per category can be found in Appendix A.

**Primary task support** These design principles support the user while performing the primary task of the system. They are reduction, tunneling, tailoring, personalization, self-monitoring, simulation, and rehearsal [9].

**Dialogue support** These design principles should help implementing human-computer dialogue support and provide means of moving towards the target behavior. They include praise, rewards, reminders, suggestion, similarity, liking, and social role [9].

**Credibility support** The design principles of this category support designing in a more credible and thus, more persuasive manner. Credibility support contains the principles trustworthiness, expertise, surface credibility, real-world feel, authority, third-party endorsements, and verifiability [9].

**Social support** These design principles should help motivating the user by leveraging social influence. They consist of social facilitation, social comparison, normative influence, social learning, cooperation, competition, and recognition [9].

In the current study, each principle was evaluated, if suitable for the online grocery shop. However, the most suitable design principles were decided in the phase Conception.

## 2.2 E-food in Germany

Electronic food (e-food) is based on the term e-commerce and refers to the purchase of food via digital sales channels [28]. Since the turn of the century, food suppliers in Germany have been trying to convince consumers of the added value of e-food. As a result of increased consumer interest, many e-food retailers emerged [29]. Since 2010, stationary retail companies have also become increasingly involved in online grocery sales [30].

The e-food market in Germany is, despite high growth rates, not yet an established distribution channel [31]. While in other European countries, market sales have already achieved 5%, it lies around 1% in Germany [13]. On the one hand, this is due to the demanding logistics of fresh and frozen goods [31]. On the other hand, according to Lehr et al., it could also be a consequence of the high store density and market saturation in Germany, which fulfill the basic needs of consumers [32].

Nevertheless, a survey conducted by *Bitkom* in 2015 indicated good development opportunities for online grocery shopping due to a high level of user

satisfaction [33]. According to *Eurostat*, the proportion of people buying their groceries via online channels has risen from 5% in 2007 to 24% in 2019 [34]. For the future, a high growth potential is predicted. Since the Corona pandemic in 2020, it is speculated that it will change the purchase of groceries in the long term [31].

In this chapter, the characteristics of e-food and its position in Germany will be introduced. Furthermore, sales and market leaders as well as consumer behavior in the area will be presented.

### 2.2.1 Business models

Mainly, there are three business models in the e-food market. The first business model describes established food retailers such as *Rewe* and *Edeka* who expand their sales channel with e-commerce and thus, became multichannel providers. The second group are so-called pure players of the e-food market who solely sell food online and build an online business. The last business model consists of e-marketplaces of logistic experts, such as *Amazon* and *DHL*, who include food into their product range and build an e-food business in addition to their shipping network [29]. Customers can order the groceries online from e-food retailers and get them either delivered to a specific address or pick them up at a store and at a pre-arranged time [30].

In addition, there is another special form of business model in the e-food market. So-called Aggregators serve as online platform for regional producers, i.e. an online farmers' market. The ordered goods from farmers in the surrounding area can either be picked up at a local store or delivered. An example for this exceptional model is the website *The Food Assembly* [28].

A further distinction can be made between e-food providers with a full-range assortment and a specialty assortment, where delicacies or organic products are offered [28]. A specialized online provider focuses on a specific market segment and usually has a unique selling proposition compared with less focused online offerings and traditional retail [30]. Mass customization models, that offer individualized products (e.g. *myMuesli*), complement these specialty e-stores. In addition, other innovative business models such as a subscription of meal-kits exist [28].

### 2.2.2 Sales and market leader

In Germany, online retailing is a fast-growing sector that achieved a growth of around 9% in 2019. With annual sales of €58 billion, it takes 11% of the sales volume of the German retail sector [32]. Nevertheless, the food and personal care segment is worldwide the smallest e-commerce category [35]. E-food retailers on the market are still in their establishment phase and face a well-developed network of stationary grocery stores [32].

According to the *Bundesverband E-Commerce und Versandhandel*, food sales in online retail were €618 million in 2014. In contrast, online grocery retailers sold approximately €1.4 billion in 2018. Hence, the sales doubled and increased by €742 million within four years [36]. In 2020, sales were approximately €2.2 billion. Sales in 2024 are predicted to be up to €2.9 billion [37]. In comparison to other countries, Germany has a low proportion (33%) of online food shoppers. With 91%, China has by far the most online food shoppers, followed by the US and UK with 52% [38].

*HelloFresh* with €479.4 million sales takes the leading position among other e-food retailers in 2018. The second most-selling retailer in Germany was *Amazon* with €218 million and *Rewe* generated sales of €30.4 million [39]. The Statista Global Consumer Survey in 2020 stated that *Edeka24*, *BoFrost* and *Eismann* were other suppliers where consumers ordered from in the last 12 months [40].

Due to the global corona pandemic, the demand for e-food offers is rising in Germany. Online food retailers are reporting a considerable increase in orders and a high rate of new customers. *Bofrost* assumes an increase of 100% compared to the previous year. This may be a consequence of the governmental request to minimize personal contacts [32].

### 2.2.3 Purchasing and consumer behavior

According to *Statistisches Bundesamt*, consumer expenditure for food in Germany increased by €60 billion in 28 years. In 1991, consumers spent €102,1 billion and this amount has risen to €161,9 billion in 2019 [41]. The strong correlation between expenditure on food and the intensity of online food purchases confirms that the greater the household expenditure is, the more regularly food is ordered via the Internet [32].

In principle, consumers have a good attitude towards e-food. In a study with 1050 participants by the *Bundesverband Digitale Wirtschaft* in 2018, 37% stated to have already ordered food online and are willing to do it again. 32% of the participants did not have any experience with e-food, but are inclined to give it a try [42].

A distinction has to be made between online shopping in general and grocery shopping. Due to the perishability of food products and the frequency of the shopping activity, grocery online shopping differs considerably [43]. However, consumers who are open towards e-commerce, are also more willing to buy groceries online [32].

In terms of time and effort spent, consumers who shop groceries online, don't behave differently from those who use stationary channels [44]. Nevertheless, consumers don't have to spend as much time to orient themselves and become acquainted with the online shop's assortment as it would be at a store [45]. They expect at least the familiar service that they are used to from stationary retailers, such as large assortment range or easy transaction flow [32]. A comparative study of food stores and online grocery shops in 2020 concluded that consumers place more importance on an extensive selection and the possibility of price comparison when purchasing groceries online compared to a stationary supermarket. In contrast, consumers place value on good customer service and the possibility to touch and use the products while shopping in stores [46].

Consumers on the e-food market primarily purchase non-perishable products. In the *Statista Global Consumer Survey* of 2018, the majority of participants bought coffee/tea, snacks and wine in the last 12 months [45].

### **Consumer group**

Consumer groups that benefit more from online grocery shopping, are consequently more open to it [7]. Especially the convenience aspect presents a benefit to young consumers or young families compared to a stationary grocery store. Due to their modern lifestyle, they may want to save time. The mobile access via smartphones poses additional value [28].

According to *Statista* in 2018, one quarter of users in the e-food market are between 25 and 34 years old. Individuals between 35 and 44 years as well as

between 45 and 54 years, each make up about 20% of the users in the e-food market [47]. It must be noted that for elderly consumers with limited mobility, it may be a considerable benefit, since it eliminates the need to carry heavy goods [7]. The question remains, if more consumers can be reached with increasing affinity for technology and improving the usability of online grocery shops [28]. Nevertheless, both age groups are in strong need of convenience while shopping groceries online [7].

According to a study of *Ernst & Young* in 2017, women are more inclined to buy groceries online than men [32].

### **Advantages and disadvantages from a consumer perspective**

The main drivers of e-food are the awareness of its benefits, necessity for more convenience and changing the lack of trust in the online channel. Consumers perceive the most convenience in saving time and reducing physical effort when it comes to e-food. Especially in terms of product quality and delivery time, they expect the e-food service to be worth the cost [7]. According to the *Statista Global Consumer Survey* in 2018, the price-performance ratio, product quality and freshness are the most important factors for consumers when ordering groceries online [48].

A study with 1050 participants by *Bundesverband Digitale Wirtschaft* in 2018 concluded that the most frequently mentioned advantages of online grocery shopping are the ability to purchase food independently of opening hours, the lack of physical burden carrying groceries and saving of time. Furthermore, the study found that not having to go into a crowded store and not being restricted to a store location as well as the fast search for specific products, were considerable benefits of e-food from a consumer's perspective [49].

In contrast, the consumers mentioned as disadvantages the fact that the products can't be examined in person, temporal constraints regarding the delivery as well as high delivery costs. About one third of the study participants perceived a higher price than in stationary retail and the lack of the shopping experience as drawbacks in e-food [50].

### 2.2.4 Challenges and opportunities

Establishing the e-food market in Germany is associated with challenges, which include the strong competition in the grocery market due to versatile consumer demands [32], the dense network of stationary grocery stores, and the high price sensitivity of German customers [28]. In order to offer e-food solutions nationwide and maintain the cold chain of different products, the expansion and optimization of logistic structures are required [28].

Furthermore, in the field of e-food, consumers fear electronic payments and the protection of data privacy [45]. Due to their skepticism, they may not forgive mistakes, such as poor user experience of e-food platforms [7].

However, digital platforms also offer a number of opportunities such as facilitating the access to products and services. Adjusting processes more efficiently can result in a lower environmental impact or change in consumer behavior. By boosting sales of regional products and making products accessible to a wide consumer group, the social and economic sustainability can be influenced. Product range, cultivation and packaging also have an impact on ecological effects [31].

## 2.3 Sustainable food consumption

Climate change is one of the greatest societal challenges of our time. The world's population consumes more resources than it is entitled to over the course of a year, to sustainably cultivate the planet. In 2019, the so-called Earth Overshoot Day was July 29. This means that the 156 remaining days of the year were spent living beyond the planet's natural resources [1]. The world population would need three planets, if it would live like Germany's population [51]. Due to a steadily growing world population and limited resources on our planet, it is necessary to address how the standards of living of nine billion people can be met in the future [4].

Sustainability problems caused by food systems will likely worsen [2]. The consumption of private households alone is responsible for more than one quarter of all greenhouse gas emissions in Germany. The consumption of products increasingly influences not only people's economic and social situation, but also the condition of the environment. Consequently, there is great

potential for reducing the environmental impact in the use and manufacturing of products [4].

The current setting can be considered as unsustainable due to industrialization and globalization of agriculture and food processing as well as the shift of consumption patterns towards a diet with more animal products – to name just a few reasons [2].

### 2.3.1 Definition and classification

According to the *Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit*, sustainable consumption is a consumer behavior that considers environmental and social aspects when buying and using products [4]. Sustainability is aimed at the whole value chain and ranges from the extraction of raw materials, through production and distribution of the product, to consumption and ultimate disposal [1].

Food consumption and agricultural production fulfill multiple social and individual functions, but can harm the environment in different ways and can have negative social consequences [52]. The ecologically sustainable approach implies resource-saving and environmentally friendly ways of production and consumption of everyday goods. A consistent approach to sustainable consumption does not exclude the avoidance of certain products. In addition to the ecological components, social sustainability also plays a role, which covers compliance with defined standards in labor law as well as a fair payment of the workforce [1]. The current study focuses only on the ecological component.

Consumption is sustainable, if it meets the needs of the present generation without compromising the ability of future generations to fulfill their own needs. In Germany, consumption impacts both the environment and people in other countries due to global production processes and supply chains. Sustainable consumption particularly covers conscious consumption and adhering to one's own overall balance [4].

To mitigate the consumption-related negative impacts, the German government adopted the National Program for Sustainable Consumption in 2016.

The *Bundesanstalt für Landwirtschaft und Ernährung* contributes to its implementation through project funding and support of various specialized programs [52]. The strongest developments with regards to sustainable consumption were seen in the food and clothing segments [1].

### 2.3.2 Purchasing and consumer behavior

According to *Statistisches Bundesamt*, consumer spending on food by private households was €161.92 billion in 2019, an increase of approximately €37 billion since 2010 [53]. When comparing 2018 and 2019, sales of consumer goods related to sustainability increased in all of the following segments: regional products, organic products, natural cosmetics, vegan and vegetarian products, and products from fair trade. The strongest increase of €1.2 billion in sales was seen in organic products, followed by regional products with a sales increase of €700 million [54].

A study by the *University Göttingen* in 2018 indicated that German consumers place the most value on good taste and high quality. At the same time, particular attention is paid to a low price and the regional origin of the food. Approximately 30% of the participants in the study consider organic characteristics when purchasing groceries [55]. German consumers pay equal attention towards organic food and sustainability of the packaging [56].

Furthermore, the preference for products from regional cultivation has increased gradually since 2016 [57]. More people would be willing to pay a higher price for regional products and increasingly perceive the regional reference with brands. The desire that brands are produced socially and ecologically is strongly present [58]. However, a sustainably and environmentally friendly produced product should be at most 10 to 20% more expensive than a conventionally produced product, according to the results of a study by the *IUBH Internationale Hochschule* in 2020 [59].

The willingness to purchase high-priced organic products increases with a higher household income. The higher price of organic food is explained by the more cost-intensive production in organic farming. German consumers buy organic products because of their regional origin. The terms "organic" and "regional" are closely associated among many consumers, but regional

products do not necessarily have organic origins [1].

According to a study by the *IfD Allensbach* in 2020, individuals between the ages of 50 and 69 place particular value on organic products. People aged 20 and over are increasingly willing to pay more for good quality food. However, the majority of those, who would pay more for environmentally friendly products, are 40 years and above. With increasing age, the preference for regional foods grows. This characteristic is particularly noticeable among people aged 70+. All age groups pay roughly equal attention to price [51]. Purchasing decisions depend on what consumers perceive as the right combination of offer, price and information [60].

According to the *Bundesverband der Energie- und Wasserwirtschaft*, German consumers are willing to change their behavior in order to protect the environment and the climate. Concerning food consumption, the willingness to buy regional and seasonal foods as well as reducing their meat consumption is strong [61].

A study from 2011 examining ecological consumption behaviors, found that consumers don't know enough about the environmental impacts of their food choices [62]. The idea of seasonality and regional supply is increasingly fading away in industrialized countries due to an extensive range of available foods all year round. Consumers have become estranged from the production of their food. The numerous options overwhelm consumers and present them with complex food choices [2].

### **2.3.3 Environmental impact of agriculture and food consumption**

Global food production has the single largest impact on the planet's environment [6] and accounts for 26% of the global greenhouse gas emissions. This portion is composed of on-farm production emissions, crop production for human consumption and animal feed, land use for livestock and crops, food processing and waste as well as supply chain emissions. Just for agriculture alone, half of the habitable land and 70% of the global freshwater withdrawals are used. In addition, 94% of mammal biomass, excluding humans, accounts for livestock [3]. Agricultural production often has the most

important impact, but it also depends on the type of product and its production as well as transport and processing [63].

In 2018, Germany was the 6<sup>th</sup> largest CO<sub>2</sub>-emitting country by share of global greenhouse gas emissions and emitted about 2% of the world's CO<sub>2</sub> emissions [64]. From 1990 to 2019, Germany managed to reduce its CO<sub>2</sub> emissions by about 35%. The goal of the German government is to eliminate its greenhouse gas emissions completely by the year 2050 [65].

Around one-fifth of the climate impact of a citizen in Germany is caused by food. This accounts for approximately two tons of carbon dioxide equivalents (CO<sub>2</sub>-e) per capita and year, which are caused by a person's diet alone. With a particularly climate-conscious diet, about half that amount, i.e. one ton of CO<sub>2</sub>-e per year, can be avoided. However, with a high meat consumption, many airfreighted products and vegetables from heated greenhouses, the emissions can easily reach three tons and more per person. Thus, nutrition influences the global climate, and climate-friendly food choices are an important contribution to climate protection [5].

### **The environmental cost of groceries**

Often, people believe that food from local producers has a smaller carbon footprint than non-local food. This presumption would be true, if the transport represented a significant portion of the food's environmental impact and most of the food was transported by plane. For most foods, this is not the case. Greenhouse gas emissions caused by transportation account for less than 10% of the majority of foods. In addition, all parts of the supply chain, such as processing and packaging, make up a small share of CO<sub>2</sub>-emissions [3].

Even though CO<sub>2</sub> is the most important greenhouse gas, agriculture produces a large share of the greenhouse gases methane and nitrous oxide. The term "carbon dioxide equivalents" (CO<sub>2</sub>-e) includes these emissions as well and covers all greenhouse gas emissions from food production [3].

The general conclusion of a study by the *Institut für Energie- und Umweltforschung Heidelberg* is that fresh, seasonal and regionally grown fruits and vegetables are usually significantly more climate-friendly than out-of-season food items imported from distant regions. A dietary shift to less meat and

dairy products would be the most important behavior change for a sustainable nutrition. It focuses on the impact of different food supply processes on the carbon footprint of a food product, e.g. packaging, transportation and growing systems [66].

The choice of transportation can make a difference: A fresh pineapple transported to Germany via ship generates 0.6 kg of CO<sub>2</sub>-e per kilo, as opposed to 15.1 kg of CO<sub>2</sub>-e via plane, which accounts for 25 times the amount [66]. Many foods have a specific harvest season, however, the consumer demand for these products exists all year-round. To provide this availability, three options exist: the product is imported from countries, where it is in season; energy-intensive production methods are required, so that it can be harvested throughout the year; or certain preservation measures are applied, so that the products can be stored for several months [3]. A tomato grown in season in Germany generates 0.3 kg CO<sub>2</sub>-e. In winter, on the other hand, it is grown in a greenhouse, heated with fossil energy, and emits 2.9 kg CO<sub>2</sub>-e. Therefore, an outdoor tomato from southern Europe is a better choice in colder seasons [66].

In some cases, meat, milk and eggs organically produced performed worse in terms of greenhouse gas emissions than products from conventional farming. The reason being that organic farms need more land to produce the same amount of these products. Looking at CO<sub>2</sub> emissions alone can therefore falsify the overall ecological assessment. The slightly higher emissions are compensated for by the lower use of pesticides, more sustainable soil management and an increased biodiversity [66].

### 2.3.4 Measures

To fight climate change, the Paris Agreement aims at keeping the global temperature increase of this century well below 2°C [67]. The Exponential Roadmap proposes a shift towards a healthy, plant-based diet and hence, reduced meat consumption as well as reduced food waste as a strategy to minimize the emissions caused by the food sector. Measures for this strategy could be, for example, new nudges for sustainable behavior or carbon pricing for the food system [6].

Without changes in dietary patterns, the challenges of climate protection and the ambitious reduction targets, also signed by Germany, can hardly be

achieved in the food sector.

The food sector, unlike other sectors of the economy, cannot become completely emission-free due to the greenhouse gases naturally produced in agricultural production. By omitting animal products, it is possible to halve the CO<sub>2</sub> emissions caused by diet. A comparable level of emissions would also be achievable with a flexitarian diet, if the products were technically optimized, for example, greenhouses heated entirely with renewable energies [5].

### **Climate label for food in Germany**

After a successful signature campaign by the Swedish company *Oatly*, the Petitions Committee of the German *Bundestag* dealt with the issue of climate labeling in 2020. Consumers have little opportunity to consider climate impacts in their behavior. A climate label would increase transparency for climate-conscious consumers and would raise awareness in the food industry with regards to climate protection.

It is almost impossible for consumers to realistically assess the climate impact of individual foods. People don't know very much about foods that are particularly harmful to the climate. Consumers are often mistaken, for example, by assigning the highest climate relevance to plastic packaging or overestimating the importance of transport distance. The dimensions of greenhouse gas emissions from different foods are not transparent for the population and are underestimated in general. The reasons for this ignorance in society are unknown food production processes and a lack of understanding about the high levels of methane and nitrous oxide emissions.

The retailer *Tesco* attempted to measure the exact greenhouse gas emissions of various brands. Measuring the specific carbon footprint of a single product from a particular manufacturer cost *Tesco* about 50,000 to 60,000 euros. As a result, the company had stopped greenhouse gas labeling relatively quickly. Previous attempts to establish a climate label failed because they started out too ambitiously. It would be more promising to start with standard values, i.e. to show the average values for the product category.

A climate label based on standard values is an important tool for consumers to shape their eating habits in a sustainable way to reduce climate costs. Furthermore, it can contribute in objectifying climate policy and could lead to an increase in policy acceptance for climate measures in society [5].

## Chapter 3

# Material and methods

The approach of the current study is based on the method Design Thinking and was divided into four parts: requirement analysis, conception, prototyping and evaluation.

Design Thinking is a user-centered method, which illustrates an iterative process for empathizing with users, redefining problems in human-centric ways and creating innovative solutions. This design methodology can be useful for prototyping and user testing in order to match users' needs [68].

In order to develop an online grocery shop with persuasive elements, it was necessary to research the motivations and pain points of the target group. In the beginning, the domain analysis intended to identify functional and visual requirements, such as mental models and familiar metaphors of the user group, and analyze competitors in the e-food domain. By conducting an online survey, it was intended to find out the purchasing behavior and attitude towards the topic sustainable food consumption and gain insight into the users' needs. The results and assumption about the target group contributed to forming two personas that helped maintaining a user-centered view. They were developed to visualize the target group, built empathy with the users and helped keeping their needs and expectations in mind. These steps represent the phase requirement analysis.

Then in the conception phase, ideas were generated and a concept of a grocery online shop was developed based on the design principles of the PSD model. In the next step, the concept was evaluated by interviews with the target group.

In the phase prototyping, the concept was implemented prototypically with the software Adobe XD. Two high-fidelity prototypes were realized, where one of them contained the persuasive elements of the concept. The second prototype was developed to enable the comparison between the results of

the two.

The final phase, evaluation, included establishing a strategy to evaluate the prototypes and conduct A/B testing with the target group. The intention was to investigate the effect of the Persuasive Systems Design model in the context sustainable food consumption.

After collecting data from each phase, the results of previous inquiries were re-evaluated and adjusted. In the early stages of the study, it was assumed that food's regional origin is the key to sustainable food consumption. In later research, it became clear that many factors – besides the origin of the food – influence its level of sustainability. These findings were then integrated into the process accordingly.

The target users were supposed to choose sustainable food options rather than other ones and make conscious consumption decisions. The objectives were to investigate how and which principles of the PSD model to apply in this context and to develop an online grocery store in such a way that it achieves this behavior change.

### 3.1 Target group

The target group was restricted to individuals aged 20 to 34 years. A *Statista* study from 2018 showed that the largest proportion of users in the e-food market is between 25 and 34 years old [69]. For young consumers, the benefit of grocery online stores is especially the convenience aspect [28]. Another research by *IfD Allensbach* showed that the majority of people who like to shop online are between the ages of 20 and 29 [70]. Consequently, these people were addressed as well as those who would have a higher potential of using the application.

In addition, certain assumptions were established concerning the needs and pain points, which will be evaluated with the feedback from the target group in subsequent phases.

- The target group has no time or motivation to figure out the foods' degree of sustainability and lacks an incentive.

- Target users lack knowledge regarding the environmental impact of their food choices and information to make a sustainable decision.
- They are willing to spend more money on sustainable products.

## 3.2 Requirement analysis

In order to meet the users' requirements, it is necessary to understand their motivations, pain points and situational factors. First, by analyzing the e-food domain, functional and visual requirements of grocery online shops as well as competitors should be identified. This should give an overview of the technology context. The user context was analyzed by an online survey that gives insight into the purchasing behavior and attitudes of the target group. Furthermore, two personas were created to empathize with the target users and maintain a user-centered perspective. These measures should help gaining insight into needs of the users.

### 3.2.1 Domain analysis

The domain analysis is an early step in the process and represents the research of the persuasion context with regard to the event and the technology context in the PSD model. It gives information about the functional and visual requirements as well as properties of competitors in the domain.

The method is a way to compare properties of competing products and develop improved solutions building on what already exists. It can point out established featured functionalities, mental models of the users as well as strengths, weaknesses, threats and opportunities [71]. The competitive analysis demonstrates existing features of competitor's solutions, industry standards and potential opportunities for innovations [72].

For the analysis, the three top-selling providers of grocery online shops from 2018 were examined: *Rewe* [73], *HelloFresh* [74] and *Amazon* [75] [39]. The *Statista Global Consumer Journey* in 2020 showed that, in addition to the above mentioned retailers, consumers also ordered foods from *BoFrost* [76] in the last 12 months [40]. Three of the four providers of online shops mainly sell groceries, either fresh or frozen products. *HelloFresh* offers meal-kits that contain the exact ingredients and can be cooked at home.

### Functional requirements

General functional requirements for grocery online shops are a website or mobile application where the available products are offered. The users require a computer or a mobile device. The retailers offer different payment and shipping options. For example, *Rewe* offers a pick-up service, which implies that the assortment differs between branches and the location of the customer is necessary. Customers must create an account with their personal information to order from each retailer. As inspiration, the online retailer *Bofrost* and *Rewe* offer recipes, whose ingredients can be added to the shopping cart at once. Also, products can be set as favorites in the customer's profile.

Users follow an ordering workflow: They search for a product or browse the available goods and add the desired product to the shopping cart. They expect to be able to filter the products and take a closer look at the details of a product. When they have decided on different foods, they start the process of ordering the products. Users assume that they can review the items in their shopping cart as well as their personal shipping and payment information. Here, the metaphor of a physical shopping cart for the desired products is used.

### Visual requirements

The design approach of the above mentioned provider's mobile application differs between the retailers: Some have a simple design and navigation and a limited amount of options to choose from. Others show a lot of information and navigation options at once and have an inconsistent color scheme. A main difference between the retailers is the type of navigation. For example, *Bofrost* has a burger menu while *HelloFresh*, *Amazon* and *Rewe* have a tab menu. Users can either search for a specific product or navigate through the product categories. A search bar is positioned at the top or as a part of menu.

The shopping cart is displayed at all times with an incrementing badge when products are added to the cart. Products are commonly displayed in tiles or in a list with a representative picture, the quantity and price as well as a button to add the product to the shopping cart. In the list of products, there are visual elements to filter the findings for specific characteristics. When clicking on a product, a detailed view is displayed with additional information.

### Comparison of the providers

	<b>Rewe</b>	<b>HelloFresh</b>	<b>Amazon</b>	<b>BoFrost</b>
<b>Business model</b>	The stationary retailer expanded their sales channel with an online store. It offers two different shipping options: pickup and delivery.	<i>HelloFresh</i> offers meal-kits that can be composed individually in a weekly subscription. The meal-kits contain fresh, seasonal ingredients of selected providers and cooking instructions.	<i>Amazon</i> has established an online retailing business with an extensive selection of products, such as canned food, beverages, pasta and cosmetic products.	<i>Bofrost</i> offers refrigerated or frozen products, such as instant meals, vegetables and fruits, wine and kitchen utensils.
<b>Strengths</b>	<ul style="list-style-type: none"> <li>• offers the option to pick up their order.</li> <li>• well-known from stationary retailing.</li> <li>• The grocery online shop suggests recipes for inspiration.</li> <li>• may be familiar to customers and has recognition value due to the corporate design.</li> </ul>	<ul style="list-style-type: none"> <li>• guides the user through every step of the selection process.</li> <li>• Users are able to personalize their meal-kits and choose from recipes.</li> <li>• emphasizes the environmental benefits.</li> </ul>	<ul style="list-style-type: none"> <li>• well-known from its retailing branch and may be familiar to customers.</li> <li>• Each product has a rating and reviews from customers.</li> </ul>	<ul style="list-style-type: none"> <li>• has an extensive selection of its specialized category.</li> <li>• Each product has a rating and reviews from customers.</li> <li>• has a plain design and consistent color scheme.</li> <li>• suggests recipes for inspiration.</li> </ul>

TABLE 3.1: Comparison of the providers *Rewe*, *HelloFresh*, *Amazon* and *BoFrost* in terms of business model and strengths

Considering these findings, several potential opportunities arise. A grocery online shop with a clean, plain design and clear navigation has no chance of information overflow. The ordering process can be simplified by guiding the users and limiting the product selection with suggestions. Taking into account the success of *HelloFresh*, a grocery online shop with more emphasis on the aspect of sustainability, such as considering carbon footprint or origin of food, and highlighting its benefits, can be created.

The mental models are considered in the design of the grocery online shop to meet user expectations without having to relearn workflows.

	<b>Rewe</b>	<b>HelloFresh</b>	<b>Amazon</b>	<b>BoFrost</b>
<b>Weaknesses</b>	<ul style="list-style-type: none"> <li>• shows a lot of information at once, which could lead to an information overflow.</li> <li>• There are many selection and navigation options that can be confusing for the users.</li> </ul>	<ul style="list-style-type: none"> <li>• Customers only have a limited selection of recipes and meal-kits.</li> </ul>	<ul style="list-style-type: none"> <li>• has an unclear design and color scheme as well as navigational structure.</li> <li>• shows a lot of information at once, which could lead to an information overflow.</li> </ul>	<ul style="list-style-type: none"> <li>• selection is limited to frozen products.</li> </ul>
<b>Potential threats</b>	<i>Rewe</i> is a well-known and established business which expanded to online retail.	<i>HelloFresh</i> guides its customers through the process and emphasizes the environmental benefits of their service. They eliminate the fact that customers are spoiled for choice.	<i>Amazon</i> has an extensive selection of products and is well-known for its online retail.	<i>BoFrost</i> is specialized on one specific category of groceries.

TABLE 3.2: Comparison of the providers *Rewe*, *HelloFresh*, *Amazon* and *BoFrost* in terms of weaknesses and potential threats

### 3.2.2 Online survey

As part of the target group research, an online survey was conducted in the beginning. This research method questioned a large number of people from the target group and asked them a set of questions on a specific topic via the Internet. It can give insight into their behavior and attitudes and can be used remotely and with little effort. Online surveys usually provide quantitative data. Although, qualitative data can also be obtained by asking open questions [77].

### Structure of the online survey

The survey mainly collected quantitative but also qualitative data about the target group on the topic of food consumption and purchasing behavior. The goal of the survey was to analyze the user context in the PSD model and build empathy towards the target group. The survey was conducted via the tool [umfrageonline.com](https://umfrageonline.com). The online survey can be found in Appendix B.

First, the target group was asked about the purchasing and consumption behavior in stationary grocery retailing. The aim was to find out in which environment and frequency they usually shop for groceries. The attitude and values of the target group were also investigated. A 5:1 Likert scale was used to measure the attitude.

In the second part of the survey, their purchasing and consumption behavior in online grocery retailing was examined. The intention was to find out whether individuals from the target group have already come into contact with online food retailing. Depending on the experience, the subsequent questions would appear and the attitude of the users and their background was examined. Then, they were asked about perceived advantages and disadvantages and attitudes and motivators with regards to online grocery shopping were investigated. A 5:1 Likert scale was used to determine the attitudes. Furthermore, the target group was questioned which information and stimuli are particularly important in a purchase decision. The different options were to be weighted 6:1 depending on preference.

In the requirements analysis, it was assumed that the origin of the food has a decisive impact on the sustainability of a product. Therefore, part of the survey focused on this aspect and the purchasing behavior of regional food as well as the importance of the food origin were investigated.

The last part of the survey covered opinions towards food sustainability as well as aspects of the PSD model. The purpose was to investigate what the target group thinks about sustainability and how they judge the sustainability of grocery products. In addition, they were asked to decide to what extent they agree with possible features of a grocery online store. A 5:1 Likert scale was used for measurement.

Finally, the last question examined the attitude towards aspects of the PSD principles Tunneling, Social Comparison, Rewards, Real-world-feel and Suggestion. Thus, the idea was to find out what would motivate the users. The different options were weighted 6:1 depending on preference. The demographic data of the participants was collected to assign certain characteristics, such as gender, age or diet, and to classify the respondents.

### **Results of the online survey**

The survey was distributed to individuals of the target group and conducted over a five-day period. 79 people participated, ranging in age from 20 to 34 years. The proportion of female and male participants was equally distributed, one person did not give any information about gender. A large proportion of respondents live in shared housing and the majority were students. The diet of 66% of the participants is omnivorous, i.e. they do not restrict their diet.

**Purchasing behavior in stationary retail** The supermarket was the most common place to purchase food and a large proportion of the participants commonly shopped at discounters and organic food stores. About 14% of the survey participants ordered groceries in the Internet. Unpackaged and deli stores were the least common places to shop. Most of the respondents go grocery shopping several times a week.

Good taste was the most important criteria, followed by high quality and freshness as well as species-appropriate animal farming. The participants of the survey indicated that they pay attention to ecological production, little or no packaging material and the food's shelf life. Regional origin and seasonal food were rated as only partly important. Furthermore, what they valued most of the shopping experience were large selection, discovering new things and low-price offers. The ability to compare prices and use the goods immediately were also important whereas the interpersonal element and good advice were least important.

**Purchasing behavior in online retail** About one third of the participants had already ordered food online. Out of these, two would not do it again. The remaining respondents have not yet ordered food online and 18 out of these, cannot imagine doing so.

The participants, who have ordered online, indicated the provider from which they have ordered food online: *Amazon* was mentioned seven times, *Rewe* and *HelloFresh* six times. *Etepetete* was mentioned three times. The current Covid-19 pandemic was the most cited reason for buying groceries online. Lack of availability at the supermarket, as well as quantity and package size, were also frequently mentioned reasons by the participants. Convenience, price advantage and food from regional producers were cited by three people. Fruits, vegetables and pasta were the most frequent foods ordered online. Fish and frozen foods were the least ordered online items. The majority of individuals, who have already ordered food online, ordered it via the laptop. Almost half of the participants used their smartphone for this purpose. In contrast, 46 participants of the survey have not yet ordered food online. The most-frequent reason was that they would like to inspect the groceries themselves, followed by the short distance to the supermarket. Nine people do not see added value in ordering food online as opposed to the stationary retail. Furthermore, the freshness of the food and the change from everyday life were named as decisive points that prevented participants from shopping online.

Participants in the study perceived the lack of spontaneity as the greatest disadvantage of online grocery shopping. Other disadvantages mentioned by the majority were limited viewing options, long delivery times, the unfamiliar way of grocery shopping as well as delivery costs. Three individuals referred to the additional environmental impact of transporting the food. The biggest advantages in online food retailing were seen in independent ordering and home delivery as well as independent opening hours, faster search for specific products, and the feature of not having to go to a crowded supermarket.

Regarding the product information when buying groceries online, the respondents were mainly interested in photos of the product. The next most important information was the country of origin. They also found information on production, nutritional values, 100 g price and detailed description of the product particularly interesting.

**Importance of food origin** The regional origin of food was rather important to the majority of the studied target group. About one third of the participants stated that it is important to them to some extent whereas for 11%,

it is rather unimportant. The majority of respondents purchased locally produced foods once a week, about a quarter bought them several times a week. The majority bought regional foods in supermarkets and the least, regional food is bought at the farmer or via the internet.

**Opinions towards sustainability and aspects of the PSD model** The target group defined the sustainability of a product by the regional origin of a product, species-appropriate farming of animals, and little or no packaging material. According to the participants, certifications such as *Nutriscore*, production without harmful materials and a short supply chain are less decisive.

They were also asked about possible features of a grocery online store. The majority would prefer buying groceries from local producers, even if this meant that the assortment of the online shop would be reduced. They would also be willing to pay more for a product, if it came from regional cultivation. These results suggest that the target group is willing to buy regional food. In addition, they do not particularly care what their surroundings think about their ecological footprint. Thus, it can be assumed that the persuasive design principle Social Comparison may not be suitable.

Finally, the view on aspects of the persuasive design principles was examined. When buying food, the participants are most interested in detailed information about the production and the supply chain of the food. This result stresses the suitability of the principle Real-world feel. The majority of respondents were interested in the costs of a purchase in terms of CO<sub>2</sub> emissions. This feature agrees to the Tunneling principle. Suggesting appropriate recipes for selected foods was the least popular. In addition, their views about food discounts and offers - representing the principle Rewards - tended to be positive but not particularly strong.

In general, the results of the online survey were informative about the user context. They indicated that most of the participants don't have experience with grocery online shopping. The food origin from local producers is important to them and they also attached value to good quality, freshness and animal welfare.

The participants identified the sustainability of a product by the regional origin, welfare of animals, and little or no packaging material. They would also be willing to pay more for a product, if it came from regional cultivation. It was obvious that the target group did not particularly care about the opinion of their social surroundings about their ecological footprint. When purchasing food, they were most interested in detailed information about the production and the supply chain of the food. The costs of a product in CO<sub>2</sub> emissions interested the majority of respondents. Potential motivators were the benefits of grocery online shopping such as home delivery, independent opening hours and the fast search for specific products. However, the target group regarded the lacking spontaneity and examination of products as well as the long delivery and its cost as problems.

### 3.2.3 Persona

Personas are fictional representations of user types that embody a target group regarding certain characteristics such as attitude, motivation and behaviors. They are created to empathize with target users and are usually based on user research [78]. The method can be helpful keeping a user-centered perspective and avoiding inappropriate generalization while designing as well as in communication with stakeholders [79].

Taking the constraints and assumptions about the target group as well as the results of the online survey into account, the following personas were created.

#### **Persona Anna “The environmentally conscious”**

Anna is a 24-year-old sociology student who lives in a flat share in Berlin (Fig. 3.1). Recently, she became vegetarian because she wants to pay attention to her carbon footprint. She thinks that everyone can contribute to climate protection: „The future of our planet is very important to me. Everyone can do their part.“ In her spare time, she works voluntarily at a second hand store and likes to go for coffee with her friends at a local café. She is an extroverted person with liberal viewpoints and has a determined spirit.

Anna uses her phone to stay in contact with her friends and up-to-date about events around the world. However, one could say that she is not a digital expert. She has not yet ordered groceries online and believes that existing

services are confusing. She finds the ordering process too complicated.

Anna consciously buys food and deals with its environmental qualities. This is very important to her. She would rather waive a product than buy it with a guilty conscience. She pays particular attention to origin and little packaging waste. Furthermore, she is willing to spend more money on sustainable products, especially from local producers. However, Anna has no income and hence, must look out for price. Unfortunately, she can only pay attention to sustainability up to a certain level. It is difficult for her to keep an overview with so many products with different labels etc. She would like to know more about the background story of the products to inform herself correctly.

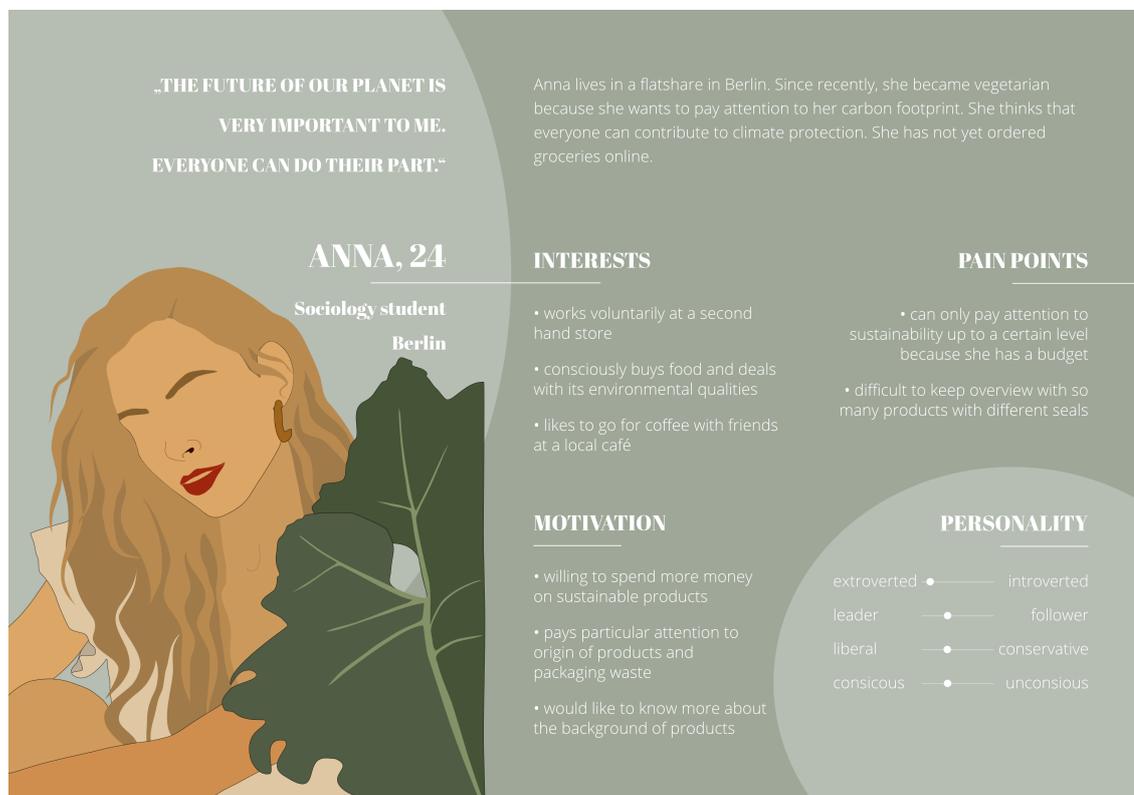


FIGURE 3.1: Persona Anna

### Persona Manuel „The willing, but no time“

Manuel lives in a flat in Munich and works as Project Manager in a small company (Fig. 3.2). He loves his work and was promoted recently. He has a rather introverted personality and likes to play tennis in his spare time, but

rarely plays because he works a lot. He usually goes grocery shopping spontaneously.

Due to the Covid-19 crisis, he has ordered food online before and has experienced how efficient and beneficial grocery online shopping can be. He believes, it is great to save time and getting the products delivered. Manuel is more of a digital expert and uses his smartphone a lot for business and private purposes, e.g. communicating on Instagram or writing emails.

He does not restrict his eating style, but rarely eats meat. It is important to him to buy good quality products. Manuel particularly tries to pay attention to species-appropriate husbandry of animals. He would like to shop sustainably because it is an important issue in society, but says: „I would like to pay more attention to sustainability, but it’s such a complex topic and I just don’t have time to deal with it.“

Price does not play a role to him when grocery shopping. He usually goes for the most expensive product, thinking that, if it is so expensive, then it will surely be justified. He does not have enough background knowledge to understand the environmental impacts of foods and to implement a sustainable diet. Furthermore, Manuel finds it difficult to identify which is the most sustainable product. He has no time to deal with this while grocery shopping and wishes that the process was easier and more effortless.

### **3.3 Conception**

In the phase Conception, a concept for the grocery online shop was developed, including certain design principles of the PSD model. In the beginning, an ideation took place, in which the concept was formed. Interviews with the target group were conducted to get relevant feedback and evaluate the concept.

#### **3.3.1 Concept *FoodPrint***

In the last phase of the Persuasive Systems Design model, the design of systems qualities is in focus. Therefore, the PSD model provides four categories with overall 28 persuasive system design principles. Every category of design support was thoroughly examined and hence, suitable principles were



FIGURE 3.2: Persona Manuel

selected to apply to a grocery online store. Considering the findings of the persuasion context analysis, ideas were generated and the following concept of a grocery online store was developed.

Based on the prior findings of the online survey where the target group would be interested in detailed information about the food production and its ecological impact, the grocery online store, called *FoodPrint*, was developed. It is intended to help making sustainable food choices and raise awareness and understanding on the consumer side for their environmental impact. The aim is to accommodate target users such as the personas Anna and Manuel. The target behavior is intended to be achieved with the help of the mobile application *FoodPrint*, which is based on the following concept.

In the grocery online store, customers receive a certain budget of CO<sub>2</sub> emissions that can be spend per week. This should help tracking their own environmental impact. As an incentive, users who adhere to the CO<sub>2</sub> budget, are given free shipping of their purchase as a discount. Otherwise, they pay the regular price of the products. The products of the store's assortment are visually labelled with the level of sustainability and CO<sub>2</sub> values to simplify

the target behavior and the assessment of the groceries for users. *FoodPrint* is designed in a clear and appealing way and provides detailed background information per product (e.g. its producer), which gives users the possibility to inform themselves in detail about the food. Furthermore, users are shown more sustainable alternatives when considering a product, if available. This concept intends to support the user in choosing sustainable options.

In the following, the design principles and their implementation in the grocery online shop *FoodPrint* are outlined (Table 3.3).

Design principle	Intention	Implementation
Tunneling	The system guides the users through a process by providing options for action.	The product's degree of sustainability is labelled visually. In addition, the CO <sub>2</sub> emissions per product are displayed.
Self-monitoring	The system presents means to track the own performance to achieve the target behavior.	The user is given a weekly budget of CO <sub>2</sub> emissions that can be spent on groceries. This way, the CO <sub>2</sub> spending can be tracked. In addition, the user's own development and past purchases can be viewed.
Rewards	The system rewards the user when performing the target behavior.	By keeping the CO <sub>2</sub> budget, the user will receive a discount.
Liking	The system is visually appealing to its users.	The store is designed attractively and appropriately.
Suggestion	The system offers meaningful suggestions to carry out the target behavior.	Alternative more sustainable options are suggested, if available.
Real-world feel	The system highlights background information of the people behind its services.	For each product, additional background information is presented, such as its producers or the production process.

TABLE 3.3: Selected design principles of the PSD model [9] and their implementation in the grocery online shop *FoodPrint*

These principles from the categories primary task, dialogue and system credibility support were assessed as most suitable and were considered when designing the grocery online shop. The principles of the category social support were neglected, since the results of the online survey indicated that social aspects are not as important to target users.

Furthermore, the implementation of the principle Tunneling may be based on the climate label from paragraph 2.3.4. Spiller and Zühlsdorf researched this topic in 2020: Currently, different forms of climate labeling already exist. Examples include absolute CO<sub>2</sub>-e values, relative ratings and compensation labels that indicate climate neutrality but state nothing about the climate friendliness of the food product. The co-existence of multiple label types, some with completely different claims, contributes to consumer confusion. However, the majority of consumers are unable to understand abstract CO<sub>2</sub>-e values because they have no notion of magnitude of the value. The authors note that a combination of an interpretive climate label with an indication of greenhouse gas values could be promising. When implementing a climate label, learning effects on the consumer side can be expected. Further information by indicating CO<sub>2</sub>-e values of food can be provided to particularly conscious consumers [5].

### 3.3.2 Interviews with target group

After the grocery online store was conceptualized, interviews with the target group were conducted for qualitative data collection. They should validate prior assumptions, obtain feedback regarding the persuasive concept and determine additional requirements.

In interviews, the researcher asks users questions about an area of interest. The purpose is understanding the topic and gaining insight into the user's opinion and values [80].

#### Structure of the interview

At the beginning, information on data protection was given to the interviewees and permission was requested to audio-record the interview.

The interview was divided into two sections. In the first part, attitudes towards regional origin of food as well as barriers and motivators for food choices were explored in more detail. These questions were intended to find out, how the grocery online shop *FoodPrint* can support users.

Initially, it was assumed that regional foods are most sustainable, which also influenced the interview. In the later development of the concept, it was

discovered that many factors, influence a food's level of sustainability. However, to a certain extent, particular results of the interview could be considered when implementing the concept.

The second part included the evaluation of the designed concept and its persuasive features. In this section, the participants were asked for their opinion and assessment of the usefulness of *FoodPrint*. In addition, the persuasive elements of the concept were examined to determine how useful the elements would be for the target group and to explore existing assumptions. The interview guide is listed in Appendix C.

### **Results of the interview**

Seven individuals were interviewed, four women and three men between the ages of 22 and 28 years.

For most of the respondents, it depended on the type of food whether they pay attention to the regional origin. The participants had a uniform image of regional origin, which meant for them Germany in general. Furthermore, the most frequent advantages of regional food consumption, were support of local suppliers and short delivery routes. Packaging, regional origin and visual appearance of food were most important to users when making purchasing decisions.

The main problem for the interviewees was the lack of or inadequate labeling of the food origin. They do not have the time or motivation to search for it. Many also mentioned that the desired product was not available for purchase due to seasonality or limited assortment of the supermarket.

All participants found the concept transparent, especially the discount and the display of CO<sub>2</sub> emissions, and thought, it would influence their food choice. They would pay attention to keep their CO<sub>2</sub> spending as low as possible. Furthermore, they regarded the features of the concept as added value. Two respondents believed that they could eventually develop a sense of their CO<sub>2</sub> spending.

All participants would use the online store, however, for a few, only when an outstanding service such as easy ordering or large assortment, would be provided. All of them would find it helpful, when shopping for products, more sustainable alternatives would be shown.

The discount on the purchase was found most interesting by most people. Two interviewees even mentioned that it does not have to be particularly high to be attractive. One person found the comparison to previous spending the most motivating. Finding products from regional vendors bundled in one place would be interesting to all participants. When asked about the social and competition aspect in grocery shopping, not all respondents agreed, four people felt that this aspect was not relevant to them.

In summary, it can be concluded that the participants of the interview considered the concept helpful and would be prepared using it. The assumption was confirmed that the aspects of social support are secondary when shopping for groceries. Regional origin is a consideration and valued by the participants when selecting foods. The results also confirm the initial assumptions about the target group of not having the time or motivation to spend much time on figuring out the foods' degree of sustainability.

### 3.4 Prototyping

Prototyping aims at demonstrating the visual design of a system as well as how its interaction and user flow may work [81]. The fidelity of the prototype can range in the areas of interactivity, visual elements, content and commands. High fidelity prototypes often match the look-and-feel of the final application. Hence, the test participants are more likely to interact with the prototype as if it was the real system [82].

In this phase, the persuasive application *FoodPrint* was implemented prototypically for a mobile device with the help of the prototyping tool Adobe XD. Two high-fidelity prototypes, A and B, were developed. Only prototype A contained the persuasive elements of the concept. Otherwise, the prototypes were structured similarly to enable comparability in A/B testing and evaluate to what extent the persuasive elements influence the user's food choice. The two prototypes were designed to convey the concept of *FoodPrint*. They were not intended to evaluate the workflow or usability issues, but instead impressions on the persuasive concept and the purchasing decisions of its users.

The design of the grocery online store *FoodPrint* was based on mental models and expectations of the users – analyzed in the section 3.2.1. The prototype was intended to represent a holistic experience of an order process with help of the mobile application.

For the prototypes, icons from [css.gg](https://css.gg) and [Piqodesign](https://Piqodesign.com) as well as images from [unsplash.com](https://unsplash.com), [pexels.com](https://pexels.com) and [freepik.com](https://freepik.com) were used for the prototype. The text content of the product details was used from [rewe.de](https://rewe.de) as an example. The background about the CO<sub>2</sub> values of the groceries and the weekly budget are described in the following paragraph 3.4.3.

### 3.4.1 Prototype A

Prototype A contained the persuasive elements of the design principles according by Oinas-Kukkonen and Harjuuma. The principles Tunneling, Self-monitoring, Rewards, Liking, Suggestion and Real-world feel of the concept *FoodPrint* were implemented prototypically.

#### Structure of the workflow

The interaction with the prototype begins with the onboarding of the application, where users can log in or register. In this step, the input fields are already prefilled. The navigation within the grocery online store is structured as tab navigation and divided into the items Products (Home), Search, FoodPrint and Shopping Cart.

The home screen displays current offers and bestsellers, as well as the store's different food categories (Fig. 3.3).

The Search menu item allows users to search for specific products and displays their most recently searched foods. Via the entries that were searched for most recently, the user is able to navigate to the desired groceries in the test scenario. However, no entries can be made via the search bar, since the food choice, and not the usability of the system, is to be evaluated (Fig. 3.4).

For each predefined food item, corresponding results are displayed. By clicking on one of the recently searched products, the user is directed to a list of results, where the food products matching the search term are displayed. In the list, the user has the option to add products to their own shopping cart

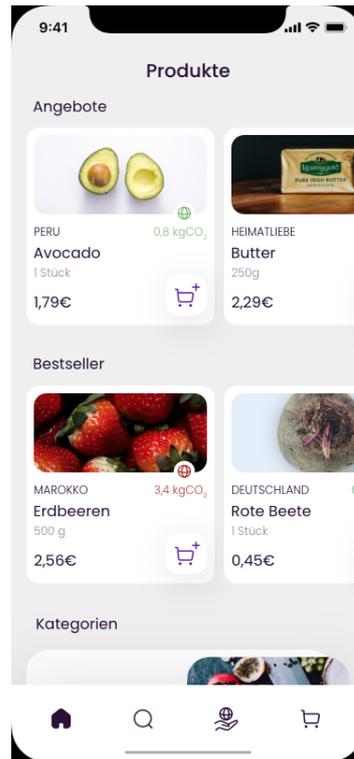


FIGURE 3.3: Screen of Home in prototype A

and view the corresponding detailed information.

Under the menu item FoodPrint, information about the underlying concept of the grocery online store can be found. Here, the weekly CO<sub>2</sub> budget, which adjusts according to expenditure, and the development of their own CO<sub>2</sub> spending are displayed. The color scale and other information on the environmental impact of foods are also explained.

On the final screen, the shopping cart displays selected products that were added as examples for the test scenario. At the top right, the order can be completed. Before finalizing the order, the user's contact and payment information as well as the selected products are clearly presented.

### Implementation of persuasive elements according to the PSD model

**Tunneling** The tunneling principle was applied to the grocery presentation by displaying the product's carbon footprint as well as classifying this value by means of a color scale. The intention is to support users in their food

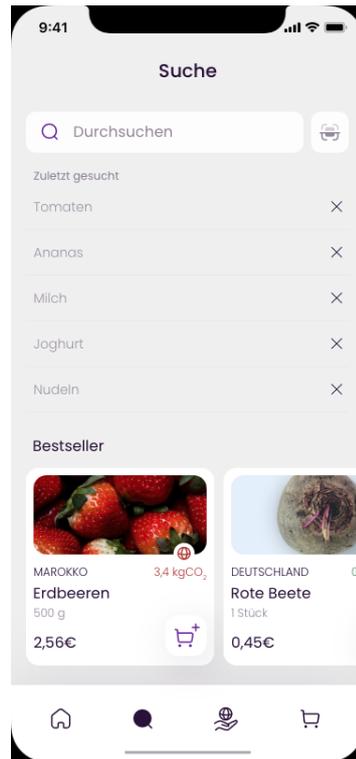


FIGURE 3.4: Screen of Search in prototype A

choices and help them make a well-informed decision in favor of a sustainable product. The emission values as well as the color classification are displayed in the result list and in the product details (Fig. 3.5). The background to the scale as well as the indication of the CO<sub>2</sub> values are explained in the following section 3.4.3.

**Self-monitoring** One of the main features of the grocery online store *Food-Print* is the weekly CO<sub>2</sub> budget. It is designed to be mindful of one's own food consumption and raise awareness of the environmental impact of food choices. The CO<sub>2</sub> budget is displayed in three places in the application.

First, under the menu item FoodPrint, where the remaining budget is displayed and the user can view past CO<sub>2</sub> spending (Fig. 3.6). Moreover, tracking the own development is also part of the implementation of the self-monitoring principle.

On the other hand, the emissions already spent are set in relation to the available budget in the shopping cart. This allows the user to track how much of their CO<sub>2</sub> budget is left at any time and, if necessary, to remove products

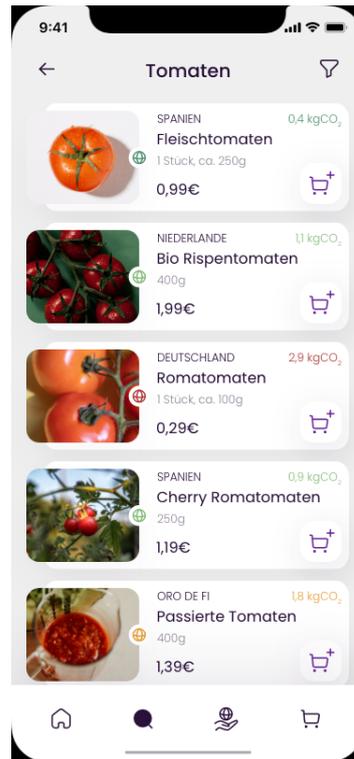


FIGURE 3.5: Screen of the product list in prototype A

from the shopping cart (Fig. 3.7).

In addition, per food product, its budget percentage is displayed in the product details, along with the product's environmental footprint (Fig. 3.8).

**Rewards** If the CO<sub>2</sub> budget is met, *FoodPrint* users receive free shipping. They are rewarded to stay within budget and consequently serve as an incentive to keep their CO<sub>2</sub> spending as low as possible and make sustainable food choices. The features of this principle become clear in the shopping cart, where the achievement of the bonus is displayed above the product list. The free shipping costs are also emphasized in the display when summarizing the total sum.

**Liking** The grocery online store is designed to be simple, clear and appealing to users. The products are clearly illustrated, which is reinforced, for example, by displaying the origin or season. It was decided to use simple colors, so that the color scale is more accentuated and the user is not overwhelmed. It is intended to avoid distractions of the users by secondary elements and thus, make it easier to choose sustainable food products.



FIGURE 3.6: Screen of FoodPrint in prototype A

**Suggestion** If possible, a more sustainable alternative of the same product category is suggested to the user when viewing the product details. This feature aims to support the user in choosing the sustainable product, rather than the displayed option. Additionally, it intends to show that the presented product is not the most sustainable option. The suggested alternative indicates how much more environmentally friendly the product is (Fig. 3.9).

**Real-world feel** In the product details, additional background information of the product is visualized, such as the producer or the cultivation (Fig. 3.10). This principle aims at helping the user to better understand the background of the product and create a relationship to the food.

### 3.4.2 Prototype B

Prototype B was developed without the persuasive elements to be able to collect comparative data while user testing. Compared to prototype A, the structure is similar, the difference is that the menu item FoodPrint is missing – as well as features of the PSD principles, such as the CO<sub>2</sub> information and alternative sustainable product suggestions.

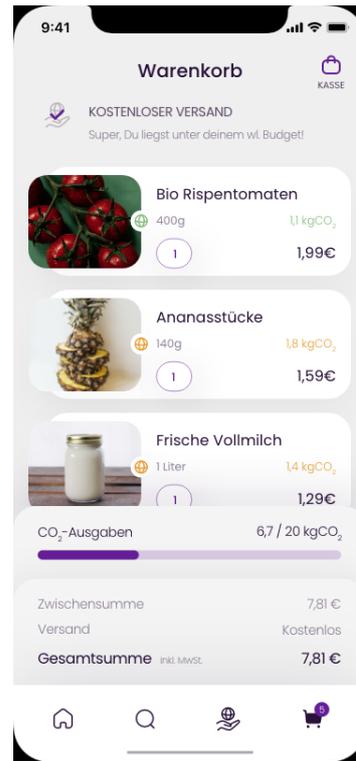


FIGURE 3.7: Screen of Shopping cart in prototype A

### 3.4.3 Background on the implementation of the primary task support principles

#### Tunneling

The research by Spiller and Zühlsdorf about the climate label and suggestions for its implementation, was used to create the color scale. It clearly shows that consumers do not understand the abstract CO<sub>2</sub>-e values alone and cannot assess their magnitude. In contrast, they understand color-coded labeling better such as the nutrition label *Nutri-Score* [5].

The different gradations of the five-level color scale, including dark green to dark red, were adopted from the proposal by Spiller and Zühlsdorf and rounded up (Table 3.4) [5].

Gradation	Value in CO <sub>2</sub> -e
Very low (dark green)	0,0 – 0,6
Low (light green)	0,7 – 1,3
Medium (yellow)	1,4 – 2,0
High (light red)	2,1 – 2,7
Very high (dark red)	> 2,8

TABLE 3.4: Gradation of the color scale



FIGURE 3.8: Screen of the product details in prototype A



FIGURE 3.9: Display of sustainable suggestion in prototype A

In addition, a study by *Institut für Energie- und Umweltforschung Heidelberg*, which calculated the average ecological footprint of numerous foods and dishes, was used to display the CO<sub>2</sub>-e impact per food item and to enable a differentiated assessment [83]. The products selected for the prototypes and their average emission values are shown in Appendix D.

### Self-monitoring

A person in Germany consumes an average of 2 tons of CO<sub>2</sub>-e per year through food. To reduce the carbon footprint, this expenditure should be reduced by half [5]. The weekly budget was rounded up to 20 kg of CO<sub>2</sub>-e



FIGURE 3.10: Display of a product's background information in prototype A

for a person from Germany using the target value of the carbon footprint per year, consisting of 52 weeks.

## 3.5 Evaluation strategy

The final phase included the evaluation of the prototypes by means of A/B testing with target users. The aim was to investigate the effect of the Persuasive Systems Design model by Oinas-Kukkonen and Harjumaa and its design principles in the context of sustainable food consumption. It was examined to what extent it can influence the users' food choices. The study intended to clarify these issues as well as to capture the impressions on the concept of the prototype. Two interactive High-Fidelity prototypes were evaluated, one of them including persuasive elements (A) and the other one being the neutral counterpart (B).

### 3.5.1 Study structure

The user test aimed at German individuals between the ages of 20 and 34 representing the target users. A duration of approximately 30 minutes per

person was estimated.

Possible limitations of the results could be that they are based on behavioral intentions and not on real market behavior. The test represents a fictitious scenario. Also, the number of cases in the study is not high enough to make a representative statement. Another limitation is the lack of interaction with the participants due to the remote nature of the test.

The user test took place via the communication platform *Zoom*. Initially, the participants were asked about their personal data. Subsequently, the testers were requested to put themselves in a given situation and complete a set of tasks with the help of a prototypical grocery online shop. The impressions and purchasing decisions of the users were collected during task completion, using the Think Aloud method. The participants evaluated their experience and satisfaction via UEQ questionnaire. Finally, the opinion towards the persuasive concept and the perception of food choices was obtained with the help of concluding interviews. The data privacy statement can be found in Appendix G.

### 3.5.2 Think Aloud during task completion

In the test during the task completion, the participants were asked to verbalize their thoughts while using the prototype. This qualitative method is called Think Aloud and may help discovering the honest opinion of the participants [84]. It should provide insights into the target user's impressions and understand their view about the persuasive prototype as well as their food choices.

The participants were requested to express their thoughts aloud and put themselves in the following situation: Due to the current Corona pandemic, they get the idea to do their weekly grocery shopping online using the application *FoodPrint*. The given task is to select tomatoes, pineapple, milk, yogurt and pasta in the online store *FoodPrint* and choose one of the available options. Subsequently, their order should be completed.

Thus, an entire registration and ordering process was performed to simulate a realistic user scenario. During the completion of the task, the background of the purchase decisions should be reasoned by the participants. Prior to task completion, it was emphasized by the study leader that the study was

not testing the participants' abilities, but the prototype, and that there was no judging of right or wrong. This way, a pleasant testing atmosphere was created and the participants had the feeling that they can express their honest opinion.

Furthermore, the concept behind the online store was explained to the testers of prototype A. The task assignment of test A and B can be found in Appendix E.

### 3.5.3 Interview

At the beginning, demographic data of the participants, such as age, gender, life situation and attitude towards sustainable food consumption, was obtained via interview. This data was collected in order to make a statement about the study population and analyze if these characteristics influence their behavior.

After the user test was completed, the participants were interviewed to find out the reasons for their food choices and what they think of the persuasive concept. It was determined to what degree the application was considered helpful and whether anything surprised the participants. Furthermore, it was evaluated whether they would use the online store in the future. Additionally, the interview investigated to what extent and which elements of the PSD principles had influence on the purchasing decisions of the participants and were perceived as helpful. Regarding the perception of sustainability, it was also explored whether it was clear, when using the prototype, which was the most sustainable product option and whether, in general, they felt sufficiently informed about the carbon footprint of food in the supermarket.

After the testers of prototype B had answered the interview questions, the persuasive concept was explained to them using prototype A as a reference. These participants were asked for their opinion of the concept and which aspects they considered particularly helpful. The study and interview guidelines of test A and B can be found in Appendix F.

### 3.5.4 UEQ questionnaire

The UEQ questionnaire is a method to quantify the impression of the product user experience [85]. It covers 26 items measuring the aspects Attractiveness,

Perspicuity, Efficiency, Dependability, Stimulation and Novelty [86]. The experience and sensations of the target users were mapped quantitatively. The questionnaire is standardized and can be found in Appendix H.



## Chapter 4

# Results from A/B testing

The purpose of the A/B testing was to evaluate how the Persuasive Systems Design model and its design principles can be applied in a context of sustainable food consumption and to what extent its characteristics influence the target group's food choices. Two interactive High-Fidelity prototypes of the grocery online shop *FoodPrint* were evaluated. In test A, prototype A, which includes the persuasive elements, was analyzed and in test B, prototype B was assessed.

Following, the data collected in the study will be presented. The evaluation strategy was described in section 3.5. Mainly qualitative data were collected through Think Aloud and interview methods. The UEQ questionnaire provided quantitative results on the overall user experience. The findings are categorized by area of interest comparing Test A and B.

### 4.1 Study population

The study population included ten participants between 23 and 28 years old representing the target group. The average age of the participants was 24 years with a standard deviation of 1.4. To test both prototypes A and B, the participants were distributed equally..

Half of the participants were female and half male. 60% of the test subjects eat a vegetarian diet and 40% an omnivorous diet, which means they do not restrict their food choices. More vegetarians participated in test A than in test B. The majority of participants were students (80%), two individuals in test B were professionals.

For 80% of the participants, sustainability was an important aspect when buying food, for two individuals not so much. Seven participants consider

sustainability important because of the environment and to keep their own ecological footprint as small as possible. For two people good quality as well as fair payment and working conditions of the producers were important besides the environment. One person paid attention to sustainable food consumption because of animal welfare and packaging waste. Two individuals regarded regional origin to be particularly important, and one person valued ecological production.

When asked about further important aspects other than sustainability, three participants expressed their willingness to pay more for sustainable groceries as long as there is a good price-performance ratio. Three individuals would consider the sustainability aspect up to a certain price. The two professionals even mentioned that price played a secondary role, while quality and sustainability were the most important to them. Thus, for the majority of the participants, price played a role in buying sustainable products.

The current study is not representative because the number of subjects is not high enough to achieve significance and high reliability.

## 4.2 Overall user experience

After completing the tasks, the participating individuals were asked to complete the UEQ questionnaire to measure their user experience quantitatively. Figure 4.1 shows the mean values of the six different dimensions for both prototypes and the corresponding confidence intervals with a 95% confidence level. The possible range of values for the scale extends from -3 (terribly bad) to +3 (extremely good). The values between -0.8 and 0.8 are considered neutral evaluation, values greater than 0.8 are represent a positive evaluation and values smaller than -0.8 a negative evaluation of the corresponding dimension.

In the test, Prototype A achieved a positive evaluation in each dimension, while prototype B achieved a neutral evaluation in the dimensions Stimulation and Novelty. Neither of the two prototypes achieved a negative rating. While the results of prototype B varied more widely, prototype A's scores ranged from 1.75 to 2.67.

The positive evaluation in Attractiveness, Perspicuity, Efficiency, and Dependability do not show significant differences when comparing the two prototypes. Prototype A scored highest in the dimension Attractiveness with 2.67 and prototype B in the aspect Perspicuity with 2.25. However, the average values of the aspect Stimulation differ by 1.25, and the aspect Novelty by 2. Prototype B scores the lowest value with 0.05 in the dimension Novelty.

A two-tailed paired T-test conducted for each dimension showed that the two prototypes A and B were significantly different on the dimensions of Stimulation and Novelty (alpha value = 0.05) (Fig. 4.1).

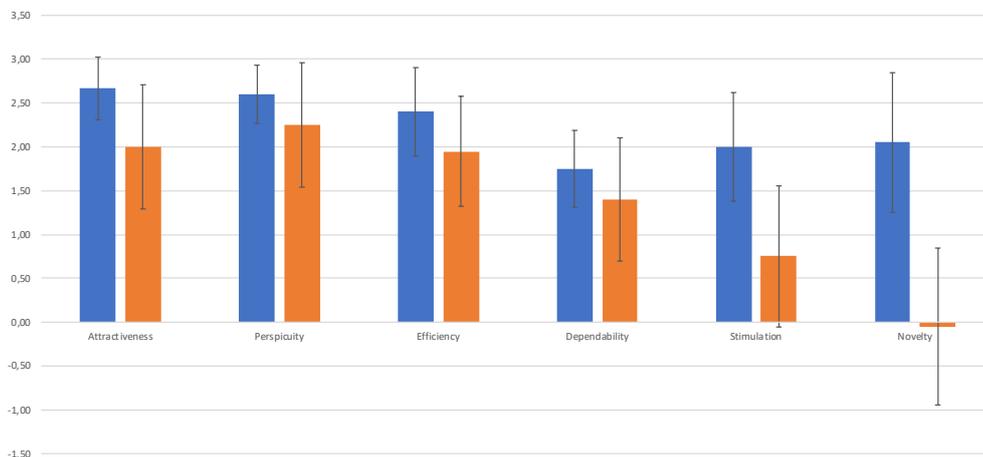


FIGURE 4.1: UEQ results of test A (blue) and B (orange) according to dimension with confidence intervals illustrated and a confidence level of 95%

### 4.3 Perception of use

The overall usefulness was evaluated by asking the participants about their impressions while using the prototype. They were asked for an assessment via a concluding interview.

All subjects in test A, rated the grocery online store helpful and appealing. In their opinion, it could help to put food decisions into perspective and, if

necessary, make trade-offs in favor of the CO<sub>2</sub> budget. The color scale made the decision process easier and more intuitive. Two individuals perceived displaying the food's country of origin as positive and found searching for this information in the supermarket inconvenient. One person considered it difficult to understand a product's level of sustainability in the supermarket.

Four out of five users of prototype B found the application helpful. They emphasized the clarity and the appealing design of the grocery online shop. One person also complimented the fast ordering process. Only one participant rated the prototype as not particularly exceptional.

All testers of prototype A would use the online shop in the future – two individuals would only use it, if the assortment was more extensive. Compared to prototype B, the majority of participants would also use the online shop, especially in the current situation of the Covid-19 pandemic. One person did not find added value in the online store compared to the supermarket.

The subjects were also asked whether anything surprised them during the task completion. Four out of five participants of test A were surprised about the high CO<sub>2</sub> emissions of tomatoes from Germany. One respondent was astonished that products with the organic certification have a proportionally higher CO<sub>2</sub> footprint. They imagined that the trade-off between organic production and lower environmental impact would be difficult. One person did not know that the method of transportation has such an impact.

The majority of the testers of prototype B emphasized that the prototype behaved as they would have expected and were not surprised by anything. One person expressed the importance of consciously deciding which products to display first in the list, especially when there is a large selection.

### **4.3.1 Influence on food choice in test A**

The participants of test A agreed that the persuasive elements embedded in the grocery online shop influenced them in their purchase decision. One subject adjusted their decision based on the design principle Suggestion. Another subject believed that over time they would become more aware of the impact of their food choices and could adjust their purchasing behavior even in stationary retail.

### 4.3.2 Opinion on the persuasive concept in test B

The testers of prototype B were presented with prototype A after completing the study. All test persons liked the concept of the grocery online store and believed that its elements would have had an influence on their food choices. The majority of the participants were also surprised about the high emission values of the German tomatoes. They found it helpful to know the level of sustainability of the groceries. One person commented that prototype B didn't give the opportunity to evaluate the products according to the sustainability aspect and decided on price.

## 4.4 Food choices and their influencing factors

The food choices and their influencing factors were assessed during task completion using the Think Aloud method. Five products should be purchased. There was a choice of at least two products in each product category. The categories were: tomatoes, pineapple, milk, yogurt and pasta. The results of the two tests were evaluated and compared according to the product.

In test B, participants in all food categories selected more often products with higher CO<sub>2</sub> values than in test A. Their decision was mainly based on the position in the product list. The test A participants were influenced by the emission values, especially in the categories fruit and vegetables. In the dairy category, the majority of Test A participants preferred plant-based alternatives. A possible reason for this result may be the larger proportion of vegetarians in Test A. Testers of B placed the most importance on the organic label in this category. In the last category, pasta, the test B participants also put more emphasis on the organic production attribute than the A testers.

### 4.4.1 Tomatoes

The majority of the users of prototype A chose the low-emission tomatoes from Southern Europe. All of them made this decision based on the emission value, the reasonable price as well as the taste. The remaining subjects chose the cherry tomatoes and the organic tomatoes, both of which were in the green range of the CO<sub>2</sub> scale. A low level of CO<sub>2</sub> and price were deciding factors in all five purchase decisions. Three participants could not believe the higher carbon footprint of the German tomatoes since they would have expected the opposite due to the regional origin. One person was surprised

that the organic tomatoes have comparatively a higher CO<sub>2</sub> impact. No one chose the tomatoes with the highest levels of CO<sub>2</sub>.

In test B, the same proportion decided for the tomatoes from Southern Europe. This was mainly influenced by personal preference and position in the product list. The remaining participants chose the tomatoes from Germany due to their regional origin, believing to be the most sustainable choice. Compared to the purchase decisions in test A, the out-of-season tomatoes with a higher CO<sub>2</sub> footprint were selected more often (Table 4.1).

Product	Number of participants in test A	Number of participants in test B
Tomatoes, from Southern Europe	3	3
Tomatoes, organic	1	0
Cherry tomatoes	1	0
Tomatoes, from Germany, grown in heated greenhouse and off-season (in winter)	0	2

TABLE 4.1: Frequency of the food choice for the product tomatoes

#### 4.4.2 Pineapple

All participants in test A chose the pineapple transported by ship emitting the least CO<sub>2</sub>. They justified this choice with the lower CO<sub>2</sub> emissions of the product. The majority did not pay attention to the price in this case. One respondent assumed less sustainable characteristics, if the product was imported from a distant country.

When completing the task with the help of prototype B, three out of five cases chose the pineapple transported by plane. Factors influencing this decision were the price, which was perceived as more justified, and the position in the product list (Table 4.2).

Product	Number of participants in test A	Number of participants in test B
Pineapple, transported by ship	5	2
Pineapple, transported by airfreight	0	3

TABLE 4.2: Frequency of the food choice for the product pineapple

#### 4.4.3 Milk

The majority of the A-testers would buy oat milk for reasons of taste and product properties but also the low CO<sub>2</sub> emissions played a role in the decision. They opted for the more sustainable product.

In the test B, the participants were significantly influenced by the organic certification label and price. Environmental protection and shelf life for other milk options, however, were reasons that differed from the majority (Table 4.3).

Product	Number of participants in test A	Number of participants in test B
ESL milk, whole milk	0	0
ESL milk, low fat	1	0
UHT milk, whole milk	0	0
UHT milk, low fat	0	1
ESL milk (organic), whole milk	0	3
Milk substitute, oat drink	4	1
Milk substitute, soy drink	0	0

TABLE 4.3: Frequency of the food choice for the product milk

#### 4.4.4 Yoghurt

The decision for the natural yogurt and the soy yogurt of the A-testers was influenced by the low CO<sub>2</sub> emissions of the products. In addition, taste affected the choice of the soy yogurt, while price played a secondary role. One subject found higher CO<sub>2</sub> cost of the organic yogurt surprising. Not a single respondent chose the organic yogurt.

In contrast, the majority of the B-subjects selected the organic yogurt because of the organic label and the price (Table 4.4).

Product	Number of participants in test A	Number of participants in test B
Yogurt, natural	2	1
Yogurt, fruit	1	0
Yogurt (organic), natural	0	3
Yogurt substitute, soy	2	1

TABLE 4.4: Frequency of the food choice for the product yoghurt

#### 4.4.5 Pasta

All test A, the participants decided in favor of the conventional pasta. The low CO<sub>2</sub> value influenced the users the most as well as never having paid attention to the organic label.

In comparison, the majority of the B testers chose the organic pasta and were influenced by the organic label. Two people would be prepared to spend more for such products (Table 4.5).

Product	Number of participants in test A	Number of participants in test B
Pasta	5	2
Pasta (organic)	0	3

TABLE 4.5: Frequency of the food choice for the product pasta

## **4.5 Opinions on the features of the PSD principles**

These data resulted mainly from Test A, since only prototype A included the persuasive elements but also from comments during use and in the subsequent interview. The B testers were introduced to prototype A at the end of the study and asked for their opinion in the interview. Features of the principles Tunneling and Self-Monitoring were rated the most helpful.

### **4.5.1 Tunneling**

These characteristics were rated most often by the users as the best feature. They found the CO<sub>2</sub> color identification very understandable and useful for classifying products. The features of the Tunneling principle lead them to choose the "green", more sustainable option. One person noted that this would be the reason they would use the shop and recommend it to others. A large proportion of the users did not have a sense of estimating the environmental impact of their food choices and wouldn't be able to assess the groceries in a supermarket.

All participants of test B were impressed by the color classification and the indication of the CO<sub>2</sub> impact. One person found it interesting to compare the products and its background considering this aspect.

### **4.5.2 Self-monitoring**

For this principle, the participants agreed that the CO<sub>2</sub> budget is helpful for illustrating spending. They would pay attention to stay within the budget. One person rated this feature as the best. They also considered it motivating to show their personal progress. Two participants found the percentage display of the CO<sub>2</sub> budget in the product details useful for evaluating the products. Within the budget, it is possible to compensate for more environmentally harmful products. The majority of the test persons considered it advantageous to display the remaining budget in the shopping cart.

A large proportion of participants in Test B claimed, they would watch the CO<sub>2</sub> budget.

### **4.5.3 Rewards**

The majority of A-testers considered the free shipping an attractive incentive. Other participants found this aspect appealing, but preferred the features of the Tunneling principle. One person was not sure, if the free shipping was enough of an incentive.

One person, who has tested Prototype B initially, considered the cost benefit as incidental and found it more challenging to stay within the CO<sub>2</sub> budget.

### **4.5.4 Liking**

All participants of test A considered the design appealing and clear. They mentioned this aspect several times throughout the task completion.

Two individuals, who tested prototype B initially, shared this opinion.

### **4.5.5 Suggestion**

All subjects of test A perceived the option of a more sustainable product as convenient and commented that it would entice them to choose this option.

Participants of the test B did not comment on the characteristics of this principle.

### **4.5.6 Real-world feel**

Four participants of test A considered it beneficial to display detailed background information about the product and its producer to establish a food reference which would be missing in the supermarket. One respondent found this aspect the most interesting, compared to other elements, but only with reference to regional products.

One tester of prototype B liked in particular the additional information.

## **4.6 Perception of the sustainability level**

These data were collected during the concluding interview and asking the participants whether the most sustainable option was obvious while using

the prototypes as well as whether they felt well informed about the environmental impact of their food choices in the supermarket.

#### 4.6.1 Were you able to clearly identify the most sustainable product?

Four of five participants of the test A state that the most sustainable option was clear to them while completing the task. Two subjects emphasized that the color scale helped them differentiate between product options. One respondent found this feature very user-friendly. For two subjects the most sustainable product was clearly identifiable by the CO<sub>2</sub> values. One respondent picked up the perceived controversy related to ecological production. Only for one respondent, the aspect of sustainability was not apparent at first glance. For this reason, they would have liked the product list to be sorted by scale value.

The majority of the B-subjects could not clearly recognize which was the most sustainable product. One person justified their answer by saying that they trust their own feeling and the product labels. Only one participant could clearly tell, which was the most sustainable product based on the display of season and country of origin.

Assessment	Number of participants in test A	Number of participants in test B
Yes, clearly identifiable	4	1
No, not clearly identifiable	1	4

TABLE 4.6: Assessment for the identification of the sustainability level

#### 4.6.2 Do you feel sufficiently informed about the carbon footprint of food in the supermarket?

All participants of test A do not feel well informed about the environmental impact of their food choices in the supermarket. Two individuals assumed that the regional origin also includes sustainability.

After prototype A was shown to the B-testers, all of them answered negatively to this question. Two persons admitted that they are less informed than they thought. One person mentioned that the level of sustainability is not consistently labeled in the supermarket. It was obvious that the participants do not have a clear overview of the existing sustainability labels and their meaning and can only make assumptions.

None of the participants felt well informed about the environmental impact of their food choices in general. They did not have enough background knowledge to correctly assess a product's sustainability and groceries that are not labeled as such.

## 4.7 Potential challenges and suggestions for improvement

Some participants suggested how the grocery online shop could be improved and mentioned potential issues. Participants of test A commented on aspects of the persuasive concept and functional characteristics. Participants of test B mainly referred to improvements of layout and design.

Two individuals testing prototype A would find it helpful, if the app could be used to scan foods in the supermarket and have its CO<sub>2</sub> emissions displayed. Another person would consider it beneficial to display the most popular product or with the best price-sustainability ratio. The respondent believed that this information could additionally support the users in their purchase decision. With regards to improving content qualities, one person would regard it helpful to know how the CO<sub>2</sub> emission cost of foods is composed.

One participant of test A expressed concerns about the persuasive elements of the prototype and imagined it difficult to keep the CO<sub>2</sub> budget for the weekly shopping. They also consider taking advantage of the features of the Rewards principle as a possible problem: A person could buy products within the budget from the grocery online store *FoodPrint* and buy the rest of the necessary groceries from a supermarket. They further regard having to prioritize animal welfare, e.g. in organic production, versus environmental

protection as a problem. The display of low CO<sub>2</sub> emissions for mass produced food with poor living conditions of the livestock could mislead consumers and seem immoral.

One participant in test A would have preferred to see the price per kilo in the product list, since it was difficult to compare prices between products of different quantities. Furthermore, two test B subjects would have expected the checkout button below the sum total, not at the top right of the shopping cart. These comments can be understood as usability issues. However, the focus of this study is not on this aspect.

In general, prototype A has a more positive user experience. The two prototypes differ significantly in the dimensions Stimulation and Novelty. The participants in test B emphasized that the prototype performed as they would have expected. In contrast, the participants of test A were most surprised about high CO<sub>2</sub> emissions of tomatoes from Germany. Testers from both A and B rated the grocery online store as helpful and would use it in the future.

All participants from test A agreed that persuasive elements embedded in the grocery online shop influenced them in their food choice. Especially the features of the principles Tunneling and Self-Monitoring were rated the most helpful. A large proportion stated that they did not have a sense of estimating the environmental impact of their food choices. In the categories of fruits and vegetables, the effects of the persuasive elements were particularly evident. In test B, participants in all food categories more often selected environmentally harmful products with higher CO<sub>2</sub> values than in test A.

Comparing the results of tests, A and B, the persuasive elements in prototype A helped users identifying the sustainable option. However, none of the participants felt well informed about the environmental impact of their food choices in general. Furthermore, having to prioritize animal welfare versus environmental protection poses a potential problem.



## Chapter 5

# Discussion

For the sake of the environment, the carbon footprint of the food sector needs to be reduced. Individual food choices can have a considerable impact on the CO<sub>2</sub> emissions. The current study aimed to evaluate how the PSD model can influence food choices towards sustainable food products compared to other products. The results of the A/B testing and potential challenges are being discussed. Furthermore, the research questions of the empirical study will be addressed and analyzed.

### **5.1 Impact of the Persuasive Systems Design model and its influence on the users' food choices**

According to participants of test A, the persuasive elements embedded in the grocery online shop had a significant influence on their purchase decision. This was confirmed by their food decisions. In test B, participants more often selected more environmentally harmful products than in test A. The results showed that the subjects of A were influenced in their purchase decision to choose a more sustainable option.

Some testers of prototype B believed making a sustainable choice with products of regional origin or from ecological production and attached value to these characteristics. They assumed less sustainable characteristics, if the product was imported from a distant country. This clearly shows their lack of knowledge about the impact of their food choices. In the case of fruits and vegetables, the influence of the persuasive elements was particularly obvious. For example chose the majority in test B the airfreighted pineapple which emits 25 times more greenhouse gases than the pineapple transported by ship. Without the persuasive elements for support and as indication, consumers cannot distinguish the differences in the transport of the products.

The test persons lacked a comparative value or any kind of information to make the sustainable decision.

The applied design principles influenced the food choice of the users. The implementation of the Tunneling and Self-monitoring principles was particularly supportive. Through the color scale and the CO<sub>2</sub> values, the grocery online store provided an increased awareness for the users, since the participants were not able to assess the environmental impact of their food choices without it. The CO<sub>2</sub> budget helped to put the purchasing decisions in perspective and to compensate with other products, if necessary. It is interesting that the principle Suggestion even influenced one subject to entirely adjust their decision for a more sustainable food choice. It shows that it can encourage to choose the sustainable food option. Although the principle Rewards influenced the participants to keep their CO<sub>2</sub> spending as low as possible, concerns about free shipping being enough of an incentive, were expressed. To address these concerns, further research could be conducted and determined what kind of rewards would be most important to users. The effect of the Liking principle was particularly positively received, describing the design of the grocery online shop as appealing and clear. The additional information of the products such as the implementation of the Credibility support principle Real-world feel, could be beneficial for establishing a reference that would otherwise be missing in the supermarket.

Evaluating the influences on the purchase decision, the selected design principles were suitable for the context of sustainable food consumption. The primary task support principles Tunneling and Self-Monitoring were found to be the most helpful. This shows that users need support in making sustainable purchasing decisions, since there is no other indication of a product's sustainability level.

The majority of participants in test A could clearly identify which was the most sustainable option in the product list compared to test B. It is obvious from these results that the persuasive elements in prototype A helped users to choose the sustainable option suggesting the need for support in the sustainable purchasing decision. It indicates that there is a lack of knowledge among consumers about the environmental impact of their food choices. This fact was also emphasized by the purchasing decisions of test B which relied on certifications and erroneous assumptions.

In summary, the PSD model was useful in influencing purchasing decisions and for implementing a grocery online store. It had the ability to help users within the target group making informed decisions about their food choices and could contribute to the environmental protection in the food sector. The evaluation showed that the persuasive elements influenced the purchasing behavior and that the PSD model had the potential to encourage consumers making sustainable food choices and was positively received by users. However, the results only represent intentions of the target group and not the real purchasing behavior.

## **5.2 Need for support to make sustainable decisions**

Considering the positive results of the UEQ questionnaire, it can be concluded that both prototypes, A and B, were well designed and easy to understand and to use. While the results of prototype B varied more widely, prototype A – including the persuasive elements – suggested a generally more positive user experience in all dimensions. This result was emphasized by the mean values of the aspect Stimulation and Novelty, which showed that Prototype B was perceived as significantly less stimulating and unique compared to prototype A. The participants of test B perceived the prototype as more conventional and compliant with expectations.

The majority of subjects from Test A and B, rated the grocery online store as helpful and appealing. They were willing to use the online store in the future. The results expressed the added value and usefulness to mind the own food consumption and to be able to classify foods in terms of sustainability. The users found it helpful to receive more information about the sustainability level of groceries. Furthermore, the need for support became obvious. When comparing the two prototypes, the users of prototype B did not have the opportunity to evaluate the sustainability of products and chose a food based on price. They did not have any reference points to assess the sustainability of a food item. This confirms that the persuasive elements in prototype A supported the sustainable decision.

In general, the participants were not well informed about the environmental impact of their food choices nor did they have the opportunity to inform themselves. Certain misbeliefs were discovered such as the regional origin of

food being more sustainable. This was also reflected in the fact that the majority was surprised about the high emissions of the German tomatoes. They did not know which factors influence the sustainability of foods. This result picked up the second postulate of the PSD model, where inconsistencies can motivate the user to think about the presented information. It may persuade them to adjust their behavior.

Compared to the online experience, none of the participants felt well informed about the environmental impact of their food choices when shopping in stationary retail stores. They did not have enough background knowledge to assess the product's level of sustainability correctly and found it difficult, since the groceries are not labeled accordingly. These results illustrated the need for user support to learn about the environmental impact of groceries.

### 5.3 Challenges and opportunities

Some suggestions of improvement may represent potential extensions of the application *FoodPrint*. For instance, the use of the application to scan foods in the supermarket and display its CO<sub>2</sub> emissions. It emphasizes that consumers want to be informed about the environmental impact of their purchasing decisions and its composition. The application could be useful for creating more transparency and comprehension for the consumers. Furthermore, the concept could be expanded to other grocery online shops to guide consumers in making sustainable food choices.

A possible problem using the app could be the concern about adhering to the budget for the weekly grocery shopping. The weekly budget of 20 kg CO<sub>2</sub> may be too ambitious and would need to be calculated more accurately. A possible extension could be the selection of different budget options depending on the personal ambition.

Over time, consumers would become more aware of the impact of their food choices and hence, could adjust their purchasing behavior in stationary retail stores. On the other hand, it may not be easy because emissions can differ significantly between products of the same category. It is a complex decision and it is difficult for consumers to assess sustainability without any kind of support. The characteristics of the food that are important for the environmental impact, such as the type of transport, are not very obvious or

consumers do not have enough knowledge about them.

Having to weigh animal welfare, e.g. in organic production, versus environmental protection was seen as contradictory. The indication of higher CO<sub>2</sub> emissions of organic products compared to conventionally produced food contradicted the assumption of most participants that organic products are more sustainable. So were the food choices of Test B mostly influenced by the organic label. It depends on the area in which the sustainability of a food product is considered – social or environmental sustainability. According to their personal values, consumers need to prioritize what is more important to them. The trade-off between organic production and lower environmental impact may be difficult. However, in this study, the focus was on environmental sustainability of food choices.



## Chapter 6

# Conclusion

The study aimed to find out to what extent the PSD model and its principles can influence food choices and guide users towards sustainable consumption decisions.

Based on the study results, the Persuasive Systems Design model by Oinas-Kukkonen and Harjumaa was useful for implementing a grocery online store and in influencing food choices. The evaluation of the developed prototypes, A and B, showed that the persuasive elements influenced the purchasing behavior and were positively received by users. The PSD model had the potential to impact consumption behavior in a sustainable way and to encourage consumers making sustainable food choices. Especially, the design principles of the primary task support were perceived as supportive. The concept *FoodPrint* may represent an implementation option for the planned climate label.

In general, it can be concluded that the target group lacked knowledge to estimate the environmental impact of their food choices. It is difficult for consumers to assess sustainability without any kind of support. The users do not have any reference points to evaluate the sustainability level of a product. As observed in the current study, the participants considered it difficult to assess the product's level of sustainability correctly when grocery shopping. Their purchasing decisions may rely on certifications and erroneous assumptions. This suggests the need for support in making sustainable purchasing decisions and would be helpful for creating comprehension on the consumer side.

In the longer term, the implementation of Persuasive Technology could have the effect of making consumers more aware of the environmental impact and

more conscious about their food choices. It may present a way to proceed efficiently from behavior to attitude change.

In this study, the intentions of the target group, and not the real purchasing behavior, were examined. It can be concluded from the study results that the PSD model had the potential to induce behavioral change in the area of sustainable food consumption. It had the ability to influence the food decisions of the users and may be used to contribute to environmental protection in the food sector.

## **Appendix A**

# **Design principles of the PSD model (per category)**

Table 2. Primary Task Support		
Principle	Example requirement	Example implementation
<p><b>Reduction</b> A system that reduces complex behavior into simple tasks helps users perform the target behavior, and it may increase the benefit/cost ratio of a behavior.</p>	System should reduce effort that users expend with regard to performing their target behavior.	<p>Mobile application for healthier eating habits lists proper food choices at fast food restaurants [Lee et al. 2006].</p> <p>Smoking cessation Web site provides an interactive test that measures how much money a user will save with quitting.</p>
<p><b>Tunneling</b> Using the system to guide users through a process or experience provides opportunities to persuade along the way.</p>	System should guide users in the attitude change process by providing means for action that brings them closer to the target behavior.	Smoking cessation Web site offers information about treatment opportunities after a user has taken an interactive test about how addicted (s)he is on tobacco.
<p><b>Tailoring</b> Information provided by the system will be more persuasive if it is tailored to the potential needs, interests, personality, usage context, or other factors relevant to a user group.</p>	System should provide tailored information for its user groups.	<p>Personal trainer Web site provides different information content for different user groups, e.g. beginners and professionals.</p> <p>Web site for recovering alcoholics presents stories that are close to the user's own story.</p>
<p><b>Personalization</b> A system that offers personalized content or services has a greater capability for persuasion.</p>	System should offer personalized content and services for its users.	Arguments most likely to be relevant for the user presented first on a professional Web site rather than in random order.
<p><b>Self-monitoring</b> A system that keeps track of one's own performance or status supports the user in achieving goals.</p>	System should provide means for users to track their performance or status.	<p>Heart rate monitor presents a user's heart rate and the duration of the exercise.</p> <p>Mobile phone application presents daily step count [Consolvo et al. 2006].</p>
<p><b>Simulation</b> Systems that provide simulations can persuade by enabling users to observe immediately the link between cause and effect.</p>	System should provide means for observing the link between the cause and effect with regard to users' behavior.	Before-and-after pictures of people who have lost weight are presented on a Web site.
<p><b>Rehearsal</b> A system providing means with which to rehearse a behavior can enable people to change their attitudes or behavior in the real world.</p>	System should provide means for rehearsing a target behavior.	A flying simulator to help flight pilots practice for severe weather conditions.

FIGURE A.1: Design principles of primary task support [9]

Table 3. Dialogue Support		
Principle	Example requirement	Example implementation
<p><b>Praise</b> By offering praise, a system can make users more open to persuasion.</p>	System should use praise via words, images, symbols, or sounds as a way to provide user feedback information based on his/her behaviors.	Mobile application that aims at motivating teenagers to exercise praises user by sending automated text-messages for reaching individual goals. [Toscos et al. 2006]
<p><b>Rewards</b> Systems that reward target behaviors may have great persuasive powers.</p>	System should provide virtual rewards for users in order to give credit for performing the target behavior.	Heart rate monitor gives users a virtual trophy if they follow their fitness program.  Game rewards users by altering media items, such as sounds, background skin, or a user's avatar according to user's performance. [Sohn and Lee 2007]
<p><b>Reminders</b> If a system reminds users of their target behavior, the users will more likely achieve their goals.</p>	System should remind users of their target behavior during the use of the system.	Caloric balance monitoring application sends text-messages to its users as daily reminders. [Lee et al. 2006]
<p><b>Suggestion</b> Systems offering fitting suggestions will have greater persuasive powers.</p>	System should suggest that users carry out behaviors during the system use process.	Application for healthier eating habits suggests that children eat fruits instead of candy at snack time.
<p><b>Similarity</b> People are more readily persuaded through systems that remind them of themselves in some meaningful way.</p>	System should imitate its users in some specific way.	Slang names are used in an application which aims at motivating teenagers to exercise. [Toscos et al. 2006]
<p><b>Liking</b> A system that is visually attractive for its users is likely to be more persuasive.</p>	System should have a look and feel that appeals to its users.	Web site that aims at encouraging children to take care of their pets properly has pictures of cute animals.
<p><b>Social role</b> If a system adopts a social role, users will more likely use it for persuasive purposes.</p>	System should adopt a social role.	E-health application has a virtual specialist to support communication between users and health specialists. [Silva et al. 2006]

FIGURE A.2: Design principles of dialogue support [9]

Principle	Example requirement	Example implementation
<b>Trustworthiness</b> A system that is viewed as trustworthy will have increased powers of persuasion.	System should provide information that is truthful, fair and unbiased.	Company Web site provides information related to its products rather than simply providing biased advertising or marketing information.
<b>Expertise</b> A system that is viewed as incorporating expertise will have increased powers of persuasion.	System should provide information showing knowledge, experience, and competence.	Company Web site provides information about their core knowledge base.  Mobile application is updated regularly and there are no dangling links or out-of-date information.
<b>Surface credibility</b> People make initial assessments of the system credibility based on a firsthand inspection.	System should have competent look and feel.	There are only a limited number of, and a logical reason for, ads on a Web site or mobile application.
<b>Real-world feel</b> A system that highlights people or organization behind its content or services will have more credibility.	System should provide information of the organization and/or actual people behind its content and services.	Company Web site provides possibilities to contact specific people through sending feedback or asking questions.
<b>Authority</b> A system that leverages roles of authority will have enhanced powers of persuasion.	System should refer to people in the role of authority.	Web site quotes an authority, such as a statement by government health office.
<b>Third-party endorsements</b> Third-party endorsements, especially from well-known and respected sources, boost perceptions on system credibility.	System should provide endorsements from respected sources.	E-shop shows a logo of a certificate that assures that they use secure connections.  Web site refers to its reward for high usability.
<b>Verifiability</b> Credibility perceptions will be enhanced if a system makes it easy to verify the accuracy of site content via outside sources.	System should provide means to verify the accuracy of site content via outside sources.	Claims on a Web site are supported by offering links to other web sites.

FIGURE A.3: Design principles of credibility support [9]

Table 5: Social support		
Principle	Example requirement	Example implementation
<p><b>Social learning</b> A person will be more motivated to perform a target behavior if (s)he can use a system to observe others performing the behavior.</p>	System should provide means to observe other users who are performing their target behaviors and to see the outcomes of their behavior.	A shared fitness journal in a mobile application for encouraging physical activity [Consolvo et al. 2006].
<p><b>Social comparison</b> System users will have a greater motivation to perform the target behavior if they can compare their performance with the performance of others.</p>	System should provide means for comparing performance with the performance of other users.	Users can share and compare information related to their physical health and smoking behavior via instant messaging application [Sohn and Lee 2007].
<p><b>Normative influence</b> A system can leverage normative influence or peer pressure to increase the likelihood that a person will adopt a target behavior.</p>	System should provide means for gathering together people who have the same goal and make them feel norms.	A smoking cessation application shows pictures of newborn babies with serious health problems due to the mother's smoking habit.
<p><b>Social facilitation</b> System users are more likely to perform target behavior if they discern via the system that others are performing the behavior along with them.</p>	System should provide means for discerning other users who are performing the behavior.	Users of a computer-based learning environment can recognize how many co-students are doing their assigned homework at the same time as them.
<p><b>Cooperation</b> A system can motivate users to adopt a target attitude or behavior by leveraging human beings' natural drive to co-operate.</p>	System should provide means for co-operation.	The behavioral patterns of overweight patients are studied through a mobile application, which collects data and sends it to a central server where it can be analyzed at the group level in more detail [Lee et al. 2006].
<p><b>Competition</b> A system can motivate users to adopt a target attitude or behavior by leveraging human beings' natural drive to compete.</p>	System should provide means for competing with other users.	Online competition, such as Quit and Win (stop smoking for a month and win a prize).
<p><b>Recognition</b> By offering public recognition for an individual or group, a system can increase the likelihood that a person/group will adopt a target behavior.</p>	System should provide public recognition for users who perform their target behavior.	Names of awarded people, such as "stopper of the month," are published on a Web site.  Personal stories of the people who have succeeded in their goal behavior are published on a smoking cessation Web site.

FIGURE A.4: Design principles of social support [9]



## **Appendix B**

### **Structure of the online survey**

## Umfrage zum Kauf- und Konsumverhalten von regionalen Lebensmitteln

### Seite 1

Liebe/r TeilnehmerIn,

vielen Dank, dass Du Dich dazu bereit erklärst und Dir die Zeit nimmst, meine Umfrage zu beantworten!

Im Rahmen meiner Bachelorarbeit untersuche ich das Kauf- und Konsumverhalten sowie die Wertstellung von regionalen Lebensmitteln. Um ein zielgruppenorientiertes Konzept eines Onlinehandels zu entwickeln, möchte ich herausfinden inwiefern die Herkunft von Lebensmitteln Deine Kaufentscheidung beeinflussen kann.

Die Bearbeitung der Umfrage dauert maximal 10 Minuten.

Hinweis: Bitte nimm nur an der Umfrage teil, wenn Du zwischen 20 und 34 Jahre alt bist.

Über Deine Unterstützung freue ich mich riesig! 😊

Liebe Grüße und eine schöne Weihnachtszeit,  
Alicia

Hinweis zum Datenschutz: Alle erhobenen Daten werden anonym behandelt und ausschließlich zur internen Auswertung verwendet. Die Teilnehmer können bei einer Auswertung nicht identifiziert werden, um maximalen Datenschutz zu gewährleisten. Bei Rückfragen oder Anmerkungen kannst Du Dich jederzeit bei mir melden ([af084@hdm-stuttgart.de](mailto:af084@hdm-stuttgart.de)).

**Ich stimme der anonymen Nutzung meiner Daten im Rahmen der Umfrage zu: \***

Ja

## Kaufverhalten (stationär)

Wo kaufst Du Deine Lebensmittel ein? \*

- Supermarkt
- Discounter
- Bioladen
- Feinkostladen
- Wochenmarkt
- Hofläden / regionale Läden
- Unverpacktläden
- Internet
- Andere:

Wie häufig kaufst Du Lebensmittel ein? \*

- Täglich
- Einmal in der Woche
- Mehrmals die Woche
- Einmal im Monat
- Nie
-

**Worauf achtest Du besonders bei Lebensmitteln? \***

	trifft nicht zu	trifft eher nicht zu	teils-teils	trifft eher zu	trifft zu
Guter Geschmack	<input type="radio"/>				
Hohe Qualität / Frische	<input type="radio"/>				
Günstiger Preis	<input type="radio"/>				
Regionale Herkunft	<input type="radio"/>				
Saisonale Lebensmittel	<input type="radio"/>				
Haltbarkeit	<input type="radio"/>				
Zusatzstoffe	<input type="radio"/>				
Kalorienanzahl	<input type="radio"/>				
Ökologische Produktion (Bio)	<input type="radio"/>				
Wenig / Kein Verpackungsmaterial	<input type="radio"/>				
Artgerechte Haltung von Tieren	<input type="radio"/>				
Geringer Ressourcenverbrauch	<input type="radio"/>				
Faire Arbeitsbedingungen	<input type="radio"/>				
Kurze Transportwege	<input type="radio"/>				
Andere:	<input type="radio"/>				
<input type="text"/>					

## Was schätzt Du besonders am Einkaufserlebnis? \*

	trifft nicht zu	trifft eher nicht zu	teils-teils	trifft eher zu	trifft zu
Große Auswahl	<input type="radio"/>				
Möglichkeit des Preisvergleichs	<input type="radio"/>				
Günstige Angebote	<input type="radio"/>				
Auf Wünsche zugeschnittene Angebote	<input type="radio"/>				
Neues entdecken	<input type="radio"/>				
Abwechslung vom normalen Alltag	<input type="radio"/>				
Gute Beratung	<input type="radio"/>				
Möglichkeit, Waren sofort zu nutzen	<input type="radio"/>				
Möglichkeit, Waren anzufassen	<input type="radio"/>				
Zwischenmenschliches Element	<input type="radio"/>				
Andere:	<input type="radio"/>				
<input type="text"/>					

## Kaufverhalten (online)

### Hast Du bereits Lebensmittel online bestellt? \*

- Ja, und ich würde es wieder machen.
- Ja, und ich würde es nicht wieder machen.
- Nein noch nicht, aber ich kann es mir vorstellen.
- Nein, und ich kann es mir nicht vorstellen.

## Seite 4

### Bei welchem Anbieter hast Du die Lebensmittel bestellt?

**Aus welchen Gründen hast Du Lebensmittel online bestellt?**

**Welche Art von Lebensmitteln hast Du online bestellt?**

- Obst / Gemüse
- Milcherzeugnisse (zB. Käse)
- Eier
- Fleisch / Wurst
- Fisch
- Teigwaren (zB. Nudeln)
- Konserven
- Tiefkühlkost
- Brot- und Backwaren
- Süßwaren / Snacks
- Getränke
- Kaffee / Tee
- Gewürze
- Andere:

**Über welches Medium hast Du die Lebensmittel bestellt?**

- Notebook
- Smartphone
- Tablet
- Andere:

## Was hindert Dich daran, Lebensmittel online zu bestellen?

## Kaufverhalten (online)

Welche Nachteile siehst Du im Lebensmittel-Onlinehandel (und sind womöglich Gründe dafür, dass Du bisher noch keine Lebensmittel online gekauft hast)? \*

	Stimme überhaupt nicht zu	Stimme nicht zu	Stimme weder zu noch lehne ab	Stimme zu	Stimme voll und ganz zu
Größeres Vertrauen in stationären Handel	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Zweifel an Qualität / Frische	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Spontanität beim Lebensmitteleinkauf	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Eingeschränkte Betrachtungsmöglichkeiten	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Geringe Auswahl	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Einkaufserlebnis fehlt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Preis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lieferkosten	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lange Lieferzeiten	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Aufwand zu hoch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ungewohntheit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Schlechte Erfahrung	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Angst vor Datenmissbrauch	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Andere:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="text"/>					

**Welche Vorteile siehst Du im Lebensmittel-Onlinehandel? \***

	Stimme überhaupt nicht zu	Stimme nicht zu	Stimme weder zu noch lehne ab	Stimme zu	Stimme voll und ganz zu
Unabhängige Öffnungszeiten	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lieferung nach Hause	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Zeitersparnis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Größere Produktvielfalt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Schnellere Suche nach bestimmten Produkten	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mehr Produktinformationen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Automatische Nachbestellung	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Günstigere Preise / Angebote	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Online-Zahlung	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Muss nicht in vollen Supermarkt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kann von überall bestellen	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rücktrittsrecht vom Kauf	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Anonymität	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Andere:	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="text"/>					

**Welche Produktinformationen sind interessant für Dich, wenn Du deine Lebensmittel online bestellst? \***

	---	--	-	+	++	+++
Detaillierte Beschreibung vom Produkt	<input type="radio"/>					
Bewertungen von Käufern	<input type="radio"/>					
Tipps zur Lagerung und Verarbeitung	<input type="radio"/>					
Videos zum Produkt	<input type="radio"/>					
Rezeptideen	<input type="radio"/>					
Informationen zur Produktion	<input type="radio"/>					
Informationen zur Lieferkette	<input type="radio"/>					
Fotos des Produkts	<input type="radio"/>					
Herkunftsland	<input type="radio"/>					
Nährwerte	<input type="radio"/>					
100g-Preis	<input type="radio"/>					
Vorschläge zu anderen Produkten	<input type="radio"/>					
Siegel, wie Nutriscore oder Bio	<input type="radio"/>					
Andere:	<input type="radio"/>					
<input type="text"/>						

**Regionale Lebensmittel**

**Wo kaufst Du regionale Lebensmittel ein? \***

- Supermarkt
- Discounter
- Fachgeschäft (zB Metzger, Bäcker)
- Wochenmarkt
- Bioläden
- Bauern
- Internet
- Andere:

**Wie häufig kaufst Du lokal produzierte Lebensmittel? \***

- Täglich
- Einmal in der Woche
- Mehrmals die Woche
- Einmal im Monat
- Nie
- 

**Wie wichtig ist Dir bei Kauf und Zubereitung von Lebensmitteln, dass diese aus der Region stammen? \***

- wichtig
- eher wichtig
- teils-teils
- eher unwichtig
- unwichtig
- gleichgültig

## Konzeption eines Onlinehandels

Welcher/n Eigenschaft(en) machen Deiner Meinung nach die Nachhaltigkeit eines Lebensmittels aus? Bitte wähle maximal 3 Eigenschaften aus. \*

- Produktion ohne umwelt- oder gesundheitsbelastende Rohstoffe
- Kurze Lieferkette
- Faire Arbeitsbedingungen
- Siegel (wie Nutriscore oder Bio)
- Regionaler Anbau / Herkunft
- Geringer Ressourcenverbrauch
- Ökologische Produktion (Bio)
- Saison des Lebensmittels
- Artgerechte Haltung von Tieren
- Wenig / Kein Verpackungsmaterial
- Andere:

**Wie stehst Du zu folgenden Aussagen? \***

stimme nicht zu

stimme eher nicht zu

weder noch

stimme eher zu

stimme zu

"Ich würde Lebensmittel aus regionalen Anbau bevorzugen, auch wenn dadurch die Auswahl reduziert wird."

"Ich wäre bereit für ein Produkt mehr zu zahlen, wenn es aus regionalen Anbau stammt."

"Mir ist wichtig, was mein Umfeld über meinen ökologischen Fußabdruck denkt."

## Beim Lebensmittelkauf würde es mich interessieren ... \*

	---	--	-	+	++	+++
... wie viel CO2-Emissionen mein Einkauf kostet.	<input type="radio"/>					
... detailreiche Informationen zur Produktion sowie die Lieferkette von den Lebensmitteln zu sehen.	<input type="radio"/>					
... zu ausgewählten Lebensmitteln entsprechende Rezepte vorgeschlagen zu bekommen.	<input type="radio"/>					
... Rabatte und Angebote zu Lebensmitteln beim Einkauf zu erhalten.	<input type="radio"/>					

## Demografische Daten

Wie alt bist Du? \*

Welchem Geschlecht fühlst Du dich zugehörig? \*

- Weiblich
- Männlich
- Divers
- Keine Angabe

**In welcher Wohnsituation befindest Du Dich? \***

- Ein-Personen-Haushalt
- Wohngemeinschaft
- Mehr-Personenhaushalt mit Kindern
- Mehr-Personenhaushalt ohne Kinder
- Sonstige

**Was ist Deine derzeitige Beschäftigung? \***

- Schule
- Ausbildung
- Studium
- Arbeitnehmer
- Selbstständigkeit
- Arbeitslos
- Sonstige

**Was ist Deine Ernährungsweise? \***

- Omnivor (Alles-Esser)
- Vegetarisch (kein Fleisch oder Fisch)
- Pescetarisch (kein Fleisch, aber Fisch)
- Vegan (keine tierischen Produkte)

**Weitere Anmerkungen / Kommentare:**

Sonst kannst Du Dich bei Rückfragen oder Anmerkungen jederzeit bei mir melden ([af084@hdm-stuttgart.de](mailto:af084@hdm-stuttgart.de)).

» **Umleitung auf Schlusseite von Umfrage Online**



## **Appendix C**

# **Interview guideline**

# Interview Leitfaden

- Hinweis auf Datenschutz
- Ich entwerfe ein Konzept für einen Lebensmittel-Onlinehandel, der Nutzer dabei unterstützen soll mehr regionale Lebensmittel zu kaufen.

Zunächst ein paar Fragen zu Deiner Einstellung demgegenüber.

- Achtest Du auf die regionale Herkunft beim Lebensmittelkauf? Was verstehst Du darunter?
- Nach welchen Kriterien entscheidest Du welches Lebensmittel kaufst, zB Tomaten?
- Welche Vorteile siehst Du darin, regionale Lebensmittel zu kaufen?
- Warst Du schonmal in der Situation, wo du regionale Lebensmitteln kaufen wolltest, und auf Probleme oder Hürden gestoßen bist? zB. Fehlen dir irgendwelche Informationen, um die Kaufentscheidung zu treffen?

Versetze Dich in folgende Lage - Du möchtest Lebensmittel online bestellen, weil seit der Corona-Pandemie die Supermärkte entweder zu voll sind oder man für den Laden anstehen muss. Ich habe mir folgendes Konzept für einen Lebensmittel-Onlineshop überlegt:

- (1) Pro Monat hat man ein bestimmtes Budget an CO<sub>2</sub>-Emissionen. Neben den €-Preisen werden die Kosten in CO<sub>2</sub>-Emissionen dargestellt, die verbraucht wurden, um das Produkt zu produzieren oder transportieren. Bei Einhalten diesen Budgets bekommt man einen Preisnachlass auf seinen Einkauf.
- (2) Außerdem werden detailreiche Produkt-Informationen zur Produktion, Lieferkette und Personen, die hinter dem Produkt stehen, transparent dargestellt.

- Wie findest Du das Konzept?
- Würdest Du den Onlineshop nutzen? Siehst Du einen Mehrwert darin?
- Meinst Du das Konzept würde Dich bei deiner Kaufentscheidung beeinflussen? Inwiefern?
- Fändest Du es hilfreich bei der Betrachtung von massenproduzierten Lebensmitteln entsprechende Alternativen von lokalen Anbietern angezeigt zu bekommen?
- Welche Aspekte des Konzepts fändest Du besonders hilfreich und würdest sie am Meisten nutzen?
- Was für eine Art Bonus würde Dich besonders beim Einhalten des Budgets interessieren? (zB Rabatt auf Einkauf)
- Was würdest Du davon halten, wenn die Produkte von regionalen Anbietern gebündelt an einem Ort zu finden wären?
- Fändest Du es interessant zu sehen wie viel Emissionen andere KäuferInnen für ihren Einkauf ausgeben oder Du in einem Wettbewerb mit ihnen stehst?

Hast Du irgendwelche Anmerkungen?

## Appendix D

### CO<sub>2</sub>-e impact per food item

Product	Carbon footprint (in kg CO <sub>2</sub> -e / kg food)
Tomatoes, from Southern Europe (Spain)	0,4
Tomatoes, organic	1,1
Cherry tomatoes	0,9
Tomatoes, from Germany, grown in heated greenhouse and off-season (in winter)	2,9
Pineapple, transported by ship	0,6
Pineapple, transported by airfreight	15,1
ESL milk, whole milk	1,4
ESL milk, low fat	1,2
UHT milk, whole milk	1,3
UHT milk, low fat	1,1
ESL milk (organic), whole milk	1,7
Milk substitute, oat drink	0,3
Milk substitute, soy drink	0,4
Yogurt, natural (500g)	1,7
Yogurt, fruit (500g)	1,7
Yogurt (organic), natural (500g)	1,9
Yogurt substitute, soy (500g)	0,6
Pasta (500g)	0,7
Pasta (organic) (500g)	0,8

TABLE D.1: CO<sub>2</sub>-e impact per food item [83]



## **Appendix E**

### **Task description of A/B Tests**

# Empirische Studie: Möglichkeiten von Persuasive Technology im Kontext Lebensmittelkonsum

Im Rahmen meiner Bachelorarbeit möchte ich die Wirkung des *Persuasive Systems Design model* im Kontext Lebensmittelkonsum untersuchen. Um diesen Sachverhalt zu analysieren, habe ich einen Prototypen eines Lebensmittel-Onlinehandels entwickelt, mit dem ich Ihre Eindrücke und Ihr Kaufverhalten evaluieren möchte.

Dem Prototyp liegt folgendes Konzept zugrunde: Im Onlineshop erhält man pro Woche ein bestimmtes Budget an CO<sub>2</sub>-Emissionen, das man ausgeben kann. Bei Einhalten des Budgets bekommt man den Versand seines Einkaufs geschenkt. Wenn man das Budget nicht einhält, zahlt man den regulären Preis der Produkte mit Versand.

Bitte lesen Sie sich die folgenden Aufgaben gründlich durch und bearbeiten Sie diese anschließend. Außerdem möchte ich Ihre Gedankengänge nachvollziehen können. Daher bitte ich Sie mir bei der Benutzung der App zu sagen, was Sie denken.

Versetzen Sie sich in folgende Situation: Seit der Corona-Pandemie möchten Sie Kontakte vermeiden und fühlen sich in überfüllten Supermärkten unwohl. Daher kommen Sie auf die Idee Ihren Wocheneinkauf online zu erledigen und stoßen auf die App *FoodPrint* - ein Lebensmittel-Onlinehandel.

## 1. Aufgabe: Suche nach Lebensmitteln

Öffnen Sie die App und finden Sie sich zurecht. Sie möchten für Ihren Wocheneinkauf folgende Lebensmittel kaufen:

- Tomaten
- Ananas
- Milch
- Joghurt
- Nudeln

## 2. Aufgabe: Auswahl der Lebensmittel

Finden Sie diese Lebensmittel mithilfe der zuletzt gesuchten Produkte in der App und wählen Sie jeweils eine der verfügbaren Optionen aus. Fügen Sie das Produkt anschließend dem Warenkorb hinzu.

## 3. Aufgabe: Abschluss der Bestellung

Schauen Sie sich nun die Produkte im Warenkorb nochmal an und schließen Sie Ihre Bestellung ab.

**Vielen Dank für Ihre Teilnahme! Als Nächstes bitte ich Sie einen Fragebogen zur Bewertung des Prototyps auszufüllen. Anschließend stelle ich Ihnen ein paar Fragen zur Benutzung.**

# Empirische Studie: Möglichkeiten von Persuasive Technology im Kontext Lebensmittelkonsum

Im Rahmen meiner Bachelorarbeit möchte ich die Wirkung des *Persuasive Systems Design model* im Kontext Lebensmittelkonsum untersuchen. Um diesen Sachverhalt zu analysieren, habe ich einen Prototypen eines Lebensmittel-Onlinehandels entwickelt, mit dem ich Ihre Eindrücke und Ihr Kaufverhalten evaluieren möchte.

Bitte lesen Sie sich die folgenden Aufgaben gründlich durch und bearbeiten Sie diese anschließend. Außerdem möchte ich Ihre Gedankengänge nachvollziehen können. Daher bitte ich Sie mir bei der Benutzung der App zu sagen, was Sie denken.

Versetzen Sie sich in folgende Situation: Seit der Corona-Pandemie möchten Sie Kontakte vermeiden und fühlen sich in überfüllten Supermärkten unwohl. Daher kommen Sie auf die Idee Ihren Wocheneinkauf online zu erledigen und stoßen auf die App *FoodPrint* - ein Lebensmittel-Onlineshop.

## 1. Aufgabe: Suche nach Lebensmitteln

Öffnen Sie die App und finden Sie sich zurecht. Sie möchten für Ihren Wocheneinkauf folgende Lebensmittel kaufen:

- Tomaten
- Ananas
- Milch
- Joghurt
- Nudeln

## 2. Aufgabe: Auswahl der Lebensmittel

Finden Sie diese Lebensmittel mithilfe der zuletzt gesuchten Produkte in der App und wählen Sie jeweils eine der verfügbaren Optionen aus. Fügen Sie das Produkt anschließend dem Warenkorb hinzu.

## 3. Aufgabe: Abschluss der Bestellung

Schauen Sie sich nun die Produkte im Warenkorb nochmal an und schließen Sie Ihre Bestellung ab.

**Vielen Dank für Ihre Teilnahme! Als Nächstes bitte ich Sie einen Fragebogen zur Bewertung des Prototyps auszufüllen. Anschließend stelle ich Ihnen ein paar Fragen zur Benutzung.**



## **Appendix F**

# **Guideline of A/B Tests**

# Leitfaden Test A

Hallo und herzlich willkommen,

schön, dass Sie an meiner Studie teilnehmen. Im Rahmen meiner Bachelorarbeit habe ich einen Prototypen eines Lebensmittel-Onlinehandels entwickelt, mit dem ich das *Persuasive Systems Design model* auf seine Wirkung im Kontext des Lebensmittelkonsums untersuchen will.

Um das Kaufverhalten sowie Eindrücke bei der Benutzung des Prototyps zu analysieren, benötige ich Ihre Hilfe.

## Datenschutz und Einwilligungserklärung

Bevor es los geht, möchte ich Sie noch über den Datenschutz bzgl. der Studie informieren.

## Fragen zu demografischen Daten

Bevor wir mit dem Nutzungstest starten, würde ich Sie bitten mir noch ein paar Fragen zu Ihrer Person und Einstellung zu beantworten.

- Wie alt sind Sie?
- Welchem Geschlecht fühlen Sie sich zugehörig?
- Was ist Ihre derzeitige Beschäftigung?
- Was ist Ihre Ernährungsweise?
- Achten Sie auf den Aspekt Nachhaltigkeit beim Lebensmitteleinkauf? Warum (nicht)? Welcher Aspekt ist Ihnen am Wichtigsten?

Vielen Dank! Dann starten wir jetzt mit dem Nutzungstest.

## Durchführung der Aufgaben

Bitte lesen Sie sich die folgenden Aufgaben durch und geben Sie mir Bescheid, sobald Sie bereit sind, anzufangen.

Vorab wäre es wichtig zu erwähnen:

- Bei der Durchführung der Aufgaben gibt es keine Wertung, wie richtig oder falsch. Mich interessieren nur Ihre Eindrücke und Ihr Verhalten bei der Benutzung des Prototyps.
- Die Studie dreht sich nicht um Ihre Fähigkeiten. Falls es zu Schwierigkeiten kommt, sprechen Sie mich an und ich helfe Ihnen.
- Es ist wichtig, dass Sie „laut denken“ und mir Ihre Gedanken mitteilen, sodass ich diese nachvollziehen kann. Sie können jederzeit unbesorgt Ihre Meinung äußern. Positive und negative Anmerkungen sind für mich gleich interessant.

## **UEQ-Fragebogen und Interview zu Eindrücken während der Benutzung**

Nun bitte ich Sie diesen Fragebogen zur Bewertung des Prototyps auszufüllen und mir anschließend noch ein paar Fragen zur Benutzung zu beantworten.

- Warum haben Sie sich für diese Produkte entschieden?
- Finden Sie die Anwendung hilfreich? Was finden Sie am Besten oder nicht so gut?
- Wie haben Sie sich beim Benutzen der App gefühlt? Wie war Ihr Nutzungserlebnis?
- Hat Sie irgendetwas überrascht?
- Finden Sie es klar erkenntlich, welches das nachhaltigste Produkt ist?
- Würden Sie die Anwendung in Zukunft benutzen?
- Was würden Sie an der Anwendung verändern, wenn Sie könnten? Wo sehen Sie Verbesserungspotential?
- Haben die Elemente der Anwendung Einfluss auf Ihre Kaufentscheidung genommen? Inwiefern?
- Welchen Aspekt fanden Sie am hilfreichsten? Warum? (Tunneling, Self-monitoring, Suggestion, Rewards, Real-world feel)
- Fühlen Sie sich ausreichend über die Klimabilanz von Lebensmitteln im Supermarkt informiert?

**Super gemacht. Vielen Dank für Ihre Teilnahme, der Nutzungstest ist nun vorbei!** Haben Sie noch Fragen oder Anmerkungen?

## Leitfaden Test B

Hallo und herzlich willkommen,

schön, dass Sie an meiner Studie teilnehmen. Im Rahmen meiner Bachelorarbeit habe ich einen Prototypen eines Lebensmittel-Onlinehandels entwickelt, mit dem ich das *Persuasive Systems Design model* auf seine Wirkung im Kontext des Lebensmittelkonsums untersuchen will.

Um das Kaufverhalten sowie Eindrücke bei der Benutzung des Prototyps zu analysieren, benötige ich Ihre Hilfe.

### Datenschutz und Einwilligungserklärung

Bevor es los geht, möchte ich Sie noch über den Datenschutz bzgl. der Studie informieren.

### Fragen zu demografischen Daten

Bevor wir mit dem Nutzungstest starten, würde ich Sie bitten mir noch ein paar Fragen zu Ihrer Person und Einstellung zu beantworten.

- Wie alt sind Sie?
- Welchem Geschlecht fühlen Sie sich zugehörig?
- Was ist Ihre derzeitige Beschäftigung?
- Was ist Ihre Ernährungsweise?
- Achten Sie auf den Aspekt Nachhaltigkeit beim Lebensmitteleinkauf? Warum (nicht)? Welcher Aspekt ist Ihnen am Wichtigsten?

Vielen Dank! Dann starten wir jetzt mit dem Nutzungstest.

### Durchführung der Aufgaben

Bitte lesen Sie sich die folgenden Aufgaben durch und geben Sie mir Bescheid, sobald Sie bereit sind, anzufangen.

Vorab wäre es wichtig zu erwähnen:

- Bei der Durchführung der Aufgaben gibt es keine Wertung, wie richtig oder falsch. Mich interessieren nur Ihre Eindrücke und Ihr Verhalten bei der Benutzung des Prototyps.
- Die Studie dreht sich nicht um Ihre Fähigkeiten. Falls es zu Schwierigkeiten kommt, sprechen Sie mich an und ich helfe Ihnen.
- Es ist wichtig, dass Sie „laut denken“ und mir Ihre Gedanken mitteilen, sodass ich diese nachvollziehen kann. Sie können jederzeit unbesorgt Ihre Meinung äußern. Positive und negative Anmerkungen sind für mich gleich interessant.

## **UEQ-Fragebogen und Interview zu Eindrücken während der Benutzung**

Nun bitte ich Sie diesen Fragebogen zur Bewertung des Prototyps auszufüllen und mir anschließend noch ein paar Fragen zur Benutzung zu beantworten.

- Warum haben Sie sich für diese Produkte entschieden?
- Finden Sie die Anwendung hilfreich? Was finden Sie am Besten oder nicht so gut?
- Wie haben Sie sich beim Benutzen der App gefühlt? Wie war Ihr Nutzungserlebnis?
- Hat Sie irgendetwas überrascht?
- Finden Sie es klar erkenntlich, welches das nachhaltigste Produkt ist?
- Würden Sie die Anwendung in Zukunft benutzen?
- Was würden Sie an der Anwendung verändern, wenn Sie könnten? Wo sehen Sie Verbesserungspotential?

*[Prototyp A zeigen]*

Der Prototyp wurde dazu entwickelt, die Kaufentscheidung zu beeinflussen und auf nachhaltige Lebensmittel zu lenken.

- Was halten Sie davon? Finden Sie die Anwendung informativ?
- Meinen Sie die Elemente der Anwendung hätten Einfluss auf Ihre Kaufentscheidung genommen? Inwiefern?
- Fühlen Sie sich ausreichend über die Klimabilanz von Lebensmitteln im Supermarkt informiert?

**Super gemacht. Vielen Dank für Ihre Teilnahme, der Nutzungstest ist nun vorbei!** Haben Sie noch Fragen oder Anmerkungen?



## **Appendix G**

# **Data privacy statement of A/B testing**

## Informationen zur Studie und zum Datenschutz

Vielen Dank für Ihre Teilnahme an der empirischen Studie im Rahmen meiner Bachelorarbeit zum Thema „Möglichkeiten von Persuasive Technology im Bereich nachhaltiger Lebensmittelkonsum“.

Um das *Persuasive Systems Design model* nach Oinas-Kukkonen und Harjumaa auf seine Wirkung im Kontext des Lebensmittelkonsums zu evaluieren, wurde ein Prototyp eines Lebensmittel-Onlinehandels entwickelt. Bei dessen Benutzung werden Ihr Kaufverhalten sowie Ihre Eindrücke untersucht.

Die Studie dauert ca. 30-45 Minuten und beginnt mit der Beantwortung ein paar Fragen zur Person. Anschließend werden Sie aufgefordert, Aufgaben mithilfe des Prototypen zu erledigen. Sie werden gebeten „laut zu denken“ und Ihre Gedanken zu teilen. Im Anschluss werden Ihre Bewertung des Prototyps per Fragebogen sowie Ihre Eindrücke zur Benutzung per Interview ermittelt.

Sie können die Studie jederzeit ohne Angabe von Gründen unterbrechen oder abbrechen. Sollten Sie die Studie abbrechen, können Sie entscheiden, ob die bereits vorliegenden Daten vernichtet werden sollen oder weiterverwendet werden dürfen.

Im Rahmen dieser Studie werden folgende Daten erhoben: demografische Daten sowie Einstellung zu Lebensmittelkonsum per Interview, Eindrücke während der Benutzung des Prototyps und Bewertung des Prototyps per Fragebogen. Diese Daten werden vertraulich behandelt und ausschließlich in anonymisierter Form (d. h. nicht rückführbar auf Ihre Person) statistisch weiterverarbeitet.

Während der Studie werden Bildschirm- und Audioaufnahmen gemacht, damit der Studienverlauf im Nachhinein besser nachvollzogen und ausgewertet werden kann. Diese Aufnahmen und Ihre Einverständniserklärung werden bis zur Abgabe der Bachelorarbeit in elektronischer Form verschlüsselt gespeichert und danach in anonymisierter Form an die BetreuerInnen meiner Bachelorarbeit übergeben.

Die Aufzeichnungen werden nicht veröffentlicht. Die erhobenen Daten werden an keine anderen Institutionen und nur an die BetreuerInnen meiner Bachelorarbeit Prof. Dr. Sabiha Ghellal und Tobias Schneider weitergegeben.

Ich bitte Sie im Folgenden, Ihr Einverständnis an der Studie zu bestätigen. Sollten Sie jetzt oder später noch Fragen haben, dürfen Sie sich gerne an die Ansprechpartnerin der Studie wenden.

### **ANSPRECHPARTNERIN**

Alicia Fradera  
Hölderlinplatz 1  
70193 Stuttgart

[af084@hdm-stuttgart.de](mailto:af084@hdm-stuttgart.de)  
+49 1517 2749272

## Einwilligungserklärung

Über die Ziele der Studie und meine Aufgaben bei der Untersuchung wurde ich informiert. Ich erkläre meine freiwillige Teilnahme an der Studie und erkläre mich insbesondere mit der Verwendung der im Rahmen der Bachelorarbeit „Möglichkeiten von Persuasive Technology im Bereich nachhaltiger Lebensmittelkonsum“ erhobenen Daten in der oben beschriebenen Weise einverstanden.

Alle Fragen zur Studie wurden zu meiner Zufriedenheit beantwortet. Eine Kopie des Informationsblattes habe ich erhalten.

---

Ort und Datum

---

Unterschrift des/r TeilnehmerIn

---

Name des/r TeilnehmerIn  
in Blockschrift



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Alicia Fradera

---

Unterschrift der Ansprechpartnerin

---

Name der Ansprechpartnerin  
in Blockschrift

### ANSPRECHPARTNERIN

Alicia Fradera  
Hölderlinplatz 1  
70193 Stuttgart

[af084@hdm-stuttgart.de](mailto:af084@hdm-stuttgart.de)  
+49 1517 2749272



## **Appendix H**

# **UEQ questionnaire**

**Bitte geben Sie Ihre Beurteilung ab.**

Um das Produkt zu bewerten, füllen Sie bitte den nachfolgenden Fragebogen aus. Er besteht aus Gegensatzpaaren von Eigenschaften, die das Produkt haben kann. Abstufungen zwischen den Gegensätzen sind durch Kreise dargestellt. Durch Ankreuzen eines dieser Kreise können Sie Ihre Zustimmung zu einem Begriff äußern.

Beispiel:

attraktiv	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	unattraktiv				
-----------	-----------------------	----------------------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------	-------------

Mit dieser Beurteilung sagen Sie aus, dass Sie das Produkt eher attraktiv als unattraktiv einschätzen.

Entscheiden Sie möglichst spontan. Es ist wichtig, dass Sie nicht lange über die Begriffe nachdenken, damit Ihre unmittelbare Einschätzung zum Tragen kommt.

Bitte kreuzen Sie immer eine Antwort an, auch wenn Sie bei der Einschätzung zu einem Begriffspaar unsicher sind oder finden, dass es nicht so gut zum Produkt passt.

Es gibt keine „richtige“ oder „falsche“ Antwort. Ihre persönliche Meinung zählt!

Bitte geben Sie nun Ihre Einschätzung des Produkts ab. Kreuzen Sie bitte nur einen Kreis pro Zeile an.

	1	2	3	4	5	6	7		
unerfreulich	<input type="radio"/>	erfreulich	1						
unverständlich	<input type="radio"/>	verständlich	2						
kreativ	<input type="radio"/>	phantasielos	3						
leicht zu lernen	<input type="radio"/>	schwer zu lernen	4						
wertvoll	<input type="radio"/>	minderwertig	5						
langweilig	<input type="radio"/>	spannend	6						
uninteressant	<input type="radio"/>	interessant	7						
unberechenbar	<input type="radio"/>	voraussagbar	8						
schnell	<input type="radio"/>	langsam	9						
originell	<input type="radio"/>	konventionell	10						
behindernd	<input type="radio"/>	unterstützend	11						
gut	<input type="radio"/>	schlecht	12						
kompliziert	<input type="radio"/>	einfach	13						
abstoßend	<input type="radio"/>	anziehend	14						
herkömmlich	<input type="radio"/>	neuartig	15						
unangenehm	<input type="radio"/>	angenehm	16						
sicher	<input type="radio"/>	unsicher	17						
aktivierend	<input type="radio"/>	einschläfernd	18						
erwartungskonform	<input type="radio"/>	nicht erwartungskonform	19						
ineffizient	<input type="radio"/>	effizient	20						
übersichtlich	<input type="radio"/>	verwirrend	21						
unpragmatisch	<input type="radio"/>	pragmatisch	22						
aufgeräumt	<input type="radio"/>	überladen	23						
attraktiv	<input type="radio"/>	unattraktiv	24						
sympathisch	<input type="radio"/>	unsympathisch	25						
konservativ	<input type="radio"/>	innovativ	26						



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