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Marketing and Consumer Behaviour Group (MCB)

Msc Thesis

Promoting healthier food choices with the application of Augmented Reality

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Abstract

In this study, nutrition fact tables as an example of back of pack labelling, traffic light logos as an example of front of pack labelling, and an augmented reality mobile application as a proposed new way for providing nutritional information method were compared and tested. There were two main objectives. First, to check whether nutritional information provided by these tools have an impact on healthy food choice. Second, to understand which tool is expected to be used in future shopping situations the most.

The research concluded that nutritional information did not have an effect on healthy food choice regardless of which method the information was provided. Nevertheless, the nutritional information was evaluated more understandable, comparable, and salient when it was conveyed by the traffic light logos than by the nutrition fact tables. The augmented reality application could only improve information saliency relative to the traffic light logos but it was evaluated only as understandable and comparable as the information that was conveyed by the nutrition fact tables.

The findings of this study also articulates that there were no differences in the reported future reuse intentions among the three information provision methods. However, it was concluded that the traffic light logos were easier to use, more enjoyable and more novel than the nutrition fact tables. The augmented reality app was assessed as the most enjoyable method, but its other characteristics were evaluated similarly to the traffic light logos.

Keywords: augmented reality, nutrition fact table, traffic light logo, healthy food choice, nutrition labelling, technology acceptance model

Contents

1. Introduction

When people are asked whether they think that purchasing healthy food products is important and beneficial for them they give the answer “yes, of course” almost without exception. Even though, most of us answer the above question very confidently, people tend to choose unhealthy food products during their everyday shopping situations. Unhealthy foods are energy-dense products containing high amount of extra added sugars, refined grains and fats. Previous studies have shown correlation between the increasing number of obese people and the consumption of energy-dense food products (French et al., 2001; Poppitt & Prentice, 1996; WHO (2016)). According to the WHO, approximately 50% of the European population was estimated overweight and more strikingly 21,5% of these were considered as obese in 2008 (WHO, 2016). It is clear that obesity occurs in epidemic proportions, however its consequences are even more noteworthy.

To begin with, the possibility that someone gets type 2 diabetes is significantly higher (Knowler et al., 2002; Tuomilehto et al., 2001). Furthermore, obesity is also a high risk factor of coronary heart disease (Eckel, 1997), sleep apnea (Guilleminault et al., 1988), gallstones and cholecystectomy (Bethesda (MD): National Heart, 1998), furthermore of colon cancer (Giovannucci et al., 1996; I. M. Lee & Paffenbarger, 1992), endometrial cancer (Calle & Thun, 2004) and postmenopausal breast cancer (Huang et al., 1997). Apart from the physical health diseases, mental problems are also more likely to happen. For example, depression occurs twice more frequently in case of obese people. (Roberts et al., 2003).

Considering the detailed dangerous consequences of overweight and obesity, it is crucial to identify and investigate – point of purchase - information provision methods in related to food products to better understand how consumers can be effectively informed, and eventually influenced towards healthier food choices.

Numerous previous marketing researches have already dealt with different - on-pack - information provision methods and tried to predict how they could influence consumers’ consciousness, in terms of healthier food choices. According to mainstream literature, two fundamental types of on-pack nutritional information provision methods can be distinguished; front of pack (FOP) and back of pack (BOP) labelling. These terms define the location of the information on the package, however the way in which the information itself is presented can also vary.

The most rudimentary information provision type is nutrition fact tables that are placed on the back side of the package. This type of information provision has several disadvantages such as customers’ inability or lack of motivation to dedicate sufficient attention towards it (Van Kleef et al., 2008). It has also other drawbacks, as it is complicated to use, furthermore it is not ideal for product comparison purposes either (Van Kleef & Dagevos, 2015). To offset this phenomenon, more effective, attention grabber labeling techniques were invented which are typically presented on the front of the package. Signpost labels has the aim to inform customers about nutrition characteristics of the product, moreover to help them to assess the nutritional quality as well (Van Kleef & Dagevos, 2015). Pereira (2010) distinguishes fact-based (Guidelines Daily Amounts (GDA) and criteria-based (health tick, NuVal system, quality stamp, guiding stars system, traffic light system) signpost systems.

Even though several new types of nutrition labelling techniques have been identified, most of them still have clear limitations. To begin with, there is always limited space on the package, therefore the amount of information is strictly finite. Furthermore, consumers dedicate little attention to them unless they have a clear dietary goal (Van Herpen & Van Trijp, 2011).

In this paper, I would like to extend the repertoire of nutritional information provision methods and propose an Augmented Reality mobile application (AR) as a new means for conveying information about nutritional quality to help consumers to choose more consciously among food products, which in turn, can help them to maintain a healthy lifestyle.

AR is a visualization method that combines different computer generated multimedia objects with the real world perspective (Kounavis et al., 2012). Owing to its characteristics, it provides an immersive experience which can aid users to obtain valuable product information, but still, in a fun and enjoyable manner. Pointing consumers' attention to key nutritional information or to health-related consequences of food products with the application of AR might have more impact on healthy product choice than traditional on-package information provision methods. One reason for this can be, that AR brings an immersive, interactive experience for consumers which will trigger more attention towards the information itself. Furthermore, its novel, unexpected applicability might also draw more attention to the information it conveys. Moreover, it is also a clear tendency that a smartphone is often the first tool certain consumer cohorts reach for information seeking purposes (Pandey et al., 2013). Consequently, information provision via smart devices is expected to be a more "organic channel" and hence, a more accepted way for certain consumers than ordinary on-product information provision methods. Another indisputable advantage of AR is that it is not limited to only textual and pictorial information, since it can broadcast 3 dimensional objects, animations, even audiovisual contents. Lastly, AR can be also considered as a two-way communication channel too, as users are able to interact with the presented content e.g. selecting an option or being redirected to a website or video.

Considering the above advantages of AR, this research proposes to compare back of pack labelling, front of pack labelling and the newly proposed Augmented reality mobile application methods to see to what extent they can aid healthier food choices in a supermarket setting. The main purpose of the research is to check whether nutritional information conveyed via traffic light logos (as a form of front of pack labelling) can trigger healthier food choices than traditional nutrition fact sheets (as a form of back of pack label). Furthermore, it is also aimed to investigate whether a similar nutritional information presented in an Augmented reality mobile application that was presented on the traffic light logos can further improve healthy food choice compared to the traffic light logos.

In addition to the comparison of the three methods, this study also aims to measure the expected future reuse intentions of the involved nutritional information provision tools. Future reuse intention is of great importance because even the tool which is able to facilitate healthy food choice the most becomes meaningless unless people have strong motivation to use it in their future purchases.

Consequently, the purpose of this study is twofold. The first objective is to understand the effects of AR on healthy food choice compared to the traditional nutritional quality information methods. And second, to test people's willingness to reuse the different methods/tools in the future.

This is of great importance, as If we can better understand the effect of the different information provision tools, we can develop improved interventions to aid healthier food choices.

In the next chapter the theoretical framework will start with a literature review which will be focusing on three cardinal topics; firstly, to present and compare the characteristics of the three different information provision methods (nutrition fact tables, traffic light logos, AR). Secondly, to identify the key characteristics of nutritional information that can facilitate their potential success in aiding healthier food choices. Third, to identify the key determinants of the future reuse intentions of the nutritional information provision methods.

In the second part of the theoretical framework chapter, the theoretical model will be presented for both interrelated but still distinctive dependent variables (1. food choice, 2. reuse intention of the information provision tools).

In the subsequent chapter the methodology will be presented which will be followed by the results, and the discussion of the research.

2. Theoretical framework

2.1 Means for providing nutritional information

Consumers show increasing interest towards health and diet in order to avoid nutrition related diseases (Ingrid Borgmeier & Joachim Westenhoefer, 2009). Nevertheless, consumers are only able to purchase healthy products if they are capable of distinguishing heathy products from unhealthy ones. This can be achieved by creating transparent nutritional information provision tools (Feunekes et al., 2008).

Nutritional information placed on food labels are the most widely used method to facilitate consumers to purchase healthier products (Baltas, 2001). In the following section, the most common nutrition labeling techniques will be presented which will be proceeded by the presentation of the technology called Augmented Realty and its perspectives and potential applicability in the field of nutritional information provision of food products.

2.1.1 Back of pack labelling (BOP)

The most basic type of nutritional labeling is the nutrition fact tables placed on the back side of food products. These tables usually present the macro nutrient content of products i.e. protein, carbohydrate, and fat. Moreover, they can also include the following details as well; calorie content, sugar ratio of the total carbohydrates, salt and saturated fat ratio of the total fat content details. This information is presented in a multicolumn system indicating the macro nutrient content is several possible ways. Some nutrition facts depict the nutrition content per the entire package, others show the quantities per 100g, yet others use a “per serving” methodology or the combination of the above.

Even though the primary reason for designing BOP nutritional fact labels was to aid customers to make healthier choices (Jordan Lin et al., 2004), research shows that many consumers find them confusing and too complex which is specifically true for the numerical information and for the applied terminology on the labels (Byrd-Bredbenner et al., 2000; Wandel, 1997). The study by G. Cowburn and L. Stockley (2005) also concluded that older people, lower educated people, and low income people are tent to have problems to interpret and understand the nutritional information presented on the BOP labels. The most difficulties were derived from the conversion between “nutrition content per 100g” and “nutrition content per serving size”. Moreover, most vulnerable consumer groups also found it hard to interpret the notion of “serving size” as well.

2.1.2 Front of pack labelling (FOP)

Not surprisingly, the industry started to search for new ways, new tools which can simplify the presentation of the nutrition quality of food product to facilitate better understandability but also better comparability among different products.

A major improvement is the tendency to present information on the front of the package. The type of information can greatly vary from comprehensive nutrition facts to simple health claims or symbols.

Detailed, comprehensive FOP labels allow consumers to make an informed choice based on key nutrients depicted in a more pleasant way compared to the traditional BOP labels (Feunekes et al., 2008). The Guideline Daily Amounts (GDA) system is an example for a comprehensive FOP label. The GDA system shows the nutrition and/or calorie content in percentage of what an average adult consumer should eat daily usually assuming a 2000 kcal daily diet (Ingrid Borgmeier & Joachim Westenhoefer, 2009). The research conducted by Viswanathan and Hastak (2002) also concluded that adding the percentages of macro nutrients relative to an average daily diet helps people to better understand and judge the nutritional content of foods.

Simple health claims and symbols have a great advantage, as they compress the cognitive effort and time in which customers can process the nutritional information compared to the more detailed fact tables (Scott & Worsley, 1994). Time and effort are two key factors, as consumers usually have only a limited possibility to process the information. Furthermore, their involvement is low in a supermarket setting which leads to superficial nutritional information comprehensions (Fiske & Neuberg, 1990; Petty et al., 1983). Hoyer (1984) also concluded that consumers tend to make purchasing decisions in seconds rather than minutes in a supermarket environment, therefore information simplification is crucial. Simplified FOP labels can summarize the properties of nutritional quality and provide a holistic interpretation on how healthy a product is (Feunekes et al., 2008).

Common health claims presented on FOP labels are; “no sugar”, “natural flavoring”, “no artificial preservatives” “low calorie” and a like.

FOP labels can also include numerous types of symbols like a star system, health protection factor, healthy choice tick, smileys, or a traffic light system.

The multiple traffic light (MTL) system has been proven to be one of the most helpful front of pack systems for many customers (Ingrid Borgmeier & Joachim Westenhoefer, 2009; Hawley et al., 2013; Roberto, Bragg, Schwartz, et al., 2012). It uses a free level color coding mechanism in order to indicate how healthy a product is (or its key nutrient content separately). The nutrients are depicted in three different colors; green, amber or red, representing ‘‘low”, ‘‘medium” and ‘‘high” respectively. Even though the MTL system has various positive empirical support, it still has some weaknesses as well. For example, some people do not realize that the red/amber/green colors involve meaning (Malam et al., 2009). Others think that the colors are only have the purpose to make the label stand out. Yet others have the idea that the colors are linked to certain macro nutrients e.g. fat is always written in red color (Hawley et al., 2013).

2.1.3 Proposing Augmented Reality as a new means

It is clear that nutrition information has to be transparent, unambiguous and simple to be understood. Additionally, it should also help people to make easy comparisons between different products. Regardless of the previously detailed simplifications and FOP techniques, there is still a great need for new innovations that can further aid consumers to distinguish healthy products from less healthy ones in order to facilitate their healthy food consumption and well-being.

In the next section the technology called Augmented Reality (AR), as a potential new means for conveying nutritional information, will be proposed;

AR is a visualization method that combines different computer generated multimedia objects like animations, texts, videos, and 3D objects with the real world perspective (Kounavis et al., 2012). Even though AR – as a concept – had already existed in the 1960s, it was only possible to use and research it on a bigger scale in the last two decades, owing to the rapid spread of smartphones. AR is unique as it superimposes digital media on top of reality with the application of a smartphone' camera, gyroscope, screen, and processing capability, which eventually provides a highly interactive and immersive experience (Kounavis et al., 2012). AR extends the real world with computer-generated objects that appear to be present in the same space as the real world (Van Krevelen & Poelman, 2010). As Van Krevelen & Poelman (2010) summarize, there are three essential aspects of an AR system as follows; first, it combines actual and virtual objects in a real environment. Second, it can align the two types of objects with each other in space and time. Lastly, the combination of objects can manifest in 3 dimensions and also in real time.

The literature differentiates AR based on the AR equipment's position relative to the user. The first major type is the head-worn technology which is often represented as a glasses-like device that people need to wear on their faces. The device projects the digital objects, so one can see additional information on top of reality by looking through the device. Nevertheless, Van Krevelen & Poelman (2006) explain that the device needs to be connected to a computer in order to present the graphical

information, which restricts the user's mobility. They also mention low battery life time as a potential weakness. The other prominent positioning way is the hand-held AR. Van Krevelen & Poelman (2010) states that this type of AR is the best work-around possibility to spread AR on the mass market owing to the relative inexpensiveness of the technology and ease of use. In addition, the main component of hand-held AR – a smartphone – is already in the possession of many people, globally.
AR shares certain similarities with Virtual Reality (VR) technology, as both of them create an interactive and simulated environment for the user, to some extent. Nevertheless, VR does not allow the user to establish a connection with the actual reality and the nearby environment, since it requires full emersion towards the simulated content. Contrary to VR, AR is able to combine virtual reality with actual reality which is very likely to be the primary reason for its increasing popularity among users (Fritz et al., 2005).

Owing to its immersive experience, AR has already pioneered the gaming industry when Niantic & Nintendo released the Pokémon Go mobile game using AR technology in 2016. It was so successful that Pokémon Go became the most downloaded app in the least amount of time ever in the mobile gaming history (Grubb, 2016). These achievements are so outstanding that it is exciting to imagine whether AR can bring new advancements outside the gaming world as well, specifically on the field of nutritional information provision methods. Owing to its highly immersive and suggestive characteristics, AR is hypothesized to be an extended version of front of pack labelling which might be an even more effective way for nutritional information provision, hence this study proposes AR as a new means to provide information about nutritional quality.

2.2 Characteristics of nutritional information

In the previous section, the main focus was on the different information media and the ways the nutritional information can be presented. Even though, the tools are of great importance, it is also essential to identify the different properties of the information itself in order to better understand how nutritional information can be of most helpful to people.

2.2.1 Understandability

Nutrition information available on the product is usually the only source of information customers can rely at the point of purchase, therefore it is crucial that customers are able to understand and the information to help their decisions on food choice (Gill Cowburn & Lynn Stockley, 2005). The authors further explicate that understandability in the nutrition information context means that consumers are able to recognize and interpret the various nutrition terms and measurement units in order to make an informed decision.

Understandability is key, as a nutrition message can soon become worthless if the recipient is not able to comprehend the information. Previous researches have shown that often times the nutritional information understandability is impaired because of ambiguity and complexity of the information stimulus itself. For instance, quantitative information especially regarding serving size has been found difficult for customers (Huizinga et al., 2009; Rothman et al., 2006). The percentages of recommended daily amounts can be also confusing for many people (Bridget Kelly et al., 2009; Lando & Labiner-Wolfe, 2007). Another important phenomenon is information overload which leads to limited understandability (G. Cowburn & L. Stockley, 2005). Information overload often triggers customers to use heuristics to simplify the decision process instead of making an objective choice (Schulte-Mecklenbeck et al., 2013). Confusing visual cues can also cause people difficulties in comprehension. Textual information and the used symbols, the size of the information, the used colors but even the amount of white space can also influence the extent to which customers are able to interpret and comprehend the nutritional information (Dan J Graham et al., 2012).

Even though the characteristics of the information stimulus greatly determine how well people are expected to understand the message, certain skills of consumers also play a major role in understanding. Rothman et al. (2006) concluded that the level of literacy and numerical skills of customers correlates with their nutrition label understanding.

It is crucial to realize that without understanding, the nutritional information cannot fulfil its role i.e. helping consumers to get an objective picture on how healthy a certain product is and how well it would serve their dietary goals. Therefore, every new attempt to improve nutritional information provision techniques should put a keen emphasis on information simplicity, unambiguity.

2.2.2 Comparability

Even if customers are able to understand a certain message, it can be challenging to infer the overall nutritional quality of a product compared to similar products in the same product category and especially between different products from dissimilar product categories. Apart from understandability, comparability is another characteristics of information that plays and important role when it comes to nutritional information.

Even though previous research has shown that people in general are able to draw simple comparisons between products based on numerical type of nutritional information (Levy & Fein, 1998), other experiments argued that this is most likely to be true when consumers compare the most well-known types of macronutrients (UK: Ministry of Agriculture, 1995) or when the comparable products are highly similar (Sullivan & Gottschall-Pass, 1995). Nevertheless, when multiple nutritional attributes have to be considered simultaneously, Black and Rayner (1992) have found that it is difficult to make product comparisons for most people and therefore, they tend to reduce the information into one well-known ingredient (e.g. fat or sugar) and use it as a benchmark to make the overall comparison. Nonetheless, focusing on only one macronutrient may lead to uninformed decisions.

Certain forms of benchmarks have been proven to be useful when the goal is to compare different products (Byrd-Bredbenner, 1994). For example, verbal descriptors along with numerical information are argued to be an effective way to aid customers in making comparisons (Lewis & Yetley, 1992). Black and Rayner (1992) further elaborates that consumers can use verbal descriptors to identify major differences among products after which they can use numerical information for further details and precision.

Bar charts, pie charts, and star system ratings are also types of non-numerical benchmark systems, nonetheless they have not been proven to be more helpful for making comparisons than verbal bandings, although Mohr et al. (1980) and Rudd (1986) concluded in their research that the participating high school graduate students were able to benefit more from graphical charts than from solely numerical information.

Taking everything into account, information comparability is also a crucial aspect, since understanding the nutritional quality of a product relative to other products considerably helps people to make a healthier choice in contrast to situations when such a comparison opportunity is not feasible.

2.2.3 Saliency

Saliency is the state or quality of being noticeable, important, and prominent which distinguishes an object from its neighborhood (OxfordUniversityPress, 2017). Information salience is an important aspect, as salient nutrition information is more likely to trigger consumers to integrate health considerations in their shopping decisions which eventually can result in heathier food choices (Enax et al., 2016).

Even though consumers have a great interest in nutritional information of food products (Grunert & Wills, 2007), the usage of nutritional labels are rather questionable in everyday, real-life situations which leads to major differences between admitted and observed usage of labels (G. Cowburn & L. Stockley, 2005; Gorton et al., 2009; Grunert & Wills, 2007). On the one hand, factors like socioeconomic status, education, and the product type are all determinants of nutrition information usage (Graham & Jeffery, 2012). On the other hand, the visual salience of the nutritional information is also a cardinal factor influencing information usage. Higher salience contributes to increased attention and use (D. J. Graham et al., 2012; Orquin et al., 2012). Previous research has argued that people tend to use visually salient cues more than visually non salient ones (Kruschke, 2011). Visual saliency is key, as it does not only facilitate information recognition but it also aids cues to be incorporated into decisions (Weber & Kirsner, 1997). Increasing the visual salience of nutrition information has been proven to decrease first gaze fixation time which results in higher attention capture (Orquin et al., 2012). This implies that more salient nutrition information is expected to be recognized faster and more frequently than the less salient ones (Dan J Graham et al., 2012).

The attributes of salience are the size, the shape, the color, and the position of the nutritional information. Bialkova and Van Trijp (2010) concluded that attention capture was faster and more accurate in case when the label size was twice as big than the standard size, furthermore when the nutrition information was monochromatic rather than polychromatic. Moving forward to the position of the labels, front of pack labeling has been also proven to be more noticeable and therefore a more salient labelling technique than traditional, back of pack nutrition tables (Becker et al., 2015). The presence of certain anchor lines can also increase visual saliency (Goldberg et al., 1999). The application of a front of pack multiple traffic light system has also been argued to have a positive impact on saliency (Jones & Richardson, 2007).

All things considered, information saliency plays an important role in the information conveyance process, therefore it has to be taken into consideration when someone aims to compare different types of information provision methods to aid healthy food choice.

2.3 Determinants of future reuse intention of information provision tools

After examining the various types of information media and the different qualities of information, it is also critical to steer our focus to one other crucial aspect i.e. people's intention to reuse a certain information provision method in the future or not. Reuse intention is of great importance, as even the most effective information provision method becomes worthless if people have no intention to use it in their future shopping situations. Therefore, in the next section various constructs will be presented all aiming to explain why people would decide to reuse certain information provision methods.

2.3.1 Perceived ease of use and usefulness

One of the most prominent theory on the field of information system acceptance is the Technology Acceptance Model (TAM) published by F. D. Davis (1989b). The TAM stems from the theory of reasoned action (Ajzen & Fishbein, 1980) and has proven to be a parsimonious concept to predict and explain the extent to which people are inclined to accept and use new information technologies in a professional work environment.

The theory argues that there are two main factors that eventually influence people when it comes to accept and use new Information systems. Davis, (1989) suggests that perceived ease of use and perceived usefulness are the two main determinants of people's acceptance of new information systems which are mediated by people's attitudes towards the given information system.

Perceived ease of use can be described as the degree to which people subjectively believe that they can use a new technology effortlessly. Perceived usefulness refers to people's beliefs that the application of a new information technology will increase their performance to achieve their goals (Fred D. Davis et al., 1989, p. 985). According to the model, the authors proved that perceived usefulness has a cardinal role in predicting the usage intentions of new information provision methods. More specifically, their research confirmed that perceived ease of use influences perceived usefulness, however the opposite direction was not significant (Agarwal & Prasad, 1999; Chau, 1996; F. D. Davis, 1989a; Lucas Jr & Spitler, 1999; Mathieson, 1991). Moreover, Davis (1993) also pointed out that perceived usefulness does not only have an indirect effect on information technology use - mediated by attitudes towards the information system - but it also has a direct effect on information technology use as well. Perceived ease of use only has an indirect effect in the model towards technology use which was also confirmed in other researches as well (Chau, 1996; Straub et al., 1997; Subramanian, 1994).

After presenting the two main constructs of the TAM, further arguments are necessary to support their applicability in this paper. First of all, it is conspicuous that TAM was developed for a professional work environment, and therefore its applicability might be limited outside of that scope. C. H. Lin et al., (2007) further explains TAM's involuntary nature, as employees at a company are most likely obliged to use new information systems. This condition is significantly different from marketing settings, as people e.g. in a purchasing situation are active participants and free to choose among different information provision methods to obtain nutritional information, and might also have high involvement in the process (C. H. Lin et al., 2007).

Consequently, it is inevitable to extend the TAM model in order to ensure its applicability in everyday situation when people are free to choose among information systems. For that reason, C. H. Lin et al., (2007) presents the Technology Readiness and Acceptance Model (TRAM) which combines TAM with another renowned technology acceptance theory called the Technology Readiness model (TR).

The technology-readiness index (TR) refers to people's tendency to embrace and use new information methods for accomplishing goals not only in their professional but also in their personal lives (Parasuraman, 2000, p. 308). In his distinguished paper Parasuraman (2000) further elaborates that TR is a four dimensional construct which is influenced by certain mental enablers and inhibitors. He defined optimism and innovativeness (as facilitating factors) and discomfort and insecurity (as inhibitor factors) in the model. Optimism is described as the positive assessment of technology, moreover the confidence that it helps people to manage their lives more efficiently, flexibly, and providing more control. Innovativeness, the other facilitating aspect, comprises people's tendencies to be technology pioneers and opinion leaders about it. Discomfort expresses the fear of being overwhelmed by technology, furthermore the sense of being "out of control" when it comes to actual usage. Lastly, the insecurity dimension articulates the general distrust in technology and the belief that it is not useful at all.

Turning back to the integrated TRAM model, it is superior as it utilizes the TR model's individual differences aspects (optimism, innovativeness, discomfort, and insecurity) into the TAM model, and therefore facilitates its applicability in voluntary and non-professional situations as well. The integration of the two models also provides further benefits, as TRAM strengthens the power of the stand-alone TR and TAM models. With the application of TRAM, we can expect more reliable predictions owing to the combination of the four personal difference dimensions of TR with the two powerful predictors of TAM.

To continue the argumentation of the applicability of the two cardinal constructs of TAM, numerous peer reviewed academic papers have been identified which applied TAM's "perceived ease of use" and "perceived usefulness" constructs in their experiments that were similar in nature than this current study. For example, Suh and Han (2002) researched the acceptance and reuse intention of an online banking system. J. S. Lee et al. (2003) checked the acceptance of a blackboard for teaching purposes. In another instance, Van der Heijden (2003)'s topic was the acceptance of a web portal. Chen et al. (2002) researched the key determinants of a web store's reuse intention which provides product information for customers. Lastly, Chung et al. (2015) studied the reuse intentions of an augmented reality application providing information about touristic places.

Even though the examined information provision methods greatly varies among the above listed studies, one important similarity can be observed i.e. they all provide information for people (let it be financial information, product specific information or touristic information). They also had very similar purposes i.e. helping people to achieve their goals in multiple areas of their lives. In my view, nutrition information tools (in various forms like different types of labels or even an augmented reality application) also fit into this logic and they can be regarded as a form of information systems which aid people to make a certain decision in a purchasing situation.

2.3.2 Perceived enjoyment

After presenting the first two constructs and providing argumentation for their applicability, it is also indispensable to introduce the notion of perceived enjoyment.

Even though the original TAM model (published in 1989) only included perceived usefulness and ease of use, three years later, F. D. Davis et al. (1992) proposed that people might not only choose to reuse an information system because of its usefulness but also because people can derive certain hedonic benefits of the actual usage. In that 1992 study, perceived enjoyment was proposed as a new determinant of future reuse intentions. Enjoyment is related to the extent to which an activity can be considered as enjoyable solely because of its own right, regardless of any potential benefits that can be anticipated from its usage (Carroll & Thomas, 1988; Deci, 1971; Malone, 1981). This definition is in strong relation with the typology of the intrinsic and extrinsic motivation concept.

In their research F. D. Davis et al. (1992) also proposed that people increase their efforts in an activity because of both extrinsic and intrinsic motivational factors. Extrinsic motivation can be described as the "performance of an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself" (F. D. Davis et al., 1992, p. 1112). On the other hand, intrinsic motivations can be explained as the ”performance of an activity for no apparent reinforcement other than the process of performing the activity per se” (F. D. Davis et al., 1992, p. 1112).

Teo et al. (1999) also emphasizes that people are more likely to initiate an activity when it leads to fun and enjoyment. Consequently, in terms of obtaining nutritional information, it is of great importance how engaging and fun a certain information provision method is. Not surprisingly, the education industry has already recognized this phenomenon and there is a notable tendency to export certain aspects of video games into non-gaming educative contexts (Domínguez et al., 2013). This idea also known as “gamification” when certain game design elements and game mechanics are implemented in non-game contexts to facilitate enjoyment and engagement (Deterding et al., 2011).

2.3.3 Perceived novelty

Following the intrinsic motivational thread, perceived novelty - as another source of intrinsic motivational factors – is presented. Oudeyer et al. (2016) argues that novelty and surprise are intrinsically rewarding, and therefore inspiring people to actively seek for situations in which they experience them. Berlyne (1960) similarly claims that intrinsic rewards can be triggered in circumstances in which novelty, surprise, or incongruity are involved. Furthermore, he also argues that situations in which an intermediate level of novelty are presented are the most rewarding ones as well. This concept shares certain similarities with the concept of flow (Csikszentmihalyi, 1990) which states that important sources of internal rewards are derived from activities that require skills slightly above the current level of an individual. Ryan and Deci (2000) shares similar thoughts as they describe intrinsic motivations as the propensity to search for novelty and challenges in order to explore and learn. Gehrt and Carter (1992) reports further empirical support as they explain that consumers enjoy the process of exploring novel and interesting activities, products. Holbrook and Hirschman (1982) also state that consumers might consider to start using a certain product because of its novelty.

Considering the above results, it is expected that perceived novelty can also facilitate future reuse intentions of nutritional information methods.

2.4 Research model and hypotheses

It is important to note that this study includes two interrelated but still very distinctive dependent variables. First, the actual food choice in case of the three different conditions and second, the future reuse intention of the three different information provision tools. Considering the dual nature of this study, two separate models will be presented both of them are attempting to explain the underlying interactions between the independent and dependent variables.

2.4.1 Study A – Drink choice

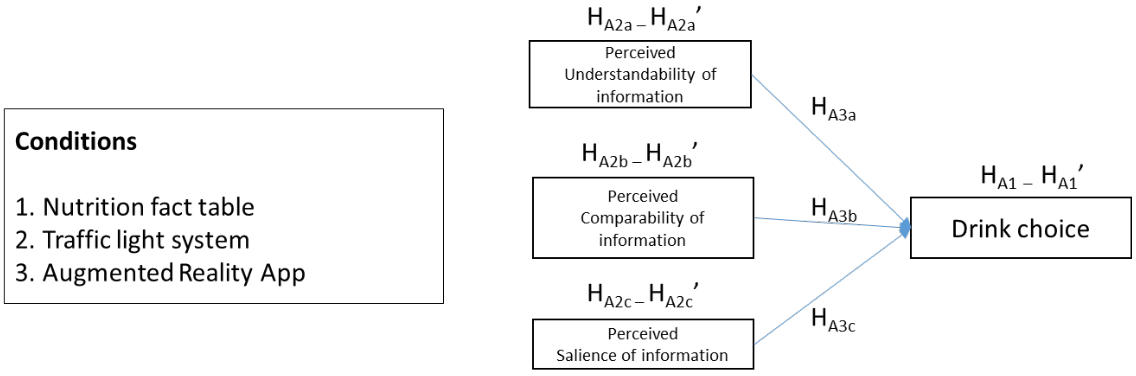

Figure 1: Theoretical mode for explaining food choice

As already proposed the first core topic of this thesis is to compare the back of pack nutrition fact tables with the front of pack traffic light logos which are compared with the newly proposed AR mobile application in terms of their capability to facilitate healthier product choices. Based on previous researches, traffic light logos have proven to be superior in many ways than simple nutrition fact tables. In this thesis, I propose that a similar nutritional information that used on the traffic light logos would be even more effective when they were shown in an AR mobile app.

Therefore, this study proposes the following hypothesis:

H_{A1}: People choose healthier products when they obtain nutritional information via traffic light logos than via nutrition fact tables.

H_{A1}': People who choose healthier products when they obtain nutritional information via an augmented reality mobile application than via traffic light logos.

Figure 1 presents the complete theoretical framework of **Study A** which also aims to explain the underlying interactions between the predictor (characteristics of information) and dependent (drink choice) variables.

First of all, the extent to which consumers can understand the nutritional information has been identified as one of key factors that determine whether customers can make an informed choice. Several examples have shown that back of pack nutrition fact tables can be confusing, misleading or overwhelming which eventually make it harder to objectively distinguish healthy food products from the unhealthy ones. Traffic light logos provide several advantages, as they simplify the information and they also require less cognitive effort form customers. Nevertheless, traffic light logos might be still confusing or ambiguous for some people. AR as a proposed new nutritional information provision tool is expected to overcome several deficiencies the traffic light logos. It provides an immersive experience and the information it conveys is expected to be more straight forward and understandable.

Therefore, this study proposes the following hypothesis:

H_{A2a}: Nutritional information is perceived more understandable in case of the traffic light logos than in the nutrition fact tables.
H_{A2a}': Nutritional information is perceived more understandable in case of the augmented reality mobile application than in the traffic light logos.

To continue with, comparability has been also defined as a key nutrition information property which has a vast impact on product choice. Traditional information provision methods can serve just well when consumers like to compare a simple macro nutrient among different products, however their usability is greatly limited in case of more complex products when multiple nutritional aspects have to be compared and considered. AR on the other hand, can provide a new and unique way for presenting nutritional quality. It provides the opportunity to depict the overall nutritional quality in a simple manner that makes it easier to make product comparisons even among complex products. Therefore, this study proposes the following hypothesis:

H_{A2b}: Nutritional information is perceived more comparable in case of the traffic light logos than in the nutrition fact tables.
H_{A2b}': Nutritional information is perceived more comparable in case of the augmented reality mobile application than in the traffic light logos.

Lastly, information salience has been proven to be a crucial aspect that eventually determines whether the information grabs consumers' attention or not. Nutrition fact tables are placed on the back of the package are frequently ignored by most people. Traffic light logos provides clear benefits, as they are presented on the front of the package, right in front of the customer's eye. One of the biggest added values of AR could be that the information it is conveying is much more salient compared to even the traffic light logos. To begin with, the size of an AR information can be much bigger than the traditional nutritional labels. Logically, when it comes to on-pack labelling the maximum size is limited by the physical dimensions of the product package. Naturally, apart from the nutritional label, many other information also needs to be placed on the package which reduce the maximum visibility of the nutritional infomration. In case of AR, the size of the information is almost infinite as the viewer uses a smartphone to see the generated digital content on top of the real view. What is even noteworthy that AR is not restricted to textual and pictorial information like traditional on-pack labels, as AR can also present animations, and 3D objects. In addition, AR's big advantage that it can also broadcast dynamic content like moving objects which is absolutely impossible in case of the on-pack labels were the information is always presented in a static manner.
Therefore, this study proposes the following hypothesis:

H_{A2c}: Nutritional information is perceived more salient in case of the traffic light logos than in the nutrition fact tables.

H_{A2c}': Nutritional information is perceived more salient in case of the augmented reality mobile application than in the traffic light logos.

The second part of the model presents the assumptions that the perceived understandability, comparability, and saliency of nutritional information have a positive impact on healthy drink choice. This means that, higher perceptions lead to healthier choices. Therefore, this study proposes the following hypothesis:

H_{A3a}: Perceive understandability of nutritional information has a positive effect on healthy food choice.

H_{A3b}: Perceive comparability of nutritional information has a positive effect on healthy food choice.

H_{A3c}: Perceive saliency of nutritional information has a positive effect on healthy food choice.

2.4.2 Study B – Reuse intention of information tools

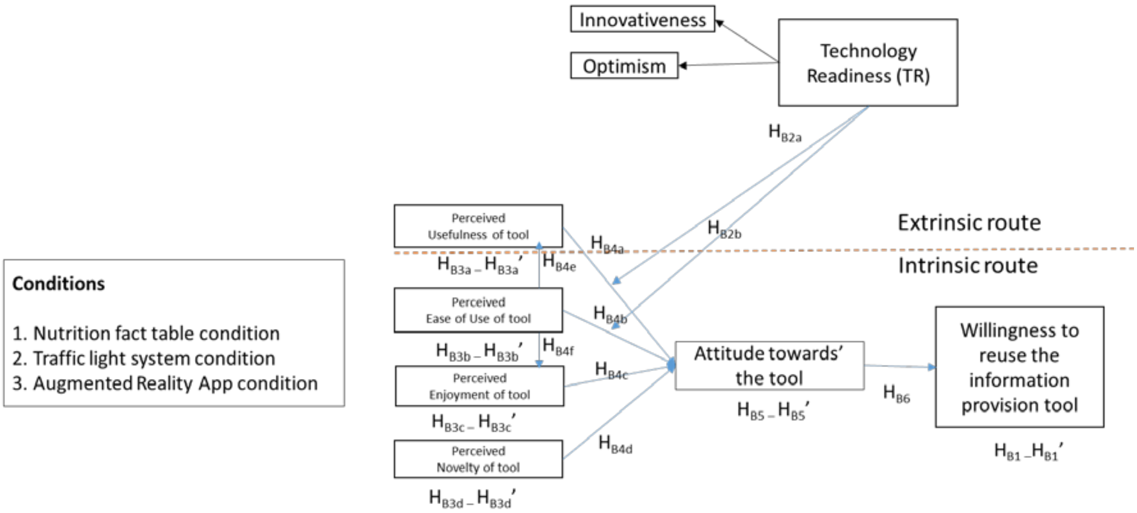

Figure 2: Theoretical model for explaining reuse intention of tools

Turning the focus to the other dependent variable i.e. the “future reuse intention of the information provision tools”, Figure 2 presents the complete theoretical model.

The primary assumption is that people are more inclined to use the traffic light logos than the nutrition fact tables, since the logos are easier to use, probably more useful too. Moreover, it is also hypothesized that the proposed AR application would be even more favored by customers, as it is expected to provide more fun and excitement in the information provision process.

Therefore, this study proposes the following hypothesis:

> **H_{B1}:** Consumers are more likely to use traffic light logos in their future shopping situations than the nutrition fact tables to obtain nutritional information.
>
> **H_{B1}':** Consumers are more likely to use the augmented reality mobile application than traffic light logos in the future to obtain nutritional information.

The core of the theoretical model stems from the Technology reediness and acceptance model (TRAM), nevertheless this study attempts to apply two additional key predictor constructs (perceived enjoyment and perceived novelty) as well in order to assure the best applicability for this experiment.

The TRAM model was chosen to be the core of the theoretical model because it has been proven to be applicable also in non-professional and involuntary situations unlike its predecessor i.e. the TAM

(C. H. Lin et al., 2005). Additionally, TRAM was also confirmed that it provides better predictive power than TAM, as it combines the personal difference dimensions of TR with the powerful predictors of TAM (Yang & Yoo, 2004).

The starting point of the model is that people have different perceptions of usefulness, ease of use, enjoyment, and novelty in case of the three information provision conditions.

Hence, this study proposes the following hypotheses:

H_{B3a}: Consumers have higher perceived usefulness evaluations about the traffic light logos than about the nutrition fact tables.
H_{B3a}': Consumers have higher perceived usefulness evaluations about an augmented reality mobile application than about the traffic light logos.

H_{B3b}: Consumers have higher perceived ease of use evaluations about the traffic light logos than about the nutrition fact tables.
H_{B3b}': Consumers have higher perceived ease of use evaluations about an augmented reality mobile application than about the traffic light logos.

H_{B3c}: Consumers have higher perceived enjoyment evaluations about the traffic light logos than about the nutrition fact tables.
H_{B3c}': Consumers have higher perceived enjoyment evaluations about an augmented reality mobile application than about the traffic light logos.

H_{B3d}: Consumers have higher perceived novelty evaluations about the traffic light logos than about the nutrition fact tables.
H_{B3d}': Consumers also have higher perceived novelty evaluations about an augmented reality mobile application than about the traffic light logos.

In the following stage the model presents the relationship between the four main predictors and consumers' attitudes towards the information provision tools. The link between usefulness / ease of use and attitude towards an information system has been well known and empirically supported by numerous previous TAM, TRAM studies (Agarwal & Prasad, 1997, 1999; Karahanna et al., 1999; S. Taylor & P. Todd, 1995; S. Taylor & P. A. Todd, 1995). The link between enjoyment and attitude was also supported (F. D. Davis et al., 1992; Ha & Stoel, 2009; Hsu & Lin, 2008; Van der Heijden, 2003). One study has been found that also confirmed that novelty has a positive effect on attitude towards an information system (Wells et al., 2010). Hence, this study proposes the following hypotheses:

H_{B4a}: Perceived usefulness of the nutritional information tool has a positive effect on attitude towards the information provision tools.

H_{B4b}: Perceived ease of use of the nutritional information tool has a positive effect on attitude towards the information provision tool.

H_{B4c}: Perceived enjoyment of the nutritional information tool has a positive effect on attitude towards the information provision tool.

H_{B4d}: Perceived novelty of the nutritional information tool has a positive effect on attitude towards the information provision tool.

F. D. Davis (1993) concluded that there is a significant empirical support for the positive relationship between perceived ease-of-use and perceived usefulness. I also expect that this relationship will be observable in this research as well. The easier to use a nutritional information tool, the more likely people consider it as a useful one.

In a similar manner, perceived ease of use can also correspond to perceived enjoyment, since the easier an information provision tool to use the more likely people enjoy the activity itself (Van der Heijden, 2003). Hence, this study proposes the following hypotheses:

H_{B4e}: Perceived ease of use of the tool has a positive effect on perceived usefulness of the tool.

H_{B4f}: Perceived ease of use of the tool has a positive effect on perceived enjoyment of the tool.

In the following step, the model presents the expected moderation effect of consumers' technology reediness indices on the relationship between the perceived usefulness / ease of us and attitude.

TR stands out of four sub-dimensions as follows; optimism, innovativeness, discomfort, and insecurity (Parasuraman, 2000). Regardless of the originally used four sub-dimensions, only optimism and innovativeness will be used in this research. The primary reason behind is that the inhibitor dimensions (discomfort and insecurity) were not proven to be stable individual factors of TR in later studies (Berger, 2009; Erdoğmuş & Esen, 2011; Taylor et al., 2002; Walczuch et al., 2007). Using TR is advantageous, as it introduces individual difference variables which makes it possible to apply TAM in case of voluntary situations as well (C. H. Lin et al., 2007).

I expect that consumers' TR scores positively moderate the relationship between perceived usefulness and attitude and perceived ease of use and attitude in case of the augmented reality mobile application scenario. However, I expect that TR negatively moderates the same relationships in the nutrition fact table and traffic light conditions.

This implies that the additional increase in attitudes, owing to the increase of one unit of perceived usefulness or ease of use, is higher for people who are more technologically ready than for people who score lower on TR in the augmented reality condition. The moderation effect is hypnotized as positive in the AR condition because the more a person is opened to high tech technologies, it is more likely that the person will like even better a high tech technology when the person thinks it is useful or easy to use. Therefore, a higher TR score strengthens the positive impact of perceived usefulness or ease of use on attitudes towards high-tech objects.

In case of the nutrition fact tables and traffic light logos the situation is different, since these nutrition information methods cannot be considered as high tech, cutting-edge information systems. Consequently, the additional increase in attitudes, owing to the increase of one unit of perceived usefulness or ease of use is expected to be lower for people who are more technologically ready than for people who score lower on TR in the nutrition fact table and traffic light logo conditions.

The negative moderation effect is explained by the assumption that people who have less knowledge about technology would like more an information system which is less technologically demanding. So, when low TR people find a simple information system useful or easy to use then the positive effect of this on their attitude towards the information system will be higher compared to people who are more technologically prepared.

Hence, this study proposes the following hypotheses:

H_{B2a}: Technology readiness propensities moderate the relationship between perceived usefulness and attitude towards the information provision tool.

H_{B2b}: Technology readiness propensities moderate the relationship between perceived ease of use and attitude towards the information provision tool.

Arriving to the attitude stage in the model, this study – following the general logic of TRAM – assumes that consumers have different attitudes toward the three nutritional information tools owing to the initial assumptions which states that people also have different perceptions of perceived usefulness, perceived ease of use, perceived enjoyment, and perceived novelty in case of the three information provision conditions. As these perceptions are hypothesized to be higher for the traffic light logos than for the nutrition fact table and highest towards the AR tool, the following hypotheses is proposed:

H_{B5}: Consumers have more positive attitudes towards the traffic light logos than towards the nutrition fact tables.
H_{B5}': Consumers have more positive attitudes towards the augmented reality mobile application than towards traffic light logos.

The very last section of the model postulates that consumers' attitudes towards a specific nutritional information provision tool determines their future re-use intentions of that tool. Meaning that people who have more positive attitudes towards a specific tool are more likely to re-use that tool in the future. Similarly, people who have rather negative attitudes towards a specific tool are less likely to re-use that tool in the future. Hence, this study proposes the following hypotheses:

H_{B6}: Attitude towards the information provision method has a positive impact on future reuse intention of the tool.

3 Methodology

3.1 Subjects

In total, 150 participants were involved in the research. Participants were assigned randomly in one of the three experimental conditions (nutrition fact sheet, traffic light logo, augmented reality application) and therefore ensuring a 50 participant / condition between subject design. In order to ensure random condition assignation, an excel sheet was used with a "=RANDBETWEEN(1;3)" function. Every time a new participant arrived, a new random number was generated between 1 and 3 which eventually decided which experimental condition the participant supposed to be assign for. Number 1 means "nutrition fact sheet," number 2 means "traffic light system", and number 3 means "AR". Participants were approached directly in a coffee corner.

3.2 Materials and design

The beverages:

The experiment involved six different bottled beverages, each of them is representing one of the following three healthiness category; unhealthy, moderately good, and healthy. The inclusion of six different beverages makes it possible to provide two product alternatives in each healthiness category.

Figure 3: The 6 beverages

In order to categorize the different beverages based on their healthiness, the calorie content was used as the primary benchmark. Calorie content is strongly correlated with the added sugar content of the beverages, therefore using it as a differentiating factor can help to better categorize these bottled drinks. Fallowing the Dutch Nutrition Centre's recommendations, the beverages can be assigned into the "healthy" class if they do not contain more than 4 kcal/100 ml. Products containing calories between 4 kcal and 30 kcal/100ml can be regarded as moderately good choices. Lastly, unhealthy products include more than 30 kcal/100ml (Voedingscentrum).

Table 1: Healthiness categorizes and their criteria

Healthiness category	**Calorie content**
Healthy	X ≤ 4 kcal/100 ml
Moderately good	4 kcal ≤ X ≤ 30 kcal/100 ml
Unhealthy	X ≥ 30 kcal/100 ml

The chosen six beverages are summarized below and also attached in Appendix 1 with separate product photos and nutritional information. Appendix 1

Table 2: List of selected beverages and their health attributes

Product name	**Calorie content per 100 ml**	**Healthiness category**
Spa Reine mineral water	0 kcal	Healthy
Chaudfontaine mineral water	0 kcal	Healthy
Lipton Ice tea green	19 kcal	Moderately good
Spa Citron	27 kcal	Moderately good
Coca-Cola Regular	42 kcal	Unhealthy
Fanta Orange	48 kcal	Unhealthy

The nutrition fact sheet condition

In the nutrition fact sheet condition, the "untouched" original drink bottles were used. On the back side of the bottles, the "factory default" nutrition fact tables were kept in original state. Therefore, this condition is aimed to represent the most common information provision method customers can encounter with in their everyday shopping situations.

The traffic light system logo condition

In case of the traffic light condition, all of the six drinks were given a front of pack multiple traffic light logo including calorie, sugar, and fat content. The calorie and sugar column were highlighted in red, orange or green colors depending the above mentioned thresholds. The applied logos are indicated below:

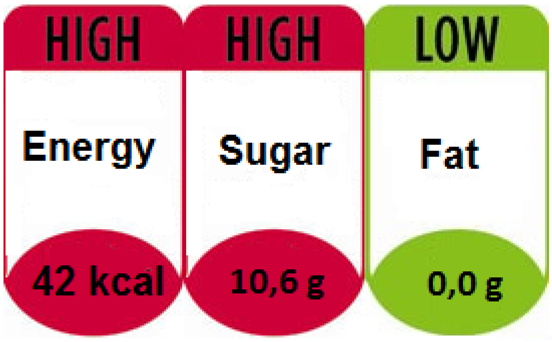

Figure 4: Traffic light logo for Coca-Cola Regular

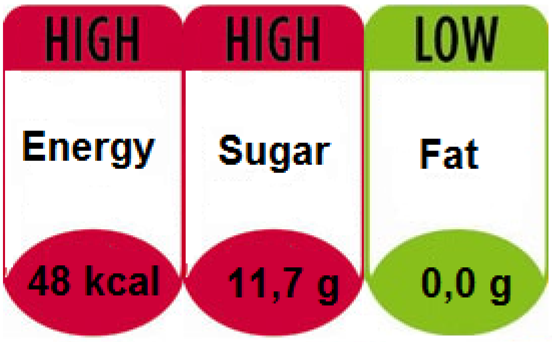

Figure 5: Traffic light logo for Fanta

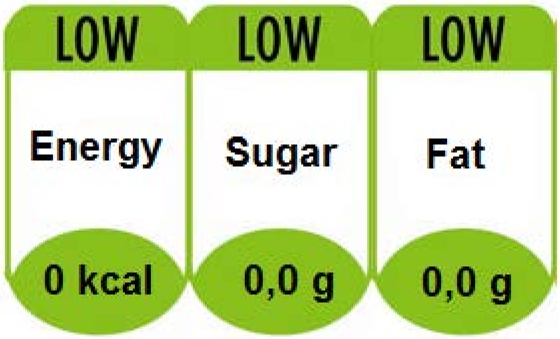

Figure 6: Traffic light logo for the mineral waters

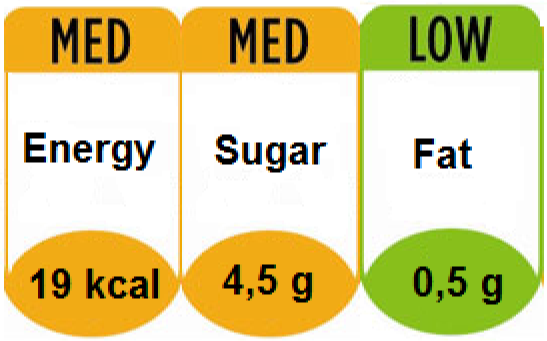

Figure 7: Traffic light logo for Spa Citron

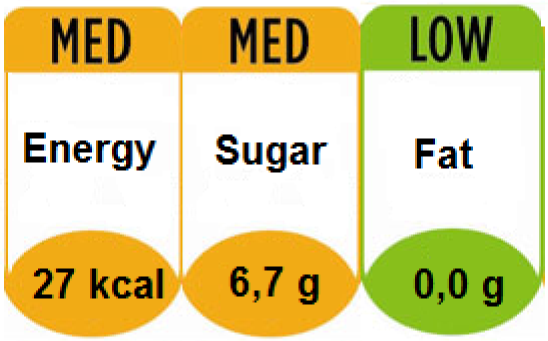

Figure 8: Lipton Ice tea green

The logos were printed on 70X37mm self-adhesive stickers that were stamped to the front of the bottles.

The augmented reality condition:

In order to present 3D models in augmented reality, a smartphone application called AUGMENT was used. AUGMENT Ltd. offered its cutting edge augmented reality visualization application for free of charge for this research.

The end-user app can be downloaded for both Android and iPhone from the following links:

For Android:

https://play.google.com/store/apps/details?id=com.ar.augment

For iPhone:

https://itunes.apple.com/us/app/augment-3d-augmented-reality/id506463171?mt=8

The 3D human models:

For each beverage, a unique, moving 3D human model was developed which aimed to "suggest" whether a particular product is a good, medium, or bad choice in terms of calorie content. For this reason, three different types of models were created for the 3 different healthiness categories. Nevertheless, each model was unique and different (even in the same healthiness category), owing to a whiteboard placed on the left side of the models which depicted the product picture of the most recently scanned product.

For the healthy products, the animated human models showed a "thumbs-up" movement (Figure 9) indicating that the two natural mineral waters are healthy choices.

Figure 9: 3D model showing "thumb-up"

Scan this QR code with the free Augment App

to see the dynamic model in action.

For the moderately good choice pair, the model bended its arms perpendicularly to its body and twisted its wrists (Figure 10) just like real humans would do when we try to express a nether supportive nor opposing opinion.

Scan this QR code with the free Augment App

to see the dynamic model in action.

Figure 10: 3D model indicating a "semi-good" choice

In case of the two unhealthy products, the model showed its index finger and move it to the left and to the right while the model's arm was perpendicular to its body (Figure 11), mimicking a "no-no", human gesture.

Figure 11: 3D model indicating a "negative" choice

Scan this QR code with the free Augment

App to see the dynamic model in acti

The used smartphone:

For the AR condition, participants were given a Xiaomi Redmi 3 android phone which has a 5-inch screen. All phone specifications are included in Appendix B.

Figure 12: Xiaomi Redmi 3 smartphone used for the experiment

The location

Figure 13: Coffee corner at Vrijhof building

3.3 Procedure

The research was executed at the library building of Twente University, Enschede from 4th April, 2017 to 28th April, 2017 between 09: 00 am till 18:00 pm in various times.

In the beginning of the experiment participants were introduced to the experiment and informed that they can choose one product from a sample "supermarket shelf" based on the provided information provision method.

After randomly assigning them to a condition, participants were asked to step in front of the table and spend a maximum of 5 minutes to choose a product after they were provided the given nutrition information method. The main manipulation was the nutritional information provision method they were asked to use.

<u>In the 1st condition:</u>

Participants were asked to carefully check out the nutrition fact tables of all 6 products and make their decisions after they checked those labels. After the choice is made, participants were asked to fill out a survey to finish the experiment. In this is condition the product bottles only included the original back of pack labelling.

<u>In the 2nd condition:</u>

Prior starting this condition, the self-made traffic light logos were placed on the bottles. Participants were asked than to carefully check out the traffic light logos of all 6 products and make their decisions after they finished the inspection. After the choice was made, participants were asked to fill out a survey to finish the experiment.

<u>In the 3rd condition:</u>

Prior starting this condition the traffic light logos were removed from the bottles. Participants were asked to use the provided smartphone and the AR application to scan all 6 products to obtain some nutritional information and make their decision after checking them out. Participants were instructed on how to use the application. Two essential instructions were shared with them: Firstly, in order to scan a product → press the "scan" button in the app. Secondly, after checking out a model they can go back to the main screen to scan a new one by pressing the back button on the phone.

After participants made their choices, they were asked to fill out a survey to finish the experiment.

3.4 Scale development

Study A and B propose various constructs that were necessary to measure throughout this thesis as follows:

Table 3: Demographic questions

What is your gender?	Male
	Female

What is your nationality?	

What is your current or highest level of education?	MBO program
	Bachelor program
	Master program
	PHD program

What is your age in years?	

Table 4: Question for the chosen beverage (DV)

What was your chosen beverage? (DV)	Spa Reine mineral water	
	Chaudfontaine mineral water	
	Lipton Ice tea green	
	Spa Citron	
	Coca-Cola Regular	
	Fanta Orange	

Table 5: Items for future reuse intention (DV)

Future intention to reuse the given information provision method		**Original source**
USE 1	I intend to use the nutrition fact sheet / traffic light logo / AR application in the future again for obtaining information about nutritional quality	(Venkatesh et al., 2003)
USE 2	I predict I will use the nutrition fact sheet / traffic light logo / AR application in the future again for obtaining information about nutritional quality	
USE 3	I plan to use the nutrition fact sheet / traffic light logo / AR application in the future again for obtaining information about nutritional quality	

Table 6: Items for perceived understandability

Perceived understandability		**Original source**
PUN 1	I could easily understand the nutrition information of the products.	Self-made scale
PUN 2	It was not demanding to understand the nutrition information of the products.	
PUN 3	It was challenging to understand the nutrition information of the products.	

Table 7: Items for perceived comparability

Perceived comparability		**Original source**
PC 1	I could easily compare the nutritional quality of the different products.	Self-made scale
PC 2	I could make a ranking between the products based on their nutritional quality.	
PC 3	It was hard to make a comparison between the products based on their nutritional quality.	

Salience

Scales for perceived salience was adopted from Kattenbeck (2015)'s salience research in which the author cites Raubal and Winter (2002)'s formal model which divides salience into two components; visual salience (shape, color, and visibility) and semantic salience (cultural and historical importance). In this research, the visual salience is predicted to have more explanatory power, since the appearance and the visual aspects of the two conditions are expected to be defining factors for consumers when they obtaining nutritional information. Hence, the following visual salience items have been shortlisted:

Table 8: Items for the perceived salience

Perceived salience		**Original source**
PS 1	The appearance of the nutritional information drew my attention	(Kattenbeck, 2015)
PS 2	The nutritional information was memorable	
PS 3	The nutritional information was eye-catching	

The scales for perceived usefulness and perceived ease of use were implemented from Davis (1989)'s scale development study, however the items must have been tailored to this research, therefore minor situation specific modifications have been made to ensure good applicability for the current research. The items will be measured on a 5-point Likert scale.

Table 9: Items for the perceived usefulness and perceived ease of use

Perceived usefulness		Original source
PUSF 1	The nutrition fact sheet / traffic light logo / AR application was a useful tool for obtaining nutritional information.	(F. D. Davis, 1989b)
PUSF 2	The nutrition fact sheet / traffic light logo / AR application was an effective way for obtaining information about nutritional information.	
PUSF 3	Overall, I found the nutrition fact sheet / traffic light logo / AR application as a useful way to understand nutritional information.	
Perceived ease of use		**Original source**
PEOU 1	I found it easy to use the nutrition fact sheet / traffic light logo / AR application	(F. D. Davis, 1989b)
PEOU 2	The interaction with the nutrition fact sheet / traffic light logo / AR application did not require much effort	
PEOU 3	The interaction with the nutrition fact sheet / traffic light logo / AR application was clear and understandable	

Table 10: Items for perceived enjoyment

Perceived enjoyment		Original source
PE 1	It was enjoyable to use the nutrition fact sheet / traffic light logo / AR application to get nutritional information	(Teo et al., 1999; Van der Heijden, 2003)
PE 2	It was pleasurable to get nutritional information via the nutrition fact sheet / traffic light logo / AR application	(Teo et al., 1999; Van der Heijden, 2003)
PE 3	It was fun to get nutritional information via the nutrition fact sheet / traffic light logo / AR application	(Teo et al., 1999)

Table 11: Items for perceived novelty

Perceived novelty		Original source
PN 1	Obtaining nutritional information via the nutrition fact sheet / traffic light logo / AR application was a novel experience.	(Wells et al., 2010)
PN 2	Obtaining nutritional information via the nutrition fact sheet / traffic light logo / AR application felt new and refreshing.	
PN 3	The nutrition fact sheet / traffic light logo / AR application was a neat and novel way for obtaining nutritional information.	

The next section is the attitude part in the model. The items will be measured on a 5-point Likert scale.

Table 12: Items for the attitude construct

Attitude		Original source
ATT 1	Using the nutrition fact sheet / traffic light logo / AR application makes me feel Happy - - - - - Annoyed	(Yang & Yoo, 2004)
ATT 2	Using the nutrition fact sheet / traffic light logo / AR application makes me feel Positive - - - - - Negative	
ATT 3	The nutrition fact sheet / traffic light logo / AR application is a Wise - - - - - Foolish way for obtaining nutritional information	
ATT 4	The nutrition fact sheet / traffic light logo / AR application is a Valuable - - - - - Worthless way for obtaining nutritional information	

Lastly, the scale for the TR construct (optimism and innovativeness) was adopted from Parasuraman (2000)'s original TR study. The selected items were also used by J.-S. C. Lin & Hsieh (2007) and Chung et al. (2015). The items will be measured on a 5-point Likert scale.

Table 13: Items for the TR scale

TR - Optimism		**Original source**
OPT 1	Technology gives me more freedom and mobility	(Parasuraman, 2000)
OPT 2	Technology gives me more control of my daily life	
OPT 3	I prefer to use the most advanced technology available	
TR - Innovativeness		**Original source**
INN 1	I keep up with the latest technological developments in my areas of interest.	(Parasuraman, 2000)
INN 2	I enjoy the challenge of figuring out high-tech gadgets	
INN 3	I can usually figure out new high-tech products and services without help from others	

3.5 **Data analysis**

3.5.1 Data screening and purification

In total, 151 people participated in the experiment. 51 people in the nutrition fact table, and 50-50 people in the traffic light logo and augmented reality app conditions.

After the drink choice experiment, the survey data was collected on printed questionnaires. Therefore, the first task was to digitalize the data and test for missing values. The answers were entered into the online Qualtrics forms. Answers were converted to their numerical equivalents (1= Strongly disagree, 2= Somewhat disagree, 3= Neither agree nor disagree, 4= Somewhat agree, 5= Strongly agree). Keen emphasis was put in the coding procedure, as 2 of the questions were reversely stated. Namely, PUN_3 "It was challenging to understand the nutrition information of the products" and PC_3 "It was hard to make a comparison between the products based on their nutritional quality). In those cases, the scores were reversed to ensure the same quantitative measurement standard.

During the data entry, two missing values were found. Participant No. 8 in the AR condition left blank the DV2_3 question (I plan to use the mobile application in the future again for obtaining information about nutritional quality), nevertheless the person gave an answer for DV2_1 (I intend to use the mobile application in the future again for obtaining information about nutritional quality) and DV2_2 (I predict I will use the mobile application in the future again for obtaining information about nutritional quality). The answer was "Somewhat disagree" for both questions, therefore the missing value was filled in with the same "Somewhat disagree" answer, since each of the three items are intended to measure the same latent variable (Future reuse intention of the app). The other missing value was associated with participant No. 47 in the nutrition fact sheet condition who left blank the PE_3 question. The situation was the same in this case as well, since the participant provided valid answers for the other two items that aim to measure the same latent variable (Perceived enjoyment). More importantly, the same "Neither agree nor disagree" answer were given, therefore the missing value was replaced by the same "Neither agree nor disagree" answer.

There were no unengaged respondents in the sample who gave the same answer for all questions.

Almost all participants answered the same for the reverse coded questions than for the straight questions in the same question group. Only five exceptions were observed but their answered were left untouched and kept in the rest of an analyses. Exact reasoning can be found in Appendix 2.

3.5.2 Reliability check

After checking the missing values and unengaged respondents, the following step was to conduct a preliminary reliability analysis (Cronbach's Alpha) for all latent constructs to check the internal consistency of the related items.

Table 14: Internal consistency of constructs before/after data purification

	Measured constructs	**Number of measuring Items**	**Cronbach's Alpha** (Before purification)
Study A	Drink choice (DV)	Not applicable, single item variable	
	Perceived understandability of information	3	0,70
	Perceived compatibility of information	3	0,77
	Perceived salience of information	3	0,86
Study B	Future reuse intention of the tool (DV)	3	0,93
	Perceived usefulness of the tools	3	0,90
	Perceived ease of use of the tools	3	0,88
	Perceived enjoyment of the tools	3	0,94
	Perceived novelty of the tools	3	0,90
	Attitude	4	0,79
	Technology readiness - Optimism	3	0,76
	Technology readiness - Innovativeness	3	0,78

In case of Study A, the reliability analysis revealed that all three constructs reached the minimally expected 0,7 Alpha value. The "drink choice" was a single item construct, therefore the internal consistence calculation was not applicable for that.

Similarly, in case of Study B, all Cronbach's α scores exceeded the 0,7 value and varied between 7,74 and 9,26 suggesting sufficient reliability between the items for all latent constructs.

3.5.3 Selecting the statistical methods for further analyses

The following step was to choose the most applicable statistical methods to test the hypotheses of the thesis.

Study A

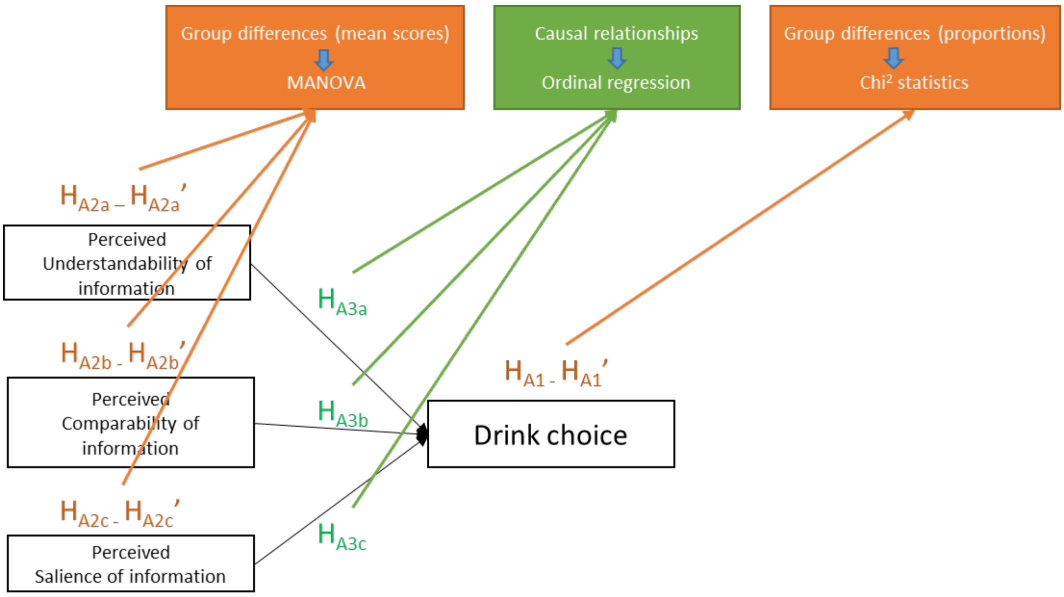

Figure 14: Statistical methods: Study A

In case of Study A, the hypotheses can be divided into two main groups based on a statistical methodological standpoint. Hypotheses of **H_{A1}-H_{A1}', H_{A2a}-H_{A2a}', H_{A2b}-H_{A2b}'**, and **H_{A2c}-H_{A2c}'** are concerning group differences and **H_{A3a}, H_{A3b},** and **H_{A3c}** are concerning causal relationships.

The main hypothesis in the first group is whether participants choose healthier drinks (drinks with less calories) in the traffic light logo than in the nutrition fact table condition (**H_{A1}**). And whether participants choose healthier drinks in the AR than in the traffic light logo condition (**H_{A1}**'). In order to check this, a 3X3 contingency table was made to depict the propositions of the drink choices among the three different groups. To test if the proportions of the drink choices are statistically different in the three different groups, a Chi^2 test was conducted.

Additionally, in the first group, we also try to find out whether perceived understandability, comparability, and saliency of the nutritional information were different in the three conditions. In order to compare mean differences for more than 2 groups (and of more than two dependent variables), a one-way Multivariate Analysis of Variance (MANOVA) was conducted for **H_{A2A}-H_{A2A}', H_{A2B}-H_{A2B}'**, and **H_{A2c}-H_{A2c}'**.

To prepare the dataset for the analyses, the item scores of perceived understandability, comparability and saliency were transformed into composite scores by calculating the means of the corresponding items. Drink choice was not transformed, since it was measured on a single item scale. The six different drinks were coded originally on a 6-point scale. Considering that each of the three healthiness categories were represented by two products, the drink choices were recoded as follows; Coca-Cola and Fanta as the high calorie drink were coded as “1”, Lipton Ice tea green and Spa Citron as the medium calorie content drinks were marked as “2”, and lastly, Spa Reine and Chaudfontaine mineral waters were coded as “3” (higher numbers mean beverages with less calories).

To continue with the second group of hypotheses in Study A, the aim here was to find out whether perceived understandability, comparability, and saliency of the nutritional information had a positive effect on the chosen drinks’ healthiness levels. To check this relationship, an ordinal logistic regression was executed to explore if there were any causality between the constructs.

For the predictor variables, the composite MEAN item scores were used. Drink choice, as the dependent variable, is an ordinal variable ranging from 1 to 3 (higher number means drinks with less calories).

Study B

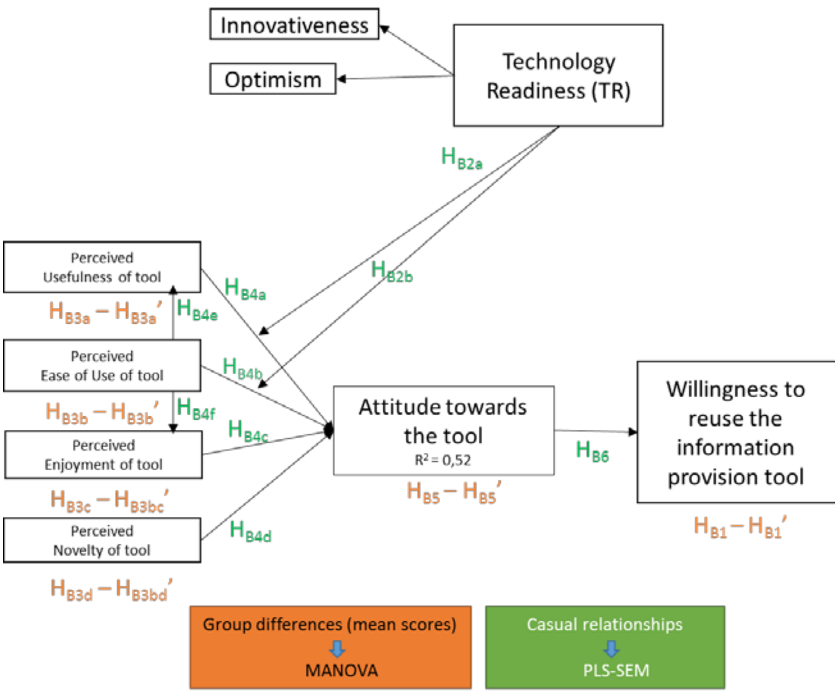

Figure 15: Statistical methods: Study B

Moving forward to Study B, the hypotheses can be also divided into two main groups based on a statistical methodological standpoint.

Hypotheses of **H_{B1} - H_{B1}', H_{B3a} - H_{B3a}', H_{B3b} - H_{B3b}', H_{B3c} - H_{B3c}', H_{B3d} - H_{B3d}'** and **H_{B5} - H_{B5}'** are concerning group differences and **H_{B2a}, H_{B2b}, H_{B2c}, H_{B4a}. H_{B4b}, H_{B4c}, H_{B4d}, H_{B4e}, H_{B4f} and H_{B6}** are concerning casual relationships.

The major question in the first group is to find out if traffic light logos are more likely to be reused than nutrition fact labels (**H_{B1}**) and whether AR is more likely to be reused than traffic light logos (**H_{B1}'**).

Furthermore, we also like to understand the differences between perceived usefulness (**H_{B3a} - $H_{B3a'}$**), ease of use (**H_{B3b} – H_{B3b}'**), enjoyment (**H_{B3c} - H_{B3c}'**), novelty (**H_{B3d} - H_{B3d}'**), and attitude (**H_{B5} - H_{B5}'**) towards the three different information provision tools.

In order to understand group differences for more than 2 groups (and of more than two dependent variables), a one-way Multivariate Analysis of Variance (MANOVA) was conducted to check hypothesizes **H_{B1} - H_{B1}', H_{B3a} - H_{B3a}', H_{B3b} - H_{B3b}', H_{B3c} - H_{B3c}', H_{B3d} - H_{B3d}'** and **H_{B5} - H_{B5}'**.

In the second group, hypotheses of **H_{B2a}, H_{B2b}, H_{B2c}, H_{B4a}. H_{B4b}, H_{B4c}, H_{B4d}, H_{B4e}, H_{B4f} and H_{B6}** are concerning a system of complex causal relationships including hypothesized mediation and moderation effects as well. These hypotheses were tested with a partial least squares structural equation modelling method (PLM-SEM). The methodological underpinning for selecting this method is detailed in Appendix 4.

4 Results

4.1 Study A – group differences of drink choices

Comparing drink choice

Table 15: Contingency table for drink choice

Drink types		Groups			Total
		1 NFS	2 TLS	3 AR	
1 Unhealthy	Number of drinks chosen	7	14	4	25
	% within Drink choice	28,00% [a]	56,00% [a]	16,00% [a]	100,00%
	Adjusted Residual (Z score)	-0,67	2,66	-1,99	
	Chi^2 statistics	0,4489	7,0756	3,9601	
	Chi^2 p value	0,5039 [NS]	0,0078 [NS]	0,0466 [NS]	
2 Medium choice	Number of drinks chosen	23	15	17	55
	% within Drink choice	41,80% [a]	27,30% [a]	30,90% [a]	100,00%
	Adjusted Residual (Z score)	1,58	-1,15	-0,44	
	Chi^2 statistics	2,4964	1,3225	0,1936	
	Chi^2 p value	0,1137 [NS]	0,2484 [NS]	0,6632 [NS]	
3 Healthy	Number of drinks chosen	21	21	29	71
	% within Drink choice	29,60% [a]	29,60% [a]	40,80% [a]	100,00%
	Adjusted Residual (Z score)	-1,03	-0,87	1,9	
	Chi^2 statistics	1,0609	0,7569	3,61	
	Chi^2 p value	0,3042 [NS]	0,3845 [NS]	0,0572 [NS]	
	Count	51	50	50	151

Note 1: NFS = nutrition fact sheet condition, TLS = traffic light system condition, AR = augmented reality condition.
Note 2: = different subscripts mean significant differences within the groups
Note 3: NS = non-significant differences (p > 0.0055 - Bonferroni corrected)

After reconciling the Chi^2 p values and the Bonferroni corrected critical value ($p = 0.0055$) the conclusion is that the proportions of the chosen drinks were not significantly different in any of the three experimental conditions. Please see the step by step methodology in Appendix 6.

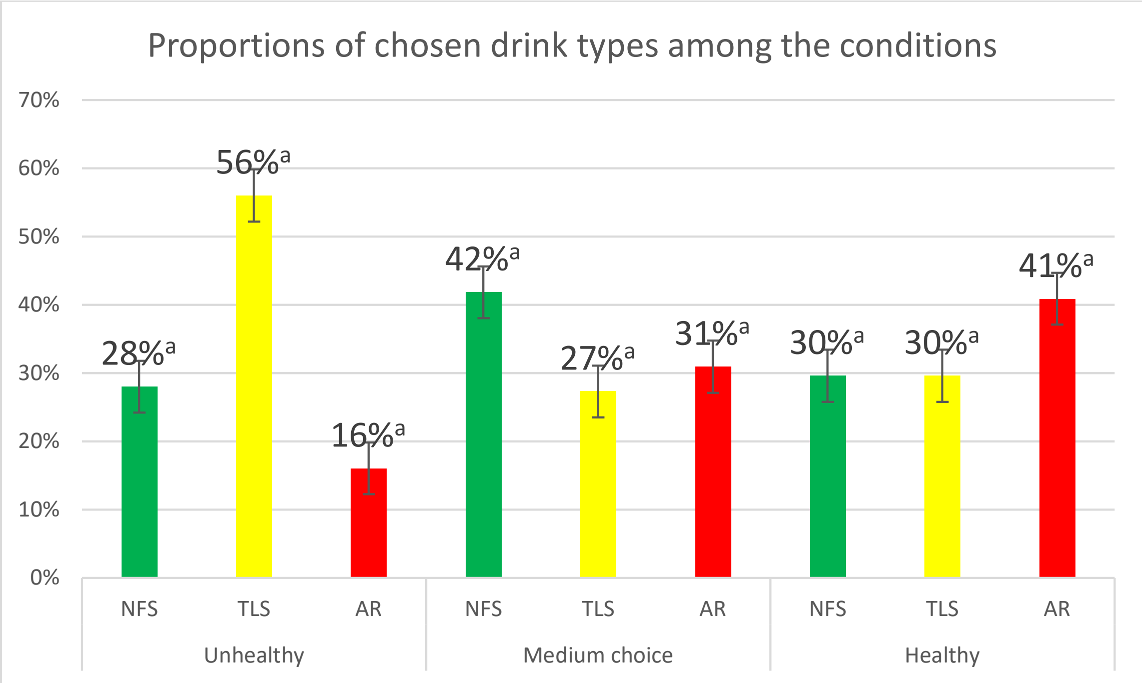

Figure 16: Proportions of chosen drinks types among the conditions

Note: = different subscripts mean significant differences within the groups

Comparing perceived understandability, comparability and saliency among the three information provision conditions.

Prior conducting the MANOVA, the dataset was checked if it met the basic assumptions of MANOVA. The dataset was normally distributed, there were no multicollinearity issues and the variance-covariance matrices were homogeneous. These results are shown in Appendix 5.

The result of the MANOVA

There was a statistically significant difference between the three information provision tool groups on the combined dependent variables, $F(6, 292) = 13.390$, $p < .0005$; Wilks' $\Lambda = .615$; partial $\eta 2 = .216$ indicating that at least one of the dependent variables are significantly different among the three conditions.

Table 16: Mean (SD), and ANOVA results – Study A

	NFS n=51	TLS n=50	AR n=50	ANOVA (F)
Understandability	$3{,}48^{a}$ (0,96)	$4{,}28^{b}$ (0,81)	$3{,}68^{a}$ (0,80)	11.708 $p < 0.0005^{*}$
Comparability	$3{,}51^{a}$ (0,90)	$4{,}17^{b}$ (0,73)	$3{,}55^{a}$ (1,01)	8.585 $p < 0.0005^{*}$
Saliency	$2{,}45^{a}$ (1,04)	$3{,}29^{b}$ (0,90)	$3{,}81^{c}$ (1,03)	23.944 $p < 0.0005^{*}$

Note 1: NFS = nutrition fact sheet condition, TLS = traffic light system condition, AR = augmented reality condition.
*Note 2: * p < 0.01*
Note 3: Different subscripts within the same row indicate significant differences (p < 0.05)

The follow-up ANOVAs further showed that there was statistically significant difference in case of all three variables in the model. Perceived understandability, comparability and saliency were statistically different in the three information provision conditions (Table 16).

The post-hoc tests confirmed most of the prior expectation as follows; participants evaluated the nutritional information more understandable, comparable, and salient when the information was conveyed via traffic light logos than via nutrition fact tables. Therefore, H_{A2a}, H_{A2b}, and H_{A2c} are confirmed. On the other hand, the AR app could only provide added value compared to the traffic light logos in terms of information saliency, since the nutritional information was evaluated only as understandable and comparable as it was in the nutrition fact sheet condition. Therefore, AR could not improve theses aspects compared to the traffic light logos. Consequently, H_{A2c}’ was confirmed but H_{A2a}’ and H_{A2b}’ were not supported.

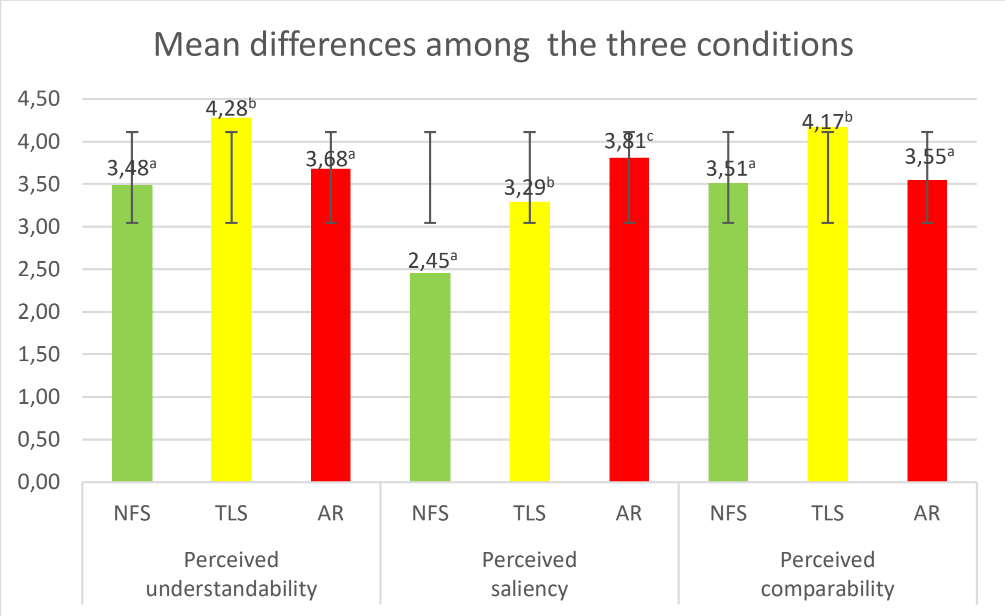

Figure 17: Mean differences among the three conditions

Note 1: NFS = nutrition fact sheet condition, TLS = traffic light system condition, AR = augmented reality condition.
Note 2: = different subscripts mean significant differences within the groups

4.2 Study A – checking the explanatory power of the proposed predictors of drink choice

For the second group of hypotheses in Study A, an ordinal logistic regression (with proportional odds) analysis was conducted to check whether perceived understandability/saliency/compatibility of nutritional information predict drink choice in the different experimental conditions.

Before interpreting the analysis, the basic assumptions of the ordinal regression were checked. There were no multicollinearity issues, the assumption of proportional odds was met, furthermore the model was a good fit to the observed data. These results are shown in Appendix 7.

Result of the ordinal logistics regression

Table 17: Result of the ordinal logistic regression (DV=drink choice)

	Independent variables	Hypothesis Test			95% Wald Confidence Interval for Exp(B)	
		Wald Chi^2	Sig.	Exp(B)	Lower	Upper
NFS	Understandability	5,436	**0,02****	0,438	0,219	0,877
	Comparability	1,276	$0{,}259^{NS}$	1,512	0,738	3,098
	Saliency	0,782	$0{,}376^{NS}$	1,29	0,734	2,268
TLS	Understandability	0,09	$0{,}764^{NS}$	0,894	0,431	1,856
	Comparability	0,072	$0{,}789^{NS}$	0,898	0,409	1,973
	Saliency	1,613	$0{,}204^{NS}$	1,506	0,8	2,835
AR	Understandability	3,335	$0{,}068^{NS}$	2,329	0,94	5,768
	Comparability	0,536	$0{,}464^{NS}$	0,765	0,374	1,566
	Saliency	2,052	$0{,}152^{NS}$	1,63	0,835	3,182

Note 1: NFS = nutrition fact sheet condition, TLS = traffic light system condition, AR = augmented reality condition.
*Note 2: **p < 0.05, NS = non-significant p > 0.05*

The result shows that; only perceived understandability was proven to be a statistically significant predictor of drink choice, nevertheless it was only true in case of the nutrition fact table condition and not in the traffic light logo or augmented reality app conditions. Surprisingly, the relationship was even negative, hence H_{A3a} is not supported.

Regarding the other two proposed predictors, information comparability and saliency had insignificant effects on drink choice in all three conditions. Therefore, H_{A3b} and H_{A3c} were not supported either.

4.3 Study B – group differences of the hypothesized predictors of tool reuse intention

This section had the primary purpose to reveal which information provision tool is expected to be used in the future the most likely by customers. Furthermore, this section also aimed to check which information provision tool provides the highest usefulness, ease of use, enjoyment and novelty perceptions for customers. Lastly, participants' attitudes towards the three tools were also compared.

Before interpreting the results, the dataset was check and concluded to be normally distributed, it was free of multicollinearity issues, it also had homogeneous variance-covariance matrices. All of these results are detailed in Appendix 8.

The result of the MANOVA

There was a statistically significant difference between the three information provision tool groups on the combined dependent variables, $F(12, 286) = 17.789$, $p < .0005$; Wilks' $\Lambda = .328$; partial $\eta 2 = .427$ meaning that at least one of the dependent variables are significantly different among the three conditions.

Table 18: Mean (SD), and ANOVA results – Study B

	NFS n=51	TLS n=50	AR n=50	ANOVA (F)
Perceived usefulness	$3,82^{a}$ (0,78)	$4,09^{a}$ (0,86)	$3,31^{b}$ (1,07)	9.521^{*} $p < 0.01$
Perceived ease of use	$3,47^{a}$ (0,91)	$4,39^{b}$ (0,65)	$4,41^{b}$ (0,66)	25.916^{*} $p < 0.01$
Perceived enjoyment	$2,58^{a}$ (1,12)	$3,29^{b}$ (0,91)	$3,93^{c}$ (0,87)	24.562^{*} $p < 0.01$
Perceived novelty	$2,19^{a}$ (0,87)	$3,55^{b}$ (0,99)	$3,96^{b}$ (0,93)	50.039^{*} $p < 0.01$
Attitude towards the tool	$3,38^{a}$ (0,60)	$3,87^{b}$ (0,69)	$3,65^{b}$ (0,77)	6.361 $p = 0.002^{**}$
Future reuse intention	$3,27^{a}$ (1,13)	$3,27^{a}$ (1,19)	$3,17^{a}$ (1,07)	0.124 $p = 0.884^{NS}$

Note 1: NFS = nutrition fact sheet condition, TLS = traffic light system condition, AR = augmented reality condition.
*Note 2: * $p < 0.01$, ** $p < 0.05$, NS $p > 0.05$ - non-significant*
Note 3: Different subscripts within the same row indicate significant differences ($p < 0.05$)

The follow-up ANOVAs further showed that there was no statistically significant difference in future reuse intentions of the three nutritional information provision methods (Table 18). Therefore, H_{B1} and H_{B1}' are not supported.

However, the predictor constructs showed significant differences as follows; the traffic light logos were evaluated as easier to use, more enjoyable, and more novel, than the nutrition fact tables. Moreover, participants also had more positive attitudes towards the traffic light logos than towards the nutrition fact tables. However, the traffic light logos were not evaluated more useful (nor least) than the nutrition fact tables, hence usefulness perceptions were not improved in case of the traffic light logos. Therefore, H_{B3b}, H_{B3c}, $H_{B3d,\ and}$ H_{B5} were confirmed but H_{B3a} was not supported.

Differences between the AR app and the traffic light logos showed great versatility. The AR app could only outdo the traffic light logos in perceived enjoyment. On the contrary, participants evaluated the AR application similarly easy to use and novel than the traffic light logos. Moreover, they also had the same attitude towards the AR app than towards the traffic light logos. Even more surprisingly, participants evaluated AR as a less useful tool than the traffic light logos (and the nutrition fact table). Consequently, H_{B3bc}' was accepted but H_{B3a}' H_{B3b}', H_{B3d}', and H_{B5}' were not supported.

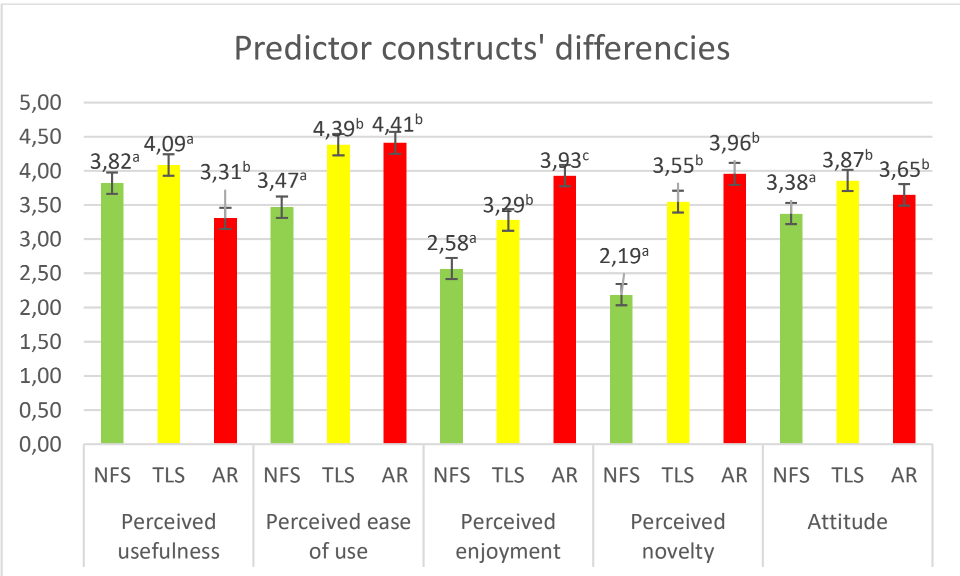

Figure 18: Construct mean differentials (Study B)

Note 1: NFS = nutrition fact sheet condition, TLS = traffic light system condition, AR = augmented reality condition.
Note 2: = different subscripts mean significant differences within the groups

4.4 Study B – checking the hypothesized theoretical model of reuse intention

For the second group of hypotheses in Study B, a PLS-SEM was conducted to check whether there are causal relationships between the proposed predictors of future reuse intentions of the information tools and future intentions.

The measurement model

The technology readiness index was treated as a 2nd order reflective construct with two dimensions of innovativeness and optimism. Similarly, attitude was also modeled as a 2nd order reflective factor with dimensions of affective and cognitive components.

The measurement model was tested for convergent and discriminant validity. Convergent validity was assessed by three criteria based on (Bagozzi & Yi, 1989; J. Hair et al., 2010). First, all the items need to have statistically significant standardized path loadings. Moreover, all patch loadings should be higher than 0.7. Second, each construct has to have sufficiently high Cronbach' α and composite reliability scores. The cut-off criterion is 0.7 for both. Lastly, for each construct, the average variance extracted (AVE) has to be higher than 0.5. Discriminant validity was evaluated based on two criteria. On the one hand, the item loadings to their corresponding constructs have to be greater than their cross loadings to other constructs (Chin, 1998b). On the other hand, the square root of the average variance extracted needs to be higher than the corresponding construct's correlations to all other constructs (Fornell & Larcker, 1981).

Convergent validity

All standardized path loadings were significant and higher than 0.7 in the experimental conditions with three exceptions (Appendix 9). Namely, in the nutrition fact sheet condition, the 3rd item of the perceived novelty construct had a loading of 0.357 (Table 26 in Appendix 9), furthermore the 1st item of the optimism dimension of the technology readiness construct in the traffic light logo condition had a loading of 0.688 (Table 27 in Appendix 9) and lastly the 3rd item of the innovativeness dimension of the technology readiness construct in the augmented reality condition had a loading of 0.684 (Table 28 in Appendix 9). These items were omitted from further analyses.

Appendix 10 also shows that every but two Cronbach's alpha scores were above the 0.7 cut-off criterion. The two exceptions were the innovativeness and optimism dimensions of the technology readiness construct which had a Cronbach's alpha of 0.681 and 0.685, respectively, in the traffic light logo condition (Table 30 in Appendix 10). These constructs were not excluded, as alpha levels between 0.6 and 0.7 also thought to be tolerable especially in case of highly abstract constructs (Hinton, 2004), which is true for optimism and innovativeness.

The composite reliability scores were all higher than 0.7 in all conditions, furthermore the average variance extracted values were higher than 0.5 in case of all construct in each of the three information provision conditions (Appendix 10). Consequently, the convergent validity of the constructs was confirmed in all three conditions.

Discriminant validity

All items had the highest loadings on their corresponding factors without any major cross loading effects (Appendix 9). Nevertheless, in the augmented reality condition, the 1st item of the affective attitude construct, the 2nd item of the affective attitude construct, the 1st item of the cognitive attitude construct and the 3rd item of the perceived enjoyment construct also had a loading - higher than 0.7 - on a different construct. However, the difference between the loadings of the main factors and the seconder factors were higher than 0.2 therefore no validity issues were involved (Gaskin, 2016).

Further supporting discriminant validity, the AVEs were always higher than the inter-correlations of the constructs (Appendix 11). Therefore, discriminant validly was also established in all three conditions.

The structural model

The hypothesized models were tested for explanatory power and path significance by a bootstrapping method. The used bootstrap sample size was 500 in Smart-PLS.

Table 19: Results of PLS-SEM – all conditions

		NFS		TLS		AR	
H	**Path**	**Estimate**	**t-value**	**Estimate**	**t-value**	**Estimate**	**t-value**
H_{B2a}	TR*PU ---> Attitude	-0.155	1.170	0.094	0.756	0.143	1.217
H_{B2b}	TR*PEU ---> Attitude	0.023	0.096	-0.035	0.217	0.181	1.162
H_{B4a}	**PU ---> Attitude**	**0.344***	**2.907**	**0.268***	**2.617**	0.166	1.104
H_{B4b}	PEU ---> Attitude	0.183	1.151	-0.076	0.406	0.082	0.636
H_{B4c}	**PE ---> Attitude**	**0.430***	**3.817**	**0.567***	**5.875**	**0.427***	**3.135**
H_{B4d}	**PN ---> Attitude**	-0.041	0.318	0.171	1.178	**0.367***	**5.190**
H_{B4e}	**PEU ---> PU**	**0.548***	**4.998**	**0.633***	**8.487**	0.209	2.935
H_{B4f}	**PEU ---> PE**	**0.433***	**3.559**	0.189	1.199	**0.404***	**3.018**
H_{B6}	**Attitude ---> Tool reuse intention**	**0.269***	**1.645**	**0.612***	**5.725**	**0.560***	**2.581**

Note 1: NFS = nutrition fact sheet condition, TLS = traffic light system condition, AR = augmented reality condition.
*Note 2: *p < 0.01*

Table 19 presents that the technology readiness (TR) did not moderate the relationship between perceived usefulness and attitude and between perceived ease of use and attitude in any of the three conditions.

Moving further in the model, perceived usefulness had a significant positive effect on attitude in the traffic light logo and nutrition fact sheet conditions but not in the augmented reality condition. On the contrary, this phenomenon was not true for the augmented reality app condition.

Perceived ease of use, had no significant direct effect on attitude in any of the three scenarios.

Nonetheless, perceived ease of use predicted perceived usefulness in the nutrition fact sheet and traffic light logo conditions and perceived enjoyment in the nutrition fact sheet and augmented reality conditions. Interestingly, ease of use did not play a role in usefulness in the augmented reality app. Furthermore, this section also concluded that the easier to use the nutrition fact tables and the augmented reality app, the higher enjoyment is expected to be perceived during their usage. Unexpectedly, higher perceived ease of use perceptions did not contribute to higher enjoyment levels in case of the traffic light logos.

Perceived enjoyment was proven to be a stable predictor of attitude and this relationship was significant in all three conditions.

Perceived novelty only had a significant positive effect on attitude in the augmented reality condition.

Finally, participants' attitudes towards the information provision tools did have a positive effect on their future tool re-use intentions in all three conditions. This is one of the most cardinal aspects of the model which is in align with prior expectations.

All three refined models are presented below:

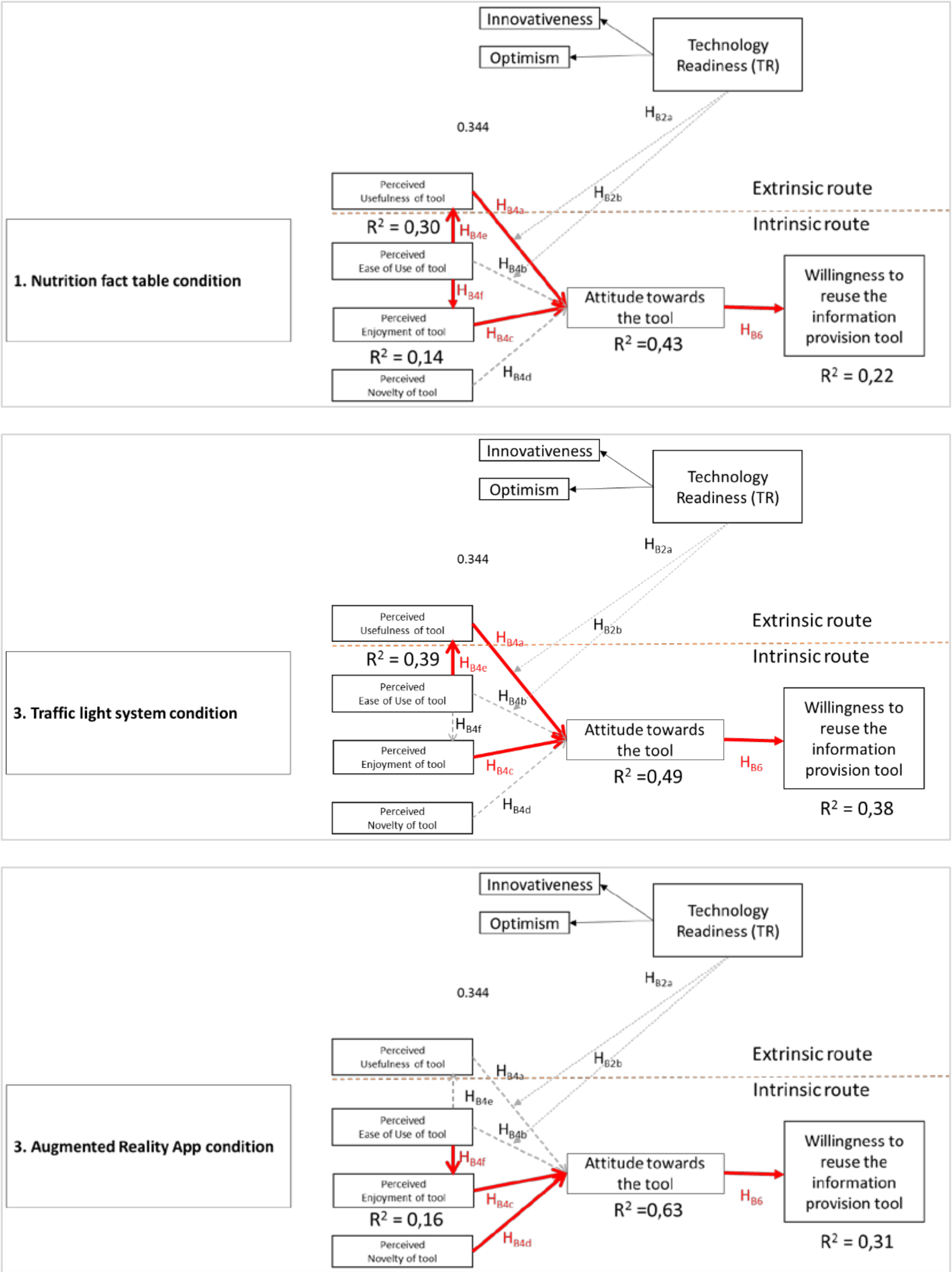

Figure 19: Refined structural models

Note: Significant relationships are shown in red color.

5 Discussion

Study A

In Study A, three main objectives were defined.

First, the main purpose was to compare three different nutritional information provision methods in terms of their impact on healthy food choice. Namely; nutrition facts table, traffic light logo, and a newly developed augmented reality mobile application.

Second, to check whether the proposed characteristics of nutritional information predict healthy food choice in the three information provision scenarios. Based on previous researches, nutritional information has three major characteristics; understandability (Gill Cowburn & Lynn Stockley, 2005), comparability (Black & Rayner, 1992; Levy & Fein, 1998; Sullivan & Gottschall-Pass, 1995) and saliency (Kruschke, 2011; Orquin et al., 2012).

Third, to check the assumption that the selected characteristics of nutritional information are perceived as highest when they are conveyed via the augmented reality app, second highest in case of the traffic light logo and lowest when the information was conveyed via the nutrition fact tables.

(1) The results showed that, contrary to prior expectations, there was no significant difference in drink choice between the three information methods. In other words, this means that participants chose high, medium, and low calorie drinks in the same proportions regardless of which information method conveyed the nutritional information.

It is worth mentioning that previous researches have provided conflicting results on whether traffic light logos can influence the actual choice or not. For example (Balcombe et al., 2010; Koenigstorfer et al., 2013; Van Herpen & Van Trijp, 2011) did find support but (I. Borgmeier & J. Westenhoefer, 2009; Hammond et al., 2013; Hawley et al., 2012) did not find evidence for this. To the best of my knowledge, the nutritional information provided via augmented reality has never been compared with other nutritional provision methods, therefore the findings provide an important first-step contribution to the field.

There are at least two potential explanations for the lack of influence of the information methods on drink choice in this study. First, the used drinks in the experiment were all well-known, A-brand products which anticipates that most participants had already known the nutritional quality of the products prior to the experiment, hence the manipulation could not provide enough added value in their decisions. Most people probably were aware that e.g. a mineral water is healthier than a sugary Coke. Second, most participants must have tried the offered drinks before the experiment which probably have established some kind of prior preference among them. Therefore, even if they were informed about the nutritional quality in the experiment, they might have already made their decisions before they started the experiment owing to their emotional attachments to some drinks.

(2) Results revealed that nutritional information conveyed via the traffic light logos were perceived more understandable, comparable, and salient than the information that was conveyed via the nutrition fact tables. This finding is consistent with the results of (Ingrid Borgmeier & Joachim Westenhoefer, 2009) who concluded that the nutrition information was more understandable when it was provided via traffic light logos than via back of pack nutrition tables. The higher reported saliency was also in align with the findings of (Becker et al., 2015) who concluded that traffic light logos grab more attention than ordinary nutrition fact tables.

Differences of the information characteristics showed a mixed picture between the traffic light logo and the augmented reality app conditions. The information was only as understandable and comparable in the augmented reality app as it was in the nutrition fact table condition, therefore the traffic light logos were proven to be the best in terms of theses aspects. This unexpected finding could be explained by the fact that the nutritional information only included non-textual information in the augmented reality app. Therefore, even if the 3D models could suggest the overall quality of the products (by using non-verbal signs), they lacked any specific, factual information supporting the suggestion it provided. Contrary, the traffic light logos included the precise macro nutrients which might have aided understanding and comparability more than the non-factual information conveyed in the augmented reality app. Geiger et al. (1991) also concluded in their research that consumers preferred nutrition labels with both absolute numbers and percentages of the macro nutrients. Another reason could be related to information type familiarity. Previous researches have shown that consumers' understanding heavily depends on their previous knowledge and expectations about the nutritional information (Kristjánsson & Nakayama, 2003; Maljkovic & Nakayama, 1994, 2000). Since, obtaining nutritional information via that particular AR app was the first time for the participants, they had limited knowledge and experience with this type of information provision method which might have constrained their understanding and comparability.

The AR app could contribute in information saliency compared to the traffic light logos which was in align with prior expectations, nevertheless. The immersive AR experience was indeed more attention grabber and memorable for people than the traffic light logos.

In overall, the traffic light logos aided participants the most to understand and compare the nutritional information from the three methods, however AR was more salient.

(3) The results also showed that information understandability had a negative impact on healthy drink choice in the nutrition fact table condition. Nevertheless, the extent to which participants claimed to understand the nutritional information did not predict drink choice in any of the other two conditions, nor did information comparability or saliency. These conclusions heavily oppose prior expectations and imply that other factors determine food choices rather than the qualities of the nutritional information. One potential reason for this contradiction can be explained by prior food preference. For example, the research by FoodMarketingInstitute (1994) concluded that the taste of food largely determines consumer's food choices regardless of any considerations of nutritional information. Since, the offered drinks were all well-known, A-brand products, participant most probably have already established some type of preference among them throughout their lives. These sensory preconceptions might have determined their choices way before they started the experiment. Furst et al. (1996) also states that sensory perceptions are frequently the most limiting aspects of food choice. Another unobserved determinant could have been the time of the day. Bellisle (2006) posits that people's food preferences differ from time to time depending on the eating occasion throughout of the day. Additionally, social influence could have also impacted the research outcomes due to the experimental design, since it was allowed to participate in the experiment simultaneously for people who arrived in small groups (2-3 people max). McIntosh (1996) asserted that the presence of friends can be a source of peer pressure for choosing particular types of food.

Study B

In Study B, the main focus was on the re-use intention of the three different information provision tools. Two main objectives were formulated as follows:

First, to check the hypotheses that consumers are expected to reuse the Augmented reality app the most likely, the traffic light logos the second most likely, and the nutrition fact tables the least in their future shopping situations.

Second, to verify the proposed theoretical model that is aimed to explain the whole process which drives future reuse intentions.

(1) Results showed that, opposing to prior expectations, there were no differences in the reuse intentions between the three information provision tools. This finding suggests that the importance of the nutritional information medium might be less cardinal as it was previously anticipated.

Regardless the insignificant differences in reuse intentions, several conclusions were drawn about the three information provision methods. For example, participants evaluated the traffic light logos easier to use, more enjoyable, and more novel than the nutrition fact tables. Additionally, they also had more positive attitudes towards it than towards the nutrition fact tables. These results cohere with some previous findings of (I. Borgmeier & J. Westenhoefer, 2009; Hawley et al., 2013; B. Kelly et al., 2009; Roberto, Bragg, Seamans, et al., 2012). Nevertheless, participants only evaluated the traffic light logos similarly useful than the nutrition fact tables which was not anticipated.

Even more surprisingly, the augmented reality app was evaluated less useful than the other two methods. This outcome can be explained by the lack of detailed information that was provided in the AR app. As cited previously from (Scott & Worsley, 1994), people tend to prefer methods which also gives some numeric background information as well. Presumably, the overly simplified information was the primary motive for downgrading the AR app's usefulness. Moreover, contrary to prior assumptions, participants also evaluated the AR app similarly easy to use and novel than the traffic light logos and they also had similar attitudes towards it. These findings imply that participants could comfortably use the AR application which is not surprising considering the fact that young, university students are expected to have above average technical affinities. The AR app did not provide added value in terms of novelty either but this yet again can be explained by university students' high level of technological awareness. Most probably, many students have already used (or at least heard) some kind of AR app or game before, therefore the experience was not as novel as anticipated.

There was only one aspect in which AR could outperform the traffic light logos i.e. perceived enjoyment. This result confirmed the assumption that AR is able provide joyful experience in the information provision process which is in align with previous findings of (Georgiou & Kyza, 2017; Pribeanu et al., 2017).

(2) The proposed theoretical models were tested for path significance with a structural equation modelling method which concluded that technology readiness does not moderate the relationship between usefulness and attitude and between ease of use and attitude in any of the three information provision circumstances. Potential explanation can be the characteristics of the sample in the study. The participating students were more technology ready than the average population. A frequency analysis showed (Appendix 12) that the distribution of the sample population is negatively skewed along the technology readiness construct, meaning that people who assessed themselves highly technologically ready were strongly overrepresented in the experiment. This phenomenon could have limited the detectability of any moderating effects from a statistical standpoint. Also the 50 participant / group design was far from ideal to reliably assess moderation effects.

Concerning the proposed antecedents of attitude, perceived usefulness was confirmed to be a predictor of attitudes in both the nutrition fact table and traffic light logo conditions which is consistent with the well-known results of (Agarwal & Prasad, 1997, 1999; F. D. Davis, 1989b, 1993;

Fred D. Davis et al., 1989; Dishaw & Strong, 1999; Karahanna et al., 1999; S. Taylor & P. Todd, 1995; S. Taylor & P. A. Todd, 1995).

On the other hand, usefulness did not predict attitude in the AR condition. The lack of explanatory power of usefulness on attitude is not unprecedented, however. For instance, (Jackson et al., 1997) could not confirm this relationship either. An explanation for this insignificance comes from (F. D. Davis, 1989b) who argued that usefulness might be challenging to be assessed, since it is a performance measure which requires extensive usage experience on a long run to evaluate. Participants could only test the AR application for a few minutes which might have impaired the link between usefulness and attitude. On the contrary, the other methods were already known for participants, since they most probably had used nutrition fact tables and traffic light logos before the experiment.

Perceived ease of use did not predict attitude in any of the experimental conditions either, which implies that ease of use does not determine how much do consumers like a nutritional information provision method. Even though, this phenomenon was not anticipated, there were also examples in previous researches like Hu et al. (1999) and (Agarwal and Prasad (2000); Dishaw & Strong, 1999) who could not find evidence for this either. A reason for this finding can be the unique characteristics of the sample population and the attitude objects. For example, the participants might have easily accommodated new nutritional information provision methods in general. They probably had high adaptability skills. Furthermore, extracting and understanding information might have been a routine for most of them. Consequently, it was less relevant how easy the involved information provision methods were to them.

In align with prior assumptions nevertheless, this research confirms the robustness of perceived enjoyment in predicting attitudes in all three conditions which replicates the previous findings of (Liao et al., 2008; Van der Heijden, 2003). The result suggests that, intrinsic factors also play a crucial role in the process and the hedonic characteristics of information provision methods are of great importance when consumers establish their general attitudes towards them.

The results also show that the easier to use the nutrition fact tables and traffic light logos, consumers also tend to assess them as more useful which mirrors the results of (S. Taylor & P. Todd, 1995; S. Taylor & P. A. Todd, 1995). On the other hand, this relationship was not significant in the AR condition. This again can be explained by the little prior experience with the AR app compared to the other two methods. Previous experience with the information methods is key, as even (F. D. Davis, 1989b) could only prove a significant path between ease of use and usefulness after a prolonged usage of the tested information system in his original research. In this study, participants could only test the AR application for a few minutes which might have impaired the link between ease of use and usefulness. On the contrary, the other information methods were already known for costumers, since they most probably had used nutrition fact tables and traffic light logos before the experiment.

The structural equation models also concluded that perceived novelty predicted attitude in the augmented reality scenario which corresponds with the assumptions of this study. Nevertheless, novelty had no effect on attitude in the nutrition fact table and traffic light logo conditions. A possible explanation for this might be that novelty can only influence attitudes in case of IT related attitude objects. AR is clearly IT related, and it is a highly technological object. On the contrary, the ordinary nutrition fact tables and traffic light logos are out of this scope. Even though, previous researches have proved that novelty has an effect on attitudes, those studies always used highly technological attitude objects. E.g. a biometric hand-scanner (Wells et al., 2010), a personal workstation by (Moore & Benbasat, 1991) or smart card-based payments (Plouffe et al., 2001).

Finally, the positive impact of attitudes on reuse intentions were confirmed in all three conditions. This finding is consistent with many previous studies from the field, e.g. (Agarwal and Prasad (1997); Agarwal & Prasad, 1999; F. D. Davis, 1989b, 1993) who could all validate this relationship in their studies. The result implies that the more positive attitude a consumer has towards a nutritional information method, the more likely the person will choose it as an aiding tool in the future to obtain information about nutrition quality.

Future research

Even though, AR as a proposed new way for conveying nutritional information was not found to be superior then the traffic light logos, it still holds big potential, in my view. It is important to note that the applied 3D models in the app were only the very first step to explore the full potential of AR technology in this field. Geiger et al. (1991) posits that consumers prefer nutrition information that not only includes logos but also some numeric information about the nutritional quality of the product. Consequently, presenting a few macro nutrient numbers might increase the impact of AR on healthy food choice.

This study used well-known products in the experiment which might have determined the insignificant differences of the impacts of the three information provision methods on healthy food choice. Jacoby et al. (1977) states the product familiarity determines the comprehension of nutritional information and concludes that consumers tent to dedicate less attention for nutritional information in case of already known products. Consequently, prospective researches should put a keen emphasis on prior product knowledge as well. I recommend to conduct a similar study with two types of products; one with consumers are familiar with and one from which they have no prior knowledge. It would be interesting to see how the three information provision methods could influence product choice in case of the limited prior knowledge scenario.

Conclusions and recommendations

Nutritional information provision methods might have less influence on actual food choice than it was assumed previously. A distinction shall be taken between how effectively can they facilitate the understandability, comparability, and saliency of the nutritional information and how likely can they aid healthier food choices in reality. This study showed that these two capabilities do not necessarily depend on each other. On the contrary, food choices are more likely depend on habits, personal tastes and preferences. Also, the low-involvement nature of food selection suggests no difference in consumers' intentions to use certain nutrition provision methods over the other.

Therefore, it is crucial to ground healthier eating habits and preferences from a very early age. Integrating specific programs in the education system might be an excellent tool for reaching such a goal. Government supported public interest ads might be also a promising way to start to educate the general public about the importance of healthy eating habits from childhood.

Limitations

Regardless of the conclusions, this study includes several limitations. First of all, the results are specific to only the involved six beverages and therefor the results cannot be generalized to other beverages or other food products.

Another major limitation is that the study did not use a representative sample, which means that the results do not reflect the opinion of the Dutch society, nor even the opinion of university students. Relating to sample characteristics, previous research has shown that gender differences can cause inconsistencies in the effects of perceived ease of use and perceived usefulness on intention to use (Ong & Lai, 2006). In this study, more than 54% of the participants were men, therefore the proportions of the genders were not perfectly balanced.

Lastly, the amount of variance explained by the SEM model in reuse intention was only 22% in the nutrition fact table condition, 38% in the traffic light logo condition, and 31% in the AR condition. This implies that several other factors - not observed in this study - also influenced the future reuse intentions of the involved nutrition information provision methods.

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List of tables

List of figures

Appendices

List of appendixes

Healthy choice (≤ 4 kcal/100 ml)

(low calorie content, coloring, flavoring, and preservative additives are not acceptable)

	Per 100 Milliliter.
Energie	0 kJ (0 kcal)
Vet	0 g
Waarvan verzadigd	0 g
Koolhydraten	0 g
Waarvan suikers	0 g
Eiwitten	0 g
Zout	0 g

	Per 100 Milliliter.
Energie	0 kJ (0 kcal)
Vet	0 g
Waarvan verzadigd	0 g
Koolhydraten	0 g
Waarvan suikers	0 g
Eiwitten	0 g
Zout	0 g

Moderately good choice (4 kcal ≤ X ≤ 30 kcal/100 ml)

(moderate calorie content, coloring, flavoring, and preservative additives are acceptable)

	Per 100 Milliliter.
Energie	81 kJ (19 kcal)
Vet	0,5 g
Waarvan verzadigd	0,1 g
Koolhydraten	4,7 g
Waarvan suikers	4,5 g
Eiwitten	0,5 g
Zout	0,03 g

	Per 100 Milliliter.
Energie	114 kJ (27 kcal)
Vet	0 g
Waarvan verzadigd	0 g
Koolhydraten	6,7 g
Waarvan suikers	6,7 g
Eiwitten	0 g
Zout	0 g

Unhealthy choice (≥ 30 kcal/100 ml)

(high calorie content, coloring, flavoring, and preservative additives are acceptable)

	Per 100 Milliliter.
Energie	180 kJ (42 kcal)
Vet	0 g
Waarvan verzadigd	0 g
Koolhydraten	10,6 g
Waarvan suikers	10,6 g
Eiwitten	0 g
Zout	0 g

	Per 100 Milliliter.
Energie	203 kJ (48 kcal)
Vet	0 g
Waarvan verzadigd	0 g
Koolhydraten	11,7 g
Waarvan suikers	11,7 g
Eiwitten	0 g
Zout	0 g

Appendix 2: Observation about revers coded questions

Participant No. 71 (Nutrition fact sheet group) and No. 135 and No. 145 (“AR” group) gave opposite direction answers to the reversely coded answers in case of the perceived comparability items. Both the No. 71 and No. 135 participant answered “strongly agree” to all three items which implies a considerable chance that they did not pay enough attention and they were just following the pattern of the first two questions when they provided their answers to the third (reversely coded) one. Participant No. 145 answered “strongly disagree” to all three items for perceived understandability and also for perceived comparability. Lastly, Participant No. 143 also gave three “strongly disagree” for the three perceived understandability items.

After a visual inspection of the answers of the above mentioned respondents, it was concluded that there were no signs of further discrepancies in case of the rest of the questionnaire and they provided fairly consistent answers for the items that were designed to measure the same constructs, furthermore their answers provided sufficient variance between items designed to measure different latent constructs. Considering the above, all five respondents were kept in the data without changing their reversely coded answers.

Appendix 3: Full specification of the used Xiaomi Redmi 3 smartphone:

NETWORK	Technology	GSM / CDMA / HSPA / EVDO / LTE
LAUNCH	Announced	2016, January
	Status	Available. Released 2016, January
BODY	Dimensions	139.3 x 69.6 x 8.5 mm (5.48 x 2.74 x 0.33 in)
	Weight	144 g (5.08 oz)
	SIM	Dual SIM (Micro-SIM/Nano-SIM, dual stand-by)
DISPLAY	Type	IPS LCD capacitive touchscreen, 16M colors
	Size	5.0 inches (~71.1% screen-to-body ratio)
	Resolution	720 x 1280 pixels (~294 ppi pixel density)
	Multitouch	Yes
		- MIUI 7.0
PLATFORM	OS	Android OS, v5.1 (Lollipop)
	Chipset	Qualcomm MSM8939v2 Snapdragon 616
	CPU	Octa-core (4x1.5 GHz Cortex-A53 & 4x1.2 GHz Cortex-A53)
	GPU	Adreno 405
MEMORY	Card slot	microSD, up to 256 GB (uses SIM 2 slot)
	Internal	16 GB, 2 GB RAM
CAMERA	Primary	13 MP, f/2.0, phase detection autofocus, LED flash, check quality
	Features	Geo-tagging, touch focus, face/smile detection, HDR, panorama
	Video	1080p@30fps, check quality
	Secondary	5 MP, f/2.2, 1080p@30fps
SOUND	Alert types	Vibration; MP3, WAV ringtones
	Loudspeaker	Yes
	3.5mm jack	Yes
		- Active noise cancellation with dedicated mic
COMMS	WLAN	Wi-Fi 802.11 b/g/n, Wi-Fi Direct, hotspot
	Bluetooth	v4.1, A2DP
	GPS	Yes, with A-GPS, GLONASS, BDS
	Infrared port	Yes
	Radio	FM radio
	USB	microUSB v2.0
FEATURES	Sensors	Accelerometer, gyro, proximity, compass
	Messaging	SMS(threaded view), MMS, Email, Push Mail, IM
	Browser	HTML5
	Java	No
		- Fast battery charging - DivX/Xvid/MP4/H.264 player - MP3/WAV/eAAC+/FLAC player - Photo/video editor - Document viewer
BATTERY		Non-removable Li-Ion 4100 mAh battery

Source: http://www.gsmarena.com/xiaomi_redmi_3-7862.php

Appendix 4: Methodological underpinning for selecting PLS-SEM in Study B

There are two district approaches with which we can try to handle these hypotheses. The first approach is to apply first generation statistical tools (1G methods from hereinafter) like a regression analysis, nevertheless an approach like that would involve many pitfalls in case of a complex model - including latent constructs - that Study B proposes. The second way would be to use a second generation statistical tool (2G methods from hereinafter) like structural equation modelling (SEM) which might be more applicable to use in a complex theoretical model like this. In the following section, a brief overview will be presented on the potential advantages of a 2G SEM over 1G methods.

To begin with, SEM is able to assess measurement and theory simultaneously. When abstract, latent constructs are measured indirectly with multiple variables, measurement error is inevitable (Chin et al., 2003). Consequently, it is crucial to ensure that the measurement instruments show sufficient reliability, discriminant and convergent validity (Gefen & Straub, 2005). The first drawback of 1G methods that they are incapable to test instrument validity and nomology together at the same time. Therefore, scholars have to split up the process and first test reliability and validity, then in a subsequent step the nomology of the theory. This approach is also known as the "two-step approach" (Gefen et al., 2000). Lowry and Gaskin (2014) states that measurement and theory are inherently intertwined with each other, and therefore separating them might cause incorrect measurements and conclusions. An example of this separation process is when a multi-item construct's reliability is first established with a Cronbach's Alpha test but then the items are transformed into a composite score to conduct e.g. a regression analysis. 1G methods usually calculate the mean or the sum of the multi-item variables which wipes-out essential information from the scale which makes further measurement error evaluations impossible. This phenomenon is often defined as the fixed-scale construction problem (Chin et al., 2003). SEM techniques on the other hand, are able to test both the measurement model (reliability, convergent and discriminant validity) and the structural model (the casual relationship among constructs) together at the same time (Gefen & Straub, 2005).

The following major advantage of SEM is that it can cope with complex multistaged models. In contrast, 1G methods are unable to handle chains of causation (mediation) directly, since they test each conceptual propositions individually instead of in a holistic manner. The individual tests can lead to compromised t and F statistics which might lead to the undesirable occurrence of type 1 errors (false positives). This effect becomes more severe as 1G methods are applied to theoretical models including more and more latent variables (Lowry & Gaskin, 2014). In case of SEM techniques, assumed causal relationships are represented with pathways. And more importantly, theses paths can link all constructs in various combinations making sure to test complex multistaged models as well (Lowry & Gaskin, 2014). Another extraordinary feature of SEM is that even though it can model relationships between latent constructs, it can still avoid the fixed-scale construction problem, since there is no need for the creation of composite scores from the items (Chin, 1998a).

Lastly, it is worth mentioning that SEM methods are capable to detect moderation effects better than 1G methods. The main reason is again that 1G methods do not account for measurement error and therefore their statistical power is much weaker than SEM's one (Chin et al., 2003). The required sample size is not marginal either. Chin et al. (1996) posits that SEM methods might require 4-10 times smaller samples sizes than a 1G counterpart method.

Based on the above detailed superiority of SEM over 1G methods and considering the complex nature of the proposed model in Study B, the second group of hypotheses of Study B will be analyzed with a SEM method to ensure maximum predictive power.

Nevertheless, the literature mentions two different variants of SEM. The first category incorporates the covariance based methods (CB-SEM) which represent constructs via factors. Widely used software for CB-SEM is e.g. LISREL, AMOS, and the LAVAAN package for R. The other category includes the least squares based techniques which represent constructs via components (PLS-SEM) (Lowry & Gaskin, 2014). Most notable software solution for PLS-SEM is e.g. Smart PLS and Warp PLS.

In this study, the partial least square (PLS-SEM) method will be used because of the following main reasons. First of all, PLS has a great deal of advantage over CB-SEM that it does not have assumptions regarding the distribution of the measurement instruments, therefore PLS-SEM is a robust method also in situations when the multivariate normal distribution assumption of the dependent variables are violated (Gefen et al., 2000). CB-SEM requires the data to be normally distributed on the other hand (J. F. Hair et al., 2011). CB-SEM also requires homogeneity of variance of the instruments, whereas PLS-SEM can also be used in instances when this assumption is not met. Chin et al. (2003) posits that PLS-SEM methods cope with measurement error better than CB-SEM, therefore it is more sensitive for interaction effects. In a Monte Carlo study, (Chin et al., 2003) concluded that the minimum sample size is much less in PLS-SEM compared to CB-SEM when a product-indicator approach is used for identifying moderations. A frequently used "rule of thumb" to estimate the minimum sample size for PLS-SEM is to multiply 10 times "the largest number of structural paths directed at a particular construct in the structural model" (Chin et al., 1996, p. 51). In the proposed theoretical model in Study B, the attitude construct has the most structural paths directed to it (4 pieces), which implies that a minimum of 40 participants / group might be already sufficient. Nevertheless, this heuristic is sometimes thought to be too lenient and general (Marcoulides et al., 2009). Joseph F. Hair et al. (2014) proposes a comprehensive table to provide indications for the minimum sample sizes in order to confidently detect R^2 values of 0,10, 0,25, 0,50 and 0,75 of constructs for significance levels of 1%, 5%, and 10% at a frequently applied level of statistical power of 80%. To bring an example, in order to detect an 0,50 R^2 value of a construct which is predicted by four independent variables (this is the most extreme in Study B), approximately 42 observations would be needed (α=5%). Nevertheless, in case of a 0,25 R^2 value prediction, the necessary sample size increases to 59. In the situations when a construct is predicted by maximum two indicators, even a sample size of 52 is sufficient to reliably predict a 0,25 R^2 value and a sample of 33 participants when the R^2 value is around 0,50.

Decesion matrix			
	Regression analysis	CB-SEM	PLS-SEM
Can it be used for latent varibales without facing the fixed scale construction problem?	No	Yes	Yes
Can it be used for small sample sizes	No	No	Yes
Can it be used for non-normal distributions?	No	No	Can cope with it, nevertheless it will still influence results but less dramatically than CB-SEM
Can it be used in case of heterogenity of variance?	No	No	Can cope with it, nevertheless it will still influence results but less dramatically than CB-SEM

Table 20: Decision table to select the most applicable statistical method for the 2nd group of hypotheses in Study B

Appendix 5: Testing the assumptions of MANOVA in Study A

Distribution of data:

The Shapiro-Wilk's test is a commonly used probe to test normal distribution for smaller sample sizes (<50). The test's H_0 hypothesis is that the normality of the data set is not violated, therefore for an α level of 5%, p values less than 0,05 reject the H_0 hypothesis.

Table 21: Shapiro-Wilk statistics

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
MEAN_PUN	,157	151	,000	,931	151	,000
MEAN_PC	,146	151	,000	,939	151	,000
MEAN_PS	,124	151	,000	,952	151	,000

a. Lilliefors Significance Correction

Note: DV1_recoded = chosen drink, MEAN_PUN = perceived understandability, MEAN_PC = perceived comparability, MEAN_PS = perceived saliency.

Based on the results, the normality assumption is violated by all constructs according to the test (Table 21). Nevertheless, (Field & Sage, 2012) articulates that the Shapiro-Wilk's test is heavily biased as the sample size increases. The data set includes 151 records which is definitely much higher than the recommended max 50 sample size for the Shapiro-Wilk's. Therefore, to have a more objective picture, the kurtosis and skewness values were also assessed.

Table 22: Skewness and kurtoses statistics of the constructs (Study A)

Descriptives

Construct		Z Statistic	Std. Error
Perceived understandability	Skewness	-,611	,197
	Kurtosis	-,010	,392
Perceived comparability	Skewness	-0,640	0,197
	Kurtosis	-0,205	0,392
Perceived saliency	Skewness	-0,312	0,197
	Kurtosis	-0,858	0,392

George (2011) states that the distribution can be considered as (close to) normal in case the kurtoses and skewness Z scores are within the ±2.00 range. Another rule of thumb claims that normality can be validated if the standard error multiplied by three times is higher than the absolute value of the corresponding skewness and kurtoses score. Based on these guidelines, all constructs were normally distributed with skewness and kurtoses z scores ranging between -0,858 and - 0,010 (Table 22). Furthermore, the absolute value of all Z statistics were less than three times their standard errors.

In conclusion, the dataset was accepted as normally distributed based on the skewness and kurtosis statistics which are more reliable in case of a sample size of 151 than the Shapiro-Wilk's test. The conclusion was also derived by the visual inspection of the normal Q-Q plots indicating close fit of the data points along the diagonal line.

Multicollinearity

There were no multicollinearity among perceived understandability and comparability as assessed by Pearson correlation (r = .519, p < .0005). Neither between perceived understandability and saliency (r = .326, p < .0005). Nor between perceived comparability and saliency (r = .343, p < .0005).

Equality of variance-covariance matrices

There was homogeneity of variance-covariances matrices, as assessed by Box's test of equality of covariance matrices (p = .453).

Homogeneity of variances

There was homogeneity of variances in case of perceived understandability (p = .231). and perceived salience (p = .522). Nevertheless, there was no homogeneity of variances in case of perceived comparability (p = .008) as assessed by Levene's Test of Homogeneity of Variance. This implies that a post-hoc test that does not assume homogeneity of variances shall be also used when it comes to interpret the results.

Appendix 6: Step by step procedure of the Chi² statistics – Study A

In order to assess whether there are significant differences between the proportions, the procedure suggested by (Beasley & Schumacker, 1995) was applied. In the first step, the adjusted residuals (which are actually Z scores) were squared in order to get the cell-wise Chi^2 values. In the subsequent step, the significance levels of the cell-wise Chi^2 values were calculated with the "SIG.CHISQ" function in SPSS (df=1). Lastly, the Chi^2 p values were compared with the Bonferroni corrected critical value. Bonferroni correction is needed, since 9 different Chi^2 tests were generated in the same contingency table. The corrected critical value is 0.05/9= 0.0055.

Appendix 7: Testing the assumptions of the ordinal regression in Study A

Assumption of Proportional odds

The assumption of proportional odds was met in all three conditions, as assessed by a full likelihood ratio test comparing the fit of the proportional odds model to a model with varying location parameters, $\chi2(3) = 3.264$, $p = .353$ (nutrition fact sheet group), $\chi2(3) = 3.556$, $p = .314$ (traffic light system group), $\chi2(3) = 0.288$, $p = .962$ (augmented reality group).

Multicollinearity

Table 23: Collinearity statistics

Coefficients			
		Collinearity Statistics	
Conditions	Predictors	Tolerance	VIF
NFS	Understandability	,764	1,310
	Comparability	,708	1,412
	Saliency	,879	1,137
TLS	Understandability	,772	1,296
	Comparability	,823	1,215
	Saliency	,876	1,142
AR	Understandability	,720	1,388
	Comparability	,656	1,525
	Saliency	,695	1,439

Note: NFS = nutrition fact sheet condition, TLS = traffic light system condition, AR = augmented reality condition.

None of the independent variables have collinearity issues based on the constructs tolerance and VIF statistics. The critical value for the tolerance is less than 0,1 and for VIF is more than 10, therefore the independent variables are not affected.

Goodness-of-fit tests

SPSS generates two goodness-of-fit induces, Pearson and Deviance statistics. The Pearson goodness-of-fit test indicated that all three models were a good fit to the observed data, $\chi2(93) = 101.179$, p = .087 (nutrition fact sheet group), $\chi2(87) = 96.406$, p = .230 (traffic light system group), $\chi2(93) = 100.395$, p = .282 (augmented reality group). Similarly, the Deviance statistics also showed that all three models were a good fit to the observed data, $\chi2(93) = 95.121$, p = .420 (nutrition fact sheet group), $\chi2(87) = 101.155$, p = .142 (traffic light system group), $\chi2(93) = 80.006$, p = .829 (augmented reality group).

Appendix 8: Testing the assumptions of MANOVA in Study B

Distribution of data:

Table 24: Shapiro –Wilk test results

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
MEAN_REUSE_INTENTION	,145	151	,000	,948	151	,000
MEAN_PU	,170	151	,000	,922	151	,000
MEAN_PEU	,189	151	,000	,876	151	,000
MEAN_PE	,097	151	,001	,958	151	,000
MEAN_PN	,111	151	,000	,941	151	,000
MEAN_ATTITUDE	,084	151	,011	,973	151	,004

Note: *MEAN_Reuse_intention = future reuse intention of the information provision tools, MEAN_PU = perceived usefulness, MEAN_ PEU = perceived ease of use, MEAN_PE = perceived enjoyment, MEAN_ PN = perceived novelty, MEAN_ Attitude = attitude towards the information provision tool*

Based on the Shapiro-Wilk's test, none of the composite constructs had normal distributions. Nonetheless, the Shapiro-Wilk's test becomes heavily biased above samples sizes more than 50, therefore the skewness and kurtoses statistics were also examined.

Table 25: Skewness and kurtoses statistics of the constructs 8Study B)

Descriptives

Construct		Z Statistic	Std. Error
Reuse intention	Skewness	-,258	,197
	Kurtosis	-,963	,392
Perceived usefulness	Skewness	-,791	,197
	Kurtosis	,460	,392
Perceived ease of sue	Skewness	-1,053	0,197
	Kurtosis	0,726	0,392
Perceived enjoyment	Skewness	-0,250	0,197
	Kurtosis	-0,720	0,392
Perceived novelty	Skewness	-,369	,197
	Kurtosis	-,855	,392
Attitude	Skewness	-0,419	0,197
	Kurtosis	0,741	0,392

Based on the Z statistics of skewness and kurtoses, all the constructs have critical values within the ±2.00 range (Table 25). The standard errors (multiplied by 3) of the skewness and kurtoses statistics were also higher than the corresponding absolute Z scores values, but two exceptions. The standard error (multiplied by 3) of perceived usefulness and ease of use did not exceed the absolute value of the skewness Z statistics, nevertheless the Q-Q plots showed a tolerable positive skewness.
In conclusion, the dataset was accepted as normally distributed based on the skewness and kurtosis statistics supported by a visual inspection of the normal Q-Q plots indicating an adequate fit of the data points along the diagonal line.

Multicollinearity

There were no multicollinearity (correlations greater than 0,9) among the constructs as assessed by Pearson correlation (N=151). Reuse intention – Perceived usefulness (r = .436, p < .0005), Reuse intention – perceived ease of us (r = .179, p = .028), Reuse intention – Perceived enjoyment (r = .290 p < .0005), Reuse intention – Perceived novelty (r = .201, p = .013), Reuse intention – Attitude (r = .465, p < .0005), Perceived usefulness – Perceived ease of use (r = .292, < .0005), Perceived usefulness – Perceived enjoyment (r = .227, p = .005), Perceived usefulness – Perceived novelty (r = .166 p = .042), Perceived usefulness – Attitude (r = .490, < .0005), Perceived ease of use – Perceived enjoyment (r = .473, < .0005), Perceived ease of use – Perceived novelty (r = .410, < .0005), Perceived ease of use – Attitude (r = .406, < .0005), Perceived enjoyment – Perceived novelty (r = .613, < .0005), Perceived enjoyment – Attitude (r = .584, < .0005), Perceived novelty – Attitude (r = .467, < .0005),

Equality of variance-covariance matrices

There was homogeneity of variance-covariances matrices, as assessed by Box's test of equality of covariance matrices (p < .0005).

Homogeneity of variances

There was homogeneity of variances in case of future reuse intention (p = .727), perceived usefulness (p = .057), perceived enjoyment (p = .104), perceived novelty (p = .946) and attitude (p = .413). Nevertheless, there was no homogeneity of variances in case of perceived ease of use (p = .024) by Levene's Test of Homogeneity of Variance.
This implies that a post-hoc test that does not assume homogeneity of variances shall be also used when it comes to interpret the results.

Appendix 9: Cross loadings of constructs – all conditions

Nutrition fact sheet condition

Table 26: Cross loadings of constructs (Nutrition fact sheet condition)

Component	atta	attc	reuse	peu	pe	pn	pu	tri	tro
ATTA_1	**0.900**	0.374	0.133	0.453	0.638	0.058	0.443	0.169	0.046
ATTA_2	**0.887**	0.315	0.323	0.359	0.532	0.093	0.383	-0.064	-0.078
ATTC_1	0.409	**0.922**	0.138	0.350	0.193	-0.089	0.411	0.301	0.212
ATTC_2	0.288	**0.898**	0.219	0.017	0.246	0.100	0.235	0.223	0.043
DV2_1	0.226	0.236	**0.941**	0.135	0.138	-0.030	0.426	0.279	0.200
DV2_2	0.231	0.185	**0.960**	0.286	0.218	-0.128	0.426	0.173	0.035
DV2_3	0.261	0.115	**0.929**	0.214	0.253	-0.088	0.433	0.145	0.016
PEU_1	0.406	0.113	0.083	**0.904**	0.370	-0.018	0.472	0.019	-0.005
PEU_2	0.456	0.191	0.305	**0.910**	0.346	-0.116	0.528	0.065	0.001
PEU_3	0.363	0.269	0.198	**0.882**	0.302	-0.236	0.476	0.157	0.182
PE_1	0.566	0.164	0.159	0.349	**0.930**	0.194	0.369	-0.077	-0.022
PE_2	0.609	0.224	0.224	0.323	**0.941**	0.249	0.342	-0.222	-0.185
PE_3	0.659	0.273	0.207	0.384	**0.936**	0.170	0.305	-0.085	-0.052
PN_1	0.077	-0.006	-0.028	-0.168	0.226	**0.989**	-0.175	-0.088	-0.122
PN_2	0.046	-0.059	0.078	-0.163	0.229	**0.732**	-0.190	0.078	-0.184
PN_3	-0.011	0.002	0.316	-0.258	0.115	**0.357**	0.103	0.007	-0.087
PU_1	0.319	0.420	0.441	0.396	0.327	-0.107	**0.762**	0.151	0.155
PU_2	0.429	0.347	0.346	0.497	0.274	-0.238	**0.901**	0.105	0.213
PU_3	0.420	0.142	0.369	0.491	0.315	-0.138	**0.861**	0.126	0.196
TRI_1	0.063	0.359	0.325	-0.030	-0.064	0.046	0.137	**0.886**	0.554
TRI_2	0.055	0.221	0.144	0.103	-0.112	-0.054	0.088	**0.908**	0.587
TRI_3	0.047	0.183	0.094	0.170	-0.190	-0.301	0.174	**0.849**	0.467
TRO_1	-0.021	0.052	0.026	0.089	-0.036	-0.064	0.133	0.417	**0.760**
TRO_2	-0.134	0.050	0.021	0.018	-0.159	-0.207	0.179	0.445	**0.835**
TRO_3	0.090	0.235	0.168	0.057	-0.044	-0.018	0.241	0.649	**0.920**

Note: ATTA = affective component of attitude, ATTC = cognitive component of attitude, REUSE = future reuse intention of the information provision tool, PEU = perceived ease of use, PE = perceived enjoyment, PN = perceived novelty, PU = perceived usefulness, TRI = innovativeness component of technology readiness, TRO = optimism component of technology readiness

Traffic light system condition

Table 27: Cross loadings of constructs (Traffic light system condition)

Component	atta	attc	reuse	peu	pe	pn	pu	tri	tro
ATTA_1	**0.924**	0.428	0.452	0.102	0.515	0.421	0.268	0.126	0.145
ATTA_2	**0.932**	0.491	0.548	0.242	0.680	0.501	0.327	0.223	0.273
ATTC_1	0.459	**0.943**	0.419	0.313	0.400	0.372	0.396	0.146	0.144
ATTC_2	0.477	**0.945**	0.555	0.157	0.451	0.415	0.364	-0.006	0.106
DV2_1	0.459	0.459	**0.925**	0.310	0.364	0.370	0.480	0.101	-0.038
DV2_2	0.498	0.498	**0.931**	0.323	0.458	0.353	0.417	0.251	0.093
DV2_3	0.545	0.482	**0.933**	0.172	0.474	0.298	0.314	0.218	0.035
PEU_1	0.199	0.268	0.310	**0.921**	0.232	0.395	0.648	0.404	0.133
PEU_2	0.061	0.008	0.231	**0.701**	0.193	0.246	0.199	0.366	0.183
PEU_3	0.163	0.238	0.186	**0.889**	0.073	0.233	0.575	0.349	0.224
PE_1	0.598	0.294	0.431	0.218	**0.920**	0.486	0.259	0.245	0.119
PE_2	0.635	0.463	0.527	0.230	**0.951**	0.496	0.326	0.165	0.050
PE_3	0.551	0.480	0.321	0.067	**0.894**	0.561	0.146	0.056	0.025
PN_1	0.446	0.388	0.295	0.286	0.498	**0.880**	0.326	0.124	0.113
PN_2	0.331	0.343	0.301	0.263	0.478	**0.852**	0.253	0.128	0.093
PN_3	0.508	0.361	0.358	0.371	0.486	**0.893**	0.500	0.193	0.188
PU_1	0.249	0.319	0.406	0.685	0.239	0.352	**0.931**	0.413	0.180
PU_2	0.349	0.344	0.354	0.536	0.274	0.407	**0.937**	0.214	0.087
PU_3	0.307	0.466	0.444	0.529	0.236	0.422	**0.928**	0.121	0.058
TRI_1	0.272	0.193	0.219	0.355	0.193	0.215	0.283	**0.774**	0.541
TRI_2	0.136	0.111	0.181	0.392	0.182	0.265	0.263	**0.835**	0.500
TRI_3	0.010	-0.179	0.067	0.248	-0.012	-0.132	0.065	**0.731**	0.331
TRO_1	0.102	-0.137	0.050	0.140	-0.035	-0.021	0.077	0.377	**0.688**
TRO_2	0.219	0.175	-0.056	0.180	0.150	0.261	0.051	0.418	**0.794**
TRO_3	0.199	0.221	0.080	0.152	0.037	0.106	0.141	0.577	**0.849**

Note: ATTA = affective component of attitude, ATTC = cognitive component of attitude, REUSE = future reuse intention of the information provision tool, PEU = perceived ease of use, PE = perceived enjoyment, PN = perceived novelty, PU = perceived usefulness, TRI = innovativeness component of technology readiness, TRO = optimism component of technology readiness

Augmented reality condition

Table 28: Cross loadings of constructs (Augmented reality condition)

	atta	attc	reuse	peu	pe	pn	pu	tri	tro
ATTA_1	**0.934**	0.557	0.488	0.345	0.725	0.562	0.507	0.197	0.050
ATTA_2	**0.948**	0.730	0.385	0.474	0.664	0.623	0.467	0.074	0.010
ATTC_1	0.707	**0.956**	0.578	0.347	0.555	0.631	0.525	0.018	0.083
ATTC_2	0.602	**0.949**	0.494	0.289	0.505	0.590	0.595	-0.112	0.062
DV2_1	0.438	0.533	**0.921**	0.206	0.427	0.399	0.538	-0.078	-0.065
DV2_2	0.349	0.415	**0.927**	0.202	0.363	0.175	0.355	-0.064	-0.134
DV2_3	0.481	0.600	**0.950**	0.079	0.419	0.306	0.484	-0.050	-0.002
PEU_1	0.307	0.217	0.047	**0.851**	0.323	0.386	0.211	0.009	-0.155
PEU_2	0.437	0.272	0.235	**0.769**	0.358	0.345	0.121	0.152	-0.022
PEU_3	0.354	0.347	0.128	**0.900**	0.333	0.403	0.172	-0.023	-0.157
PE_1	0.639	0.499	0.381	0.466	**0.927**	0.621	0.603	-0.009	-0.129
PE_2	0.649	0.495	0.445	0.314	**0.883**	0.547	0.574	-0.038	-0.076
PE_3	0.731	0.535	0.375	0.323	**0.934**	0.667	0.510	0.062	-0.116
PN_1	0.524	0.611	0.333	0.431	0.551	**0.889**	0.538	-0.059	-0.141
PN_2	0.630	0.565	0.322	0.337	0.654	**0.896**	0.473	0.211	0.087
PN_3	0.522	0.532	0.201	0.438	0.578	**0.880**	0.606	0.078	0.177
PU_1	0.442	0.478	0.346	0.150	0.551	0.535	**0.906**	-0.062	0.120
PU_2	0.406	0.500	0.430	0.128	0.540	0.525	**0.920**	-0.155	0.017
PU_3	0.556	0.624	0.578	0.250	0.603	0.601	**0.944**	-0.124	0.065
TRI_1	0.096	-0.014	0.020	-0.120	-0.043	0.036	-0.133	**0.886**	0.453
TRI_2	0.043	-0.098	-0.083	0.051	-0.053	0.062	-0.127	**0.935**	0.351
TRI_3	0.261	0.002	-0.136	0.291	0.161	0.152	-0.034	**0.684**	0.228
TRO_1	0.088	0.028	0.095	-0.138	0.005	0.066	0.071	0.379	**0.825**
TRO_2	-0.019	0.081	-0.089	-0.031	-0.132	0.014	0.106	0.251	**0.873**
TRO_3	0.008	0.085	-0.163	-0.155	-0.170	0.031	0.014	0.430	**0.852**

Note: ATTA = affective component of attitude, ATTC = cognitive component of attitude, REUSE = future reuse intention of the information provision tool, PEU = perceived ease of use, PE = perceived enjoyment, PN = perceived novelty, PU = perceived usefulness, TRI = innovativeness component of technology readiness, TRO = optimism component of technology readiness

Appendix 10: Construct reliability – all conditions

Table 29: Construct reliability (Nutrition fact sheet condition)

Construct		Cronbach's Alpha	Composite Reliability	AVE
Technology readiness	**Innovativeness**	0.856	0.913	0.777
	Optimism	0.791	0.878	0.708
Enjoyment		0.929	0.955	0.875
Ease of sue		0.881	0.926	0.807
Novelty		0.879	0.872	0.777
Usefulness		0.794	0.880	0.711
Tool attitude	**Affective**	0.747	0.888	0.798
	Cognitive	0.793	0.906	0.828
Tool reuse intention		0.938	0.960	0.890

Note: AVE = average variance extracted

Table 30: Construct reliability (Traffic light system condition)

Construct		Cronbach's Alpha	Composite Reliability	AVE
Technology readiness	**Innovativeness**	**0.681**	0.823	0.610
	Optimism	**0.685**	0.863	0.760
Enjoyment		0.912	0.945	0.850
Ease of sue		0.809	0.879	0.710
Novelty		0.848	0.907	0.766
Usefulness		0.924	0.952	0.868
Tool attitude	**Affective**	0.838	0.925	0.861
	Cognitive	0.878	0.942	0.891
Tool reuse intention		0.922	0.950	0.864

Note: AVE = average variance extracted

Table 31: Construct reliability (Augmented reality condition)

Construct		Cronbach's Alpha	Composite Reliability	AVE
Technology readiness	**Innovativeness**	0.879	0.943	0.892
	Optimism	0.809	0.887	0.723
Enjoyment		0.902	0.939	0.837
Ease of sue		0.792	0.879	0.708
Novelty		0.866	0.918	0.789
Usefulness		0.915	0.946	0.853
Tool attitude	**Affective**	0.872	0.940	0.886
	Cognitive	0.898	0.952	0.908
Tool reuse intention		0.926	0.953	0.871

Note: AVE = average variance extracted

Appendix 11: Correlations of constructs – all conditions

Table 32: Correlations of contracts (Nutrition fact sheet condition)

Constuct	atta	attc	pe	peu	pn	pu	reuse	tri	tro
atta	**0.893**								
attc	0.387	**0.910**							
pe	0.657	0.239	**0.936**						
peu	0.456	0.213	0.378	**0.898**					
pn	0.078	-0.000	0.220	-0.164	**0.881**				
pu	0.463	0.361	0.360	0.549	-0.170	**0.843**			
reuse	0.252	0.193	0.212	0.221	-0.037	0.454	**0.943**		
tri	0.063	0.290	-0.136	0.089	-0.102	0.149	0.215	**0.881**	
tro	-0.016	0.145	-0.092	0.064	-0.113	0.225	0.095	0.611	**0.841**

Table 33: Correlations of contracts (Traffic light system condition)

Construct	atta	attc	pe	peu	pn	pu	reuse	tri	tro
atta	**0.928**								
attc	0.496	**0.944**							
pe	0.646	0.451	**0.922**						
peu	0.188	0.248	0.188	**0.842**					
pn	0.498	0.417	0.557	0.354	**0.875**				
pu	0.322	0.402	0.268	0.630	0.421	**0.932**			
reuse	0.540	0.517	0.467	0.286	0.365	0.431	**0.930**		
tri	0.191	0.078	0.170	0.432	0.178	0.276	0.208	**0.781**	
tro	0.239	0.229	0.102	0.189	0.203	0.114	0.020	0.580	**0.872**

Table 34: Correlations of contracts (Augmented reality condition)

	atta	attc	pe	peu	pn	pu	reuse	tri	tro
atta	**0.941**								
attc	0.689	**0.953**							
pe	0.735	0.557	**0.915**						
peu	0.439	0.335	0.404	**0.842**					
pn	0.631	0.641	0.670	0.450	**0.888**				
pu	0.516	0.586	0.614	0.198	0.604	**0.924**			
reuse	0.461	0.564	0.436	0.167	0.324	0.501	**0.933**		
tri	0.075	-0.057	-0.051	-0.041	0.052	-0.138	-0.031	**0.944**	
tro	0.031	0.076	-0.117	-0.131	0.044	0.073	-0.062	0.430	**0.850**

Note 1: ATTA = affective component of attitude, ATTC = cognitive component of attitude, REUSE = future reuse intention of the information provision tool, PEU = perceived ease of use, PE = perceived enjoyment, PN = perceived novelty, PU = perceived usefulness, TRI = innovativeness component of technology readiness, TRO = optimism component of technology readiness

Note 2: The diagonal elements in boldface are the square root of the average variance extracted (AVE). For adequate discriminant validity, the diagonal elements should be greater than the corresponding off-diagonal elements.

Appendix 12: Distribution of sample in term of technology readiness