How can Ambient Light Displays Influence Consumer Behaviour in a Supermarket?

Paul Kokott
Max Kriwogorski
Yu Wang
pak2688@thi.de
mak3767@thi.de
yuw0818@thi.de
Technische Hochschule Ingolstadt
Ingolstadt, Bavaria, Germany

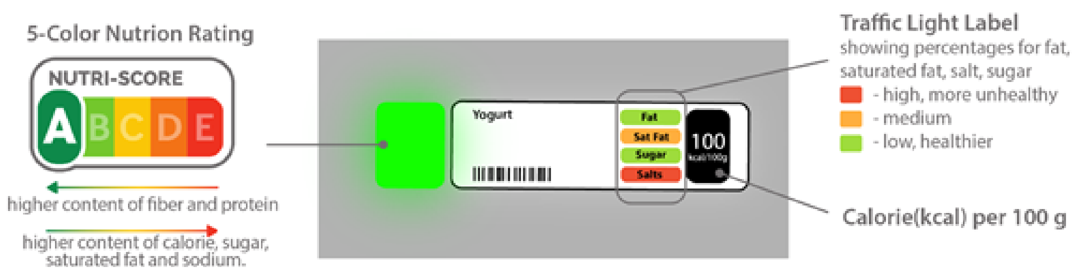


Figure 1: Ambient Light System with a Traffic Light Label for colored Visualization and Indication of Ingredients and Nutrition Rating

ABSTRACT

Efficient selection and effective search for specific products in a supermarket requires a lot of time and knowledge about the combination of healthy and unhealthy ingredients from a customer . In this paper, we investigate a possible influence of ambient light displays on the consumer behavior of customers in a supermarket. In particular, we focus on the issue of displaying ingredients. For this purpose, we did a survey about relevant information for consumers. To evaluate our study, we developed an ambient light system for digital price tag and a fully virtual environment with great simulation of shopping experience, combined with a dynamic survey. We try to identify how to help a customer to find healthy products easier and faster without disturbing or unconsciously interfering with the shopping experience. The result of the evaluation shows clear differences to conventional display types.

KEYWORDS

Ambient light, virtual reality, nutrition, behaviour change, shopping, consumer behaviour

1 INTRODUCTION

A healthy lifestyle is becoming increasingly important in today's society. More and more customers are placing a high priority on sustainable, low-fat or low-sugar products. However, customers today face a number of difficulties on the way to making a particular product choice: Many consumers complain that searching for ingredients on products turns very difficult, because manufacturers present the information in a confusing way or do not make it directly visible. Comparing healthy and unhealthy foods becomes very time-consuming and leads to consumer frustration and even shopping cancellation. In addition, many customers do not know which ingredients in which quantities are unhealthy or suitable for a diet. Attempts to introduce a nutrition score are proceeding very slowly, since it requires a major change on the side of the manufacturer and an interested customer will not buy the product at all after taking a closer look on many unhealthy ingredients.

With our solution, we change the existing price tag to a smart helper in a search process for certain products with certain ingredients. With colored elements and a Traffic Light Label, a system similar to a traffic light, which can be understood by every customer without further explanation or instruction, we try to make the shopping experience even more pleasant. Important ingredients, such as sugar or fat, are displayed in colors (red, yellow, green) and highlighted in a certain intensity. As our solution is designed to support consumers in their selection and purchase decisions, it can save time and provide better education on healthy shopping and lifestyle choices.

Our ambient light display system is designed to be minimal disturbing or limiting to peripheral vision. This means, customers who do not care about specific ingredients information will continue to shop undisturbed.

In this study, we attempt to determine whether there is a significant difference in the selection of specific products with and without our solution. Time plays an important role in a final buying decision.

Due to persistent measures against COVID-19, we concentrated on the creation of a prototype that could be tested completely remote. Therefore, we developed a fully virtual environment for our tests, which simulates the shopping experience in a supermarket.

2 RELATED WORKS

In this chapter, we focus on existing solutions and technologies that have inspired us and formed our theoretical basis. This includes the following topics:

- Healthy eating and nutritional choices.
- Display and label design for visual attention.
- Color appearance in ambient light displays.

2.1 Healthy Eating and Nutritional Choices

A healthy diet is based on the knowledge of which products are suitable for a healthy lifestyle. Supermarkets can use a variety of tools to provide customers with helpful information, but until today there are no sufficient concepts for a visualization that is understandable for the customer, no matter what its level of knowledge about nutrition and ingredients. The introduction of Nutri-Score in Germany is currently voluntary for food manufacturers. This has the consequence that only products with "good" ingredients are equipped with a "food traffic light". This fact leads to a lack of information and frustration for customers who want to compare products. In addition, a uniform solution is missing, since each supermarket, depending on the owner and location, pursues certain strategic goals and thus tries to guide the buying behavior of the customers. Interested customers should be given a way to identify product ingredients efficiently and effectively in order to make a buying decision. In doing so, the buying experience should not be interrupted or disturbed. The display of ingredients should be limited to the important few (focusing on essential aspects such as level of calories or ingredients) [1] . Correct positioning of this information with the products in the supermarket is just as important as a display system that shows the amount of ingredients and their importance. Not every customer knows which ingredients in which quantity are recommended for a healthy diet. According to a recent report by Catalina Marketing Institute, 66% of consumers want their grocery shopping in a supermarket to be as healthy as possible [5]. Only 1 of 4 consumers feel supported in this by their supermarket [5].

2.2 Display and Label Design for Visual Attention

But how exactly can the information be visualized in such a way that it is best perceived, does not distract from the shopping experience and is structured in a comprehensible way? This data, in a specific color or as a logo, should build better communication between the user and the product [6]. These data can be easily positioned on already existing price tags in front of each product. Many supermarkets already use the method of labelling products in the offer with a special color. We take up this idea and extend/digitize the price tag with additional information as ambient light display. In this way, important ingredients can be highlighted in color, thus quickly and discretely drawing the attention of potential customers to the essentials [7]. The digitalization of the price tag is based on a self-luminous device, that lights up specific areas in various colors [12]. In addition, we add a light point next to the price tag as a addition to the overall system. This light is the first point of contact of the system, because it also has a color label, showing the total value of all ingredients in color. The color palette consists of 3 basic colors: red, green and yellow. As with a traffic light, these colors associate a certain context. We also labeled the ingredients not only by color, but also by text. In this way, we achieve the transfer of information on 2 levels.

2.3 Color Appearance in Ambient Light Displays

The "traffic light system" serves as an association of the 3 colors from the everyday life of the user. Red indicates that the ingredient is present at a high or unhealthy level. Green indicates that the ingredient is present in a low or healthier way. To emphasize the importance of the colors, we did not use cold, but vibrant colors, with the use of neon light as background lighting to unconsciously focus attention in a specific way [11] . This feature adds some accent to the meaning of the color and thus is more appealing than a pure light, according to van Huysduynen et al. [10]. This combination in its entirety gives more meaning to the information visualization of the ingredients. The price tag is thereby not covered with unnecessary information and is reduced to the essentials (product name, price, ingredients and optionally a calorie display).

Based on these insights and data, we developed a simple ambient light system based on a conventional price tag, which uses basic colors and compact information to reduce the time spent searching and comparing ingredients for a product and improve the shopping experience.

3 DESIGN CONCEPT

Let's now move on to our own design concept. Before we started with the actual design of our concept, we created several idea clusters, to analyze which data and aspects could be formative for our concept. After collecting and structuring these ideas, we realized that in order to get more accurate and detailed information about the importance of the different aspects, we would need to conduct a small study in advance. Therefore, we decided to test the collected ideas with the help of a small interview guide with a few subjects. From the interviews, several interesting aspects emerged that would be considered for a design concept. These included nutritional information, especially calories, the product expiration date, the origin of the product, special features such as information about vegan or vegetarian, and other more specific ideas such as gluten-free and allergy information. Finally, we structured and collected the evaluated interviews and came to the conclusion that the implementation and relevance of the nutrients of food should play the central role in our concept. After some further design iterations we decided to place the relevant data of our ambient design in form of a display at the price tag.

3.1 Front-of-Pack-Labels and Multiple Traffic Lights

As we have already presented in the Related Works, there have been some approaches to make consumers more aware of the health aspects. First and foremost are these concepts known as front-of-pack labels (FoPLs). These are labels placed on the front of food packages to motivate consumers to make healthier food choices. In a study from 2018, five of these FoPLs were tested in an online survey of 1000 german participants. Among the different concepts were a Health Star Rating system (HSR), a Multiple Traffic Light system (MTL), the Nutri-Score, Reference Intakes (RIs,) and warning symbols. The result of the study showed that among all the systems, the NutriScore performed best and the other systems, especially the MTL system also performed well. It can be concluded that FoPLs based on colors work best[3]. Other concepts, such as Healthy Grocery Shopping via Mobile AR, also make use of the fundamental effect of traffic light colors in their design, especially green (good) and red (bad)[1]. Therefore, we also decided to use an MTL design for our design concept.

3.2 Derived Design Concept

However, unlike the Mobile AR App, for example, our design should have an ambient effect and not assume direct use. To send clear indirect and ambient signals to consumers in the supermarket, we decided, after some design iterations, to use a colored light source as the main signal generator. This is attached next to or on the price tag of the respective products. This turned out to be an ideal solution for us, as nowadays more and more supermarkets use digital and networked price tags[2], through which it would be possible in practice to control the colors of the lights dynamically. In addition to our main signaling device, the light source, after further design iterations, we added four components of unhealthy foods, as also considered in the NutriScore (sugar, salt, fat, saturated fat), to the price tag[4]. This information is also displayed in the traffic light colors green, yellow and red. It allows consumers in the supermarket to see from a distance how healthy a food is and also which ingredient, i.e. sugar, salt, fat or saturated fat, makes this food an unhealthy food, if any. In addition to the ambient features, we added another piece of information to the price tag, showing the calories per 100 grams. This information, however, was not really considered in our study and only served to complete the most important information.

So how does our idea specifically differ from the other ideas presented. As mentioned before, we used in our concept, a traffic light model (MTL), which is very effective and does not involve any doubts. However, our design does not require an application or any other system for the consumer, such as a smartphone[1]. Our design is placed in the supermarket, on the price tag or integrated into the price tag, and provides ambient information that is quickly, easily and simply absorbed and processed.

4 STUDY DESIGN

4.1 Research Questions and Hypothesis

In order to evaluate the role of the ambient light display in supermarket in guiding healthy eating, we investigate the following research questions:

RQ1: How can our system encourage healthy food choice while shopping? To look into the adoption, engagement on the use of the ambient display.

RQ2: How can our system show nutrition information intuitively, effectively and in an understandable way? To look into effectiveness and efficiency with the use of ambient display.

We conducted an online web application combined with a questionnaire to study the user behaviors and collect their feedback on the ambient light display. Our hypotheses were as follows:

H1: Participants will select healthier food items in the conditions with ambient display.

H2: Greater recognition of nutritional information will be processed more effectively in the condition with ambient display than the condition without ambient display.

H3: Our system improves the shopping experience.

4.2 Experimental Design

We used a within-subjects design and varied the scenarios with and without the ambient solution as an independent variable (IV) in the tasks.

4.3 Experimental Setup

For our study we implemented the design concept (see Section 3) in a virtual 3D environment with the help of Unity as a web application. Therefore we coded the logic part in C#. We implemented several functions that help us to generate dynamically different tasks like Likert-Scales, the choosing tasks or tasks with specific user input like asking for demographic data. We also integrated a function to passively measure reaction times while the participants select products in the choosing or finding tasks. The time for each task and the exact time on reading the information on package are automatically measured and attached to the survey results together with the answers. This allows us to compare the efficiency of completing the tasks between both scenarios and participants behavior on finding a certain nutrition information between both scenarios. After the logic part we created a visual appealing 3D environment and modelled many different food types and created their textures accordingly. We then connected the Google form API to the survey we created. The outcome data of the survey is sent in a JSON format via a web-request to the Google form as a response. After that the data gets automatically analyzed like a usual Google survey. After we finished the application we exported it as an WebGL format and hosted it on the itch.io platform, which is a free to use online portal for sharing games. We created an embedded version of this app and integrated it inside an iframe on our web-page.

Besides the technical aspects of our setup we setup up our experimental scenario. As shown in Figure.3, we created a virtual environment with a supermarket that has some products placed on a shelf. In the virtual supermarket, participants need to finish two operational tasks and answer the questions in the same time.

(a) questionnaire

(b) task statement

(c) nutrition facts

Figure 2: VR Environment, general questions (a), a choosing task with a filled shelf (b) and detailed product information after selection (c)

Task statements and questions appear in front of the shelf facing participants. Participants can browse around the supermarket, pick up a product from the shelf and read its nutrition information on the package, answer the questions with the keyboard and confirm each task or question with the space bar(Figure.2).

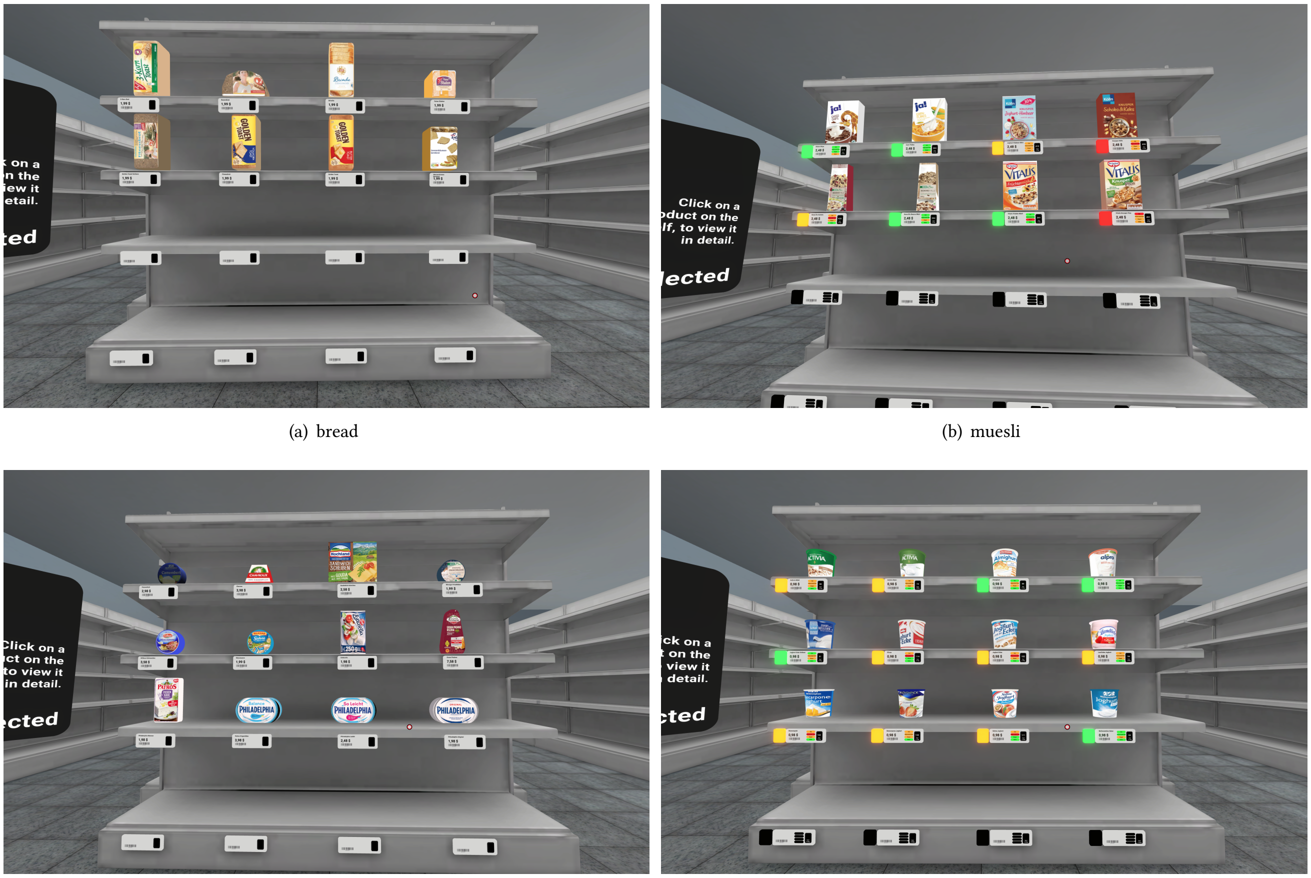
4.4 Procedure

Before entering the virtual supermarket, participants were provided with the introduction of our study and the ambient display design. We conducted the study in four sessions. First, participants need to fill out the questionnaire about demographic information and food choice behavior. The second and third session consisted of two operational tasks (choosing task and finding task) were carried out in the scenario without ambient solution and the scenario with ambient solution respectively. The order of execution of tasks is fixed. Participants do the tasks first without ambient display, then do the same tasks in the scenario with ambient display. The final session is to fill out a short version of the User Experience Questionnaire (UEQ-S)[8].

4.4.1 Questionnaire. In the virtual supermarket, participants first completed a demographic survey with regards to age, sex and if they check nutrition facts when shopping. Then they were instructed to complete the FCQ (Food Choice Questionnaire)[9], which we just listed the questions in the aspect of health, wight control and natural content. After finishing the operational tasks, participants were asked to fill out the UEQ[8] to evaluate the overall user experience of the ambient display.

4.4.2 Choosing task. In this task participants were asked to choose two products, toast and muesli, according to their preference. They were shown eight products of each kinds, which were of eight different health levels and arranged in a random order. They were allowed to take time to pick up the product and check more nutrition information on the package. After choosing a product, they needed to clarify the main consideration of their choice.

4.4.3 Finding task. In this task, participants were asked to find the products with special needs(like to find the yogurt with lowest sugar, or to find the cheese with lowest fat) considering of the time. To eliminate the learning effect in a within-subject experiment, we



(a) bread

(b) muesli

(c) cheese

(d) yogurt

Figure 3: The 4 different Product Options: Bread, Muesli, Cheese and Yogurt in our VR Environment

differ the products between both scenarios. For this reason, the finding task in the scenarios without ambient solution is to find the cheese with lowest fat and calorie, in the scenarios with ambient solution is to find the yogurt with lowest sugar and calorie. The time of completing the task and the time on reading the information on package will be counted but not shown to the participants. After selecting a product, they were asked a single ease question about how difficult or easy did they find the task.

5 DATA ANALYSIS

5.1 Participants

There are 24 participants involved in our test, two of them did not fully complete the task. We collected nine data sets from each subject. The gender of subjects is almost evenly distributed (54.17% female, 45.83% male). So are subjects' behavior of checking nutrition facts label while shopping (50% don't check, 41.67% check, 8.33% might check) and subjects' value of health in food choice (37.50% high, 37.50% medium, 25.00% low). The age is mainly distributed between 20-30 years old (50% 20-30, 20.83% 30-40, 8.33% 40-50, 4.17% 10-20).

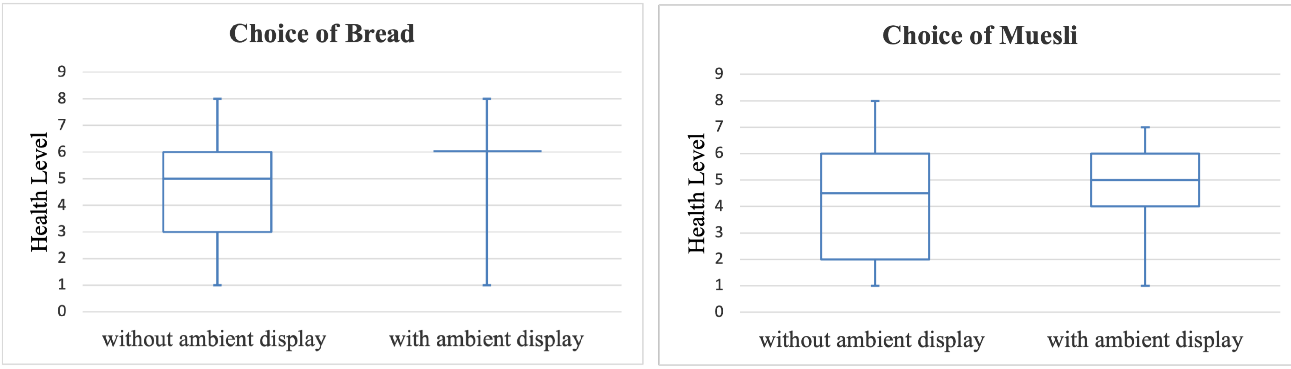
5.2 Methods

Since the valid data size is 22 ($N<30$) and values of the Shapiro-Wilk Test of each data set are below 0.05, the data significantly deviate from a normal distribution. We analyzed the data using median value to eliminate the effect of outliers and and the paired non-parametric test, Wilcoxon signed-rank tests and one-sample Kolmogorov-Smirnov Test to verify if the difference is statistically significant.

5.3 Results

H1: Healthier Food Choice

Based on the hypothesis H1, we expected that in the ambient solution, subjects tend to choose healthier food and their consideration on health will be higher. As shown in Figure.4, the results of the choice in bread and muesli have a slight increase of median value with the help of an ambient display. But through Wilcoxon test there is no significant difference of the food choice in both scenarios (bread: $p=0.074$ $Z=-1.788$, muesli: $p=0.156$ $Z=-1.418$). So we can't conclude that people tend to choose healthier foods in the scenario with ambient display from our test.



(a) Healthy Level of Bread Selection

(b) Healthy Level of Muesli Selection

Figure 4: The health level of the choice of food in scenarios without and with ambient display. The median value of healthy level increased from 5 to 6 by the selection of bread, from 4.5 to 5 by the selection of muesli.

But in the result of choosing reason (Figure.5) we found out that the consideration of health while choosing food is statistically significantly different between two scenarios (bread: p=0.004 Z=-2.850, muesli: p=0.001 Z=-3.447). In the scenario with ambient display, people will consider health factor more when they choose products. And the product type, in our case bread or muesli, will not affect the result (p=0.694 Z=-0.394).

H2: Effectiveness and Efficiency

Based on the hypothesis H2, it was expected that there is an increased proportion of correct answers, which means participants correctly selected the yogurt with the lowest sugar, the yogurt with the lowest calorie in the scenario with ambient display and correctly selected the cheese with the lowest fat and the cheese with the lowest calorie in normal scenario. A decreased average time on watching the package and completing the task is also expected to verify the efficiency of the ambient display.

As shown in Figure.6, the percentage of choosing the right product in ambient display solution (correctness of the yogurt with lowest sugar: 63.6 %) is higher than the percentage of choosing the right product in the scenario without ambient display (correctness of the cheese with lowest fat: 50%). The percentage of choosing the right product with lowest calorie in ambient display solution (correctness of the yogurt with lowest calorie: 63.6%) is the same as the percentage of choosing the right product in the scenario without ambient display (correctness of the cheese with lowest calorie: 63.6%). Despite these increasing correctness in ambient solution to find the products with a certain nutrient's requirement, there was no statistically significant difference between two scenarios in our experiment (certain nutrient's requirement: p=0.083 Z=-1.732, lowest calorie: p=0.564 Z=-0.577).

The time spent totally for each task decreases on average from the normal scenario to the scenario with ambient display (lowest fat cheese-lowest sugar yogurt: 190.77s-26.09s, lowest calorie cheese-lowest calorie yogurt: 55.95s-24.47s). The tendency of package watching time from normal scenario to scenario with ambient display is similar (lowest fat cheese-lowest sugar yogurt: 63.93s-12.17s, lowest calorie cheese-lowest calorie yogurt: 27.03s-9.61s). The results imply that to find a product with special needs (yogurt with lowest sugar or cheese with lowest fat) is faster on average for the ambient display solution and subjects spending less time on finding information on the package. But after Wilcoxon test, only the total time spent on finding lowest calorie between two scenarios are significantly different (p=0.000 Z=-3.490).

As for the tasks' difficulty, participants feel the task easier with the help of our ambient display system (median value in without-with ambient display: 3-5, 1-very difficult 7-very easy)(p=0.041 Z=-2.048).

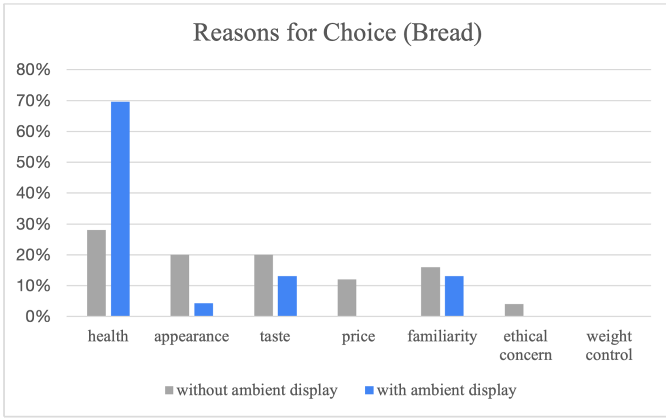
H3: Better User Experience

As shown in Figure.7 and Figure.8, most answers are in the range to the positive experience with ambient display solution. Most participants found the experience as supportive (p=0.017 Z=0.214), easy (p=0.000 Z=0.330), efficient (p=0.000 Z=0.309), clear (p=0.001 Z=0.261), exciting(p=0.007 Z=0.230), interesting(p=0.003 Z=0.244) and inventive(p=0.004 Z=0.240). Whereas the feature of leading edge is not manifested in our system (p=0.200 Z=0.153).

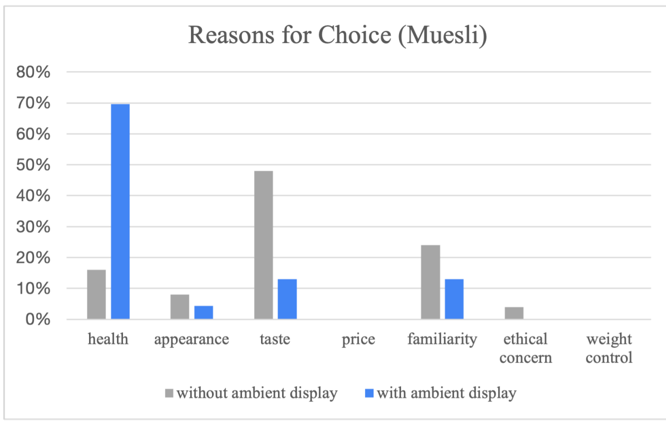
6 DISCUSSION

The choosing task represents a higher consideration on health while shopping in the ambient display scenario. However there is no significant tendency to choose healthier food with ambient display in our experiment, It might imply that people tend to consider health factor more in our system but while choosing products they would balance health factors with other factors, like the taste, familiarity, price. So the choice they made is combined with many factors not just health, they may choose the product satisfying their other needs and also is relatively healthier. And as the age of the sample is mostly between 20 to 30, health factor may not be their biggest concern. So from our experiment there is not a great tendency to choose healthier food in the environment with ambient display. But our initial expectation on the ambient display to lead healthy eating and promote the consideration on health factor when shopping is basically achieved.

The finding task represents an increasing correctness in ambient solution to find the products with a certain nutrient's requirement.



(a) Healthy Level of Bread Selection



(b) Healthy Level of Muesli Selection

Figure 5: The percentage of considering health factor in scenarios without and with ambient display. With the use of ambient display, the proportion of considering health factor increased from 28% to 69.6% by the selection of bread, from 16% to 69.6% by the selection of museli.

But the difference between two scenarios in our experiment is not statistically significant, which may due to the familiarity of the product options and leading symbols and texts on the package, like "0.1% Fat", "light", "balance" , which might help subjects to choose the correct products and diminish the function of ambient display. Based on the fundamental knowledge of products and the guides on package, the recognition of correct products could be already quite high in the scenario without ambient display. So the effect of ambient display is weakened. Moreover, scenario without ambient display. We speculate that the unfamiliarity with the operation in web-based virtual 3D environment could lead to the inaccurate time measurement. And as the online survey was completed independently by the participants, they might not fully concentrate themselves on the task and not realize that the task needs to be completed as quickly as possible. Different surroundings of participants could have different influence on the results. Though most participants feel the task easier with the help of our ambient display system according to the survey. As conclusion, the effectiveness and efficiency of the ambient solution is not fully verified in our study. As for the user experience of the ambient display, most answers are in the range to the positive experience with ambient display solution. The experience is regarded significantly as supportive, easy, efficient and clear.

7 LIMITATIONS

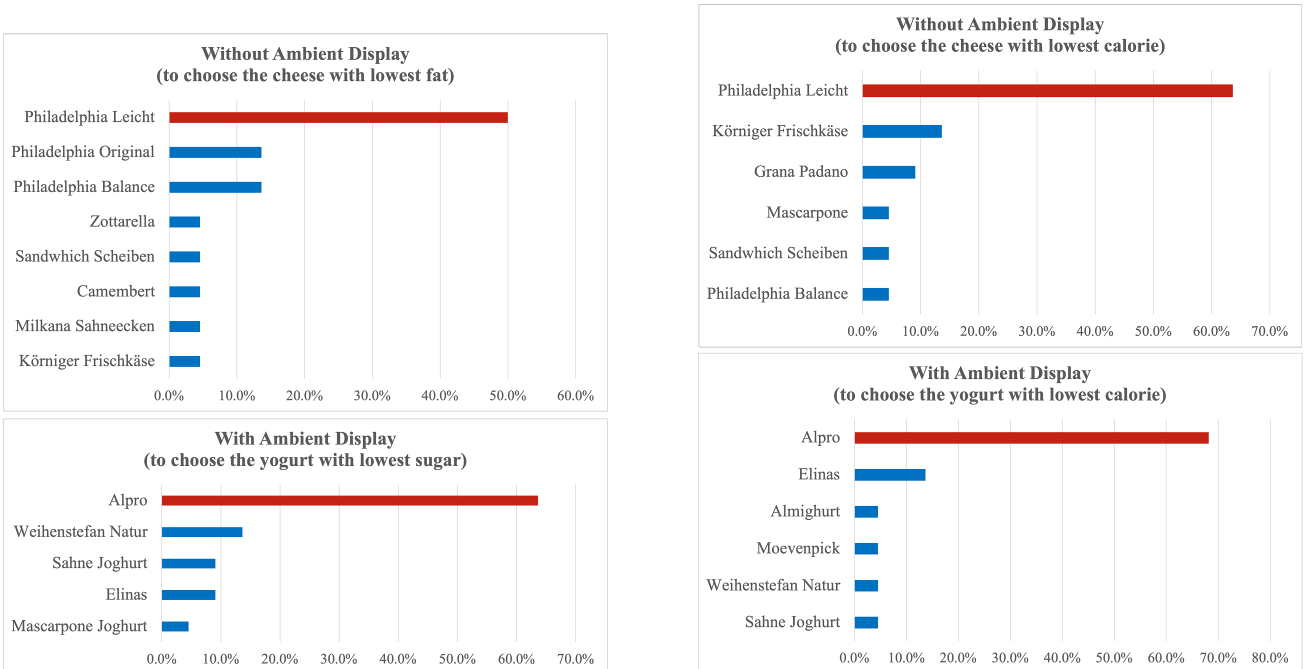
In the case of an epidemic the survey can not be conducted face to face and it was hard to find the participants with different backgrounds and the sample size is also relatively small for a quantitative analyse. VR web application gives a remarkable solution to avoiding physical contact to the greatest extent. And it makes the prototype easily accessible to anyone having a computer. But in the meantime it requires participants who can operate computers skillfully. And the VR environment also requires time to get familiar with. From the feedback of most participants, it was interesting to do the survey in VR application but there were also participants having the phenomenon of dizziness or having problem operating in the VR environment. As planned to verify H2 we planned to measure the time. However because of the different adaptability to VR environment, the measured time were strongly affected. Our study uses within-subject design. In order to eliminate the learning effect, we respectively use different products and tasks in different scenarios. In the scenario without ambient display: to find the cheese with lowest fat and calorie. In ambient solution: to find the yogurt with lowest sugar and calorie. Nevertheless, it brings a new disturbing factor which is the different difficulty of tasks between two scenarios. The results of the study will be more convincing if we test half of the participants with the opposite task in the same scenarios to eliminate the effect of tasks' difficulty. (In the scenario without ambient display: to find the yogurt with lowest sugar and calorie. In ambient solution: to find the cheese with lowest cheese and calorie.)

8 LESSONS LEARNED

First, we know that a learning effect cannot be ruled out in a within-subject design. We took this into account in the way we designed our study, but in the future we should coordinate the tasks of the study participants even more with each other. We also learned that Unity can be a reliable and fast solution to represent and test reasonably realistic and complex scenarios, even in times of a worldwide pandemic when contact with others is nearly impossible. The design of our prototype gave us good results for our study, but would the results under real conditions be similar? We noticed that the effect of the ambient light is very extreme and unnatural in the virtual environment in comparison to real lighting conditions. Thus we learned that it is necessary to check the impact of unrealistic behaviours in simulations that aim to be realistic.

9 FUTURE WORK

In order to continue researching this topic in the future, a few more important steps would be needed. The concept would need to be tested again, but this time in a real environment with a touchable, real prototype. It is necessary to test the quality and intrusiveness of



(a) Find the product with special needs

(b) Find the product with lowest calorie

Figure 6: Distribution of answers of the different choosing tasks. In both scenarios, most participants find the correct products. Without ambient display: find lowest fat(50%) and lowest calorie(63.6%) for cheese. With ambient display: find lowest sugar(63.6%)and lowest calorie(68.2%) for yogurt . The red bars represent the correct answer.

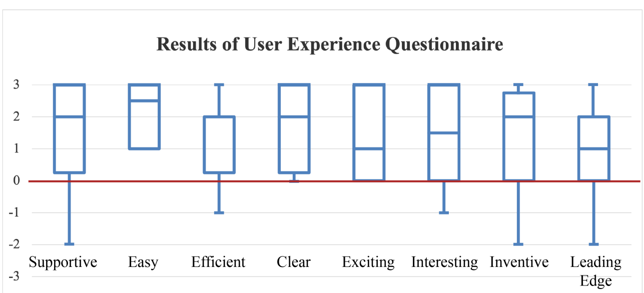


Figure 7: Results of User Experience Questionnaire. The results were overall positive.

the light source in real conditions. Also, so far we have only looked at the effects on healthy eating. It would be very interesting and important to test the impact in other areas such as consumption, marketing and market competition. Also, it would be interesting to test how our system differs from one of the established systems in terms of impact. For example, we should test whether it is better or worse than the usual NutriScore.

10 CONCLUSION

We presented an ambient display combined with the price tag on the shelves in supermarket using traffic light color that convey the nutrition information in an intuitive and direct way to minimize to complexity of nutrition facts and aims to guide healthy eating. The current study demonstrates that our ambient display system may be a promising strategy for promoting healthy eating and encouraging the attention to health factors during shopping. And it provides a supportive, easy, efficient and clear experience. But the effectiveness and efficiency of the ambient solution is not fully confirmed in our study.

REFERENCES

[1] Junho Ahn, James Williamson, Mike Gartrell, Richard Han, Qin Lv, and Shivakant Mishra. 2015. Supporting Healthy Grocery Shopping via Mobile Augmented Reality. *ACM Trans. Multimedia Comput. Commun. Appl.* 12, 1s, Article 16 (Oct. 2015), 24 pages. https://doi.org/10.1145/2808207

[2] Verbraucherzentrale Hamburg e. V. 2017. Dynamic Pricing: Digitale Preisschilder mit Flatterpreisen. *Verbraucherzentrale Hamburg e. V.* (mar 2017). http://docplayer.org/115395318-Dynamic-pricing-digitale-preisschilder-mit-flatterpreisen.html

[3] Manon Egnell, Zenobia Talati, Simone Pettigrew, Maria Galan, Serge Hercberg, and Chantal Julia. 2019. Comparison of front-of-pack labeling to clarify german consumers about the nutritional value of food color coded labels improve on all other systems. (01 2019).

[4] Bundesministerium für Ernährung und Landwirtschaft (BMEL). 2007. NutriScore Erklärt: Informationen für den Einkauf. *ACM Trans. Multimedia Comput. Commun. Appl. 12* 1s, Article 16 (Sept. 2007), 24. https://www.bmel.de/DE/themen/ernaehrung/lebensmittel-kennzeichnung/freiwillige-angaben-und-label/nutri-score/nutri-score-erklaert-verbraucherinfo.html;jsessionid=4BD25ED78271238719657BD93F82475C.live921

[5] Olivia Martinez, Noemi Rodriguez, Allison Mercurio, Marie Bragg, and Brian Elbel. 2018. Supermarket retailers' perspectives on healthy food retail strategies: In-depth interviews. *BMC Public Health* 18 (08 2018). https://doi.org/10.1186/s12889-018-5917-4

		Supportive	Easy	Efficient	Clear	Exciting	Interesting	Inventive	Leading Edge
N		20	20	20	20	20	20	20	20
Normal Parameters[a,b]	Mean	1.60	2.10	1.65	1.95	1.55	1.55	1.45	1.05
	Std. Deviation	1.569	1.165	1.268	1.191	1.234	1.432	1.538	1.538
Most Extreme Differences	Absolute	.214	.330	.309	.261	.230	.244	.240	.153
	Positive	.186	.220	.144	.189	.222	.210	.157	.153
	Negative	−.214	−.330	−.309	−.261	−.230	−.244	−.240	−.148
Test Statistic		.214	.330	.309	.261	.230	.244	.240	.153
Asymp. Sig. (2–tailed)		.017[c]	.000[c]	.000[c]	.001[c]	.007[c]	.003[c]	.004[c]	.200[c,d]

Figure 8: Results of User Experience Questionnaire. The results were overall positive.

[6] Sophie Reale and Stuart Flint. 2016. The Impact of Menu Label Design on Visual Attention, Food Choice and Recognition: An Eye Tracking Study: FOOD CHOICE. *Journal of Sensory Studies* 31 (06 2016). https://doi.org/10.1111/joss.12216

[7] Wolfgang Reitberger, Wolfgang Spreicer, and Geraldine Fitzpatrick. 2014. Situated and mobile displays for reflection on shopping and nutritional choices. *Personal and Ubiquitous Computing* 18 (10 2014), 1721–1735. https://doi.org/10.1007/s00779-014-0781-4

[8] Martin Schrepp, Andreas Hinderks, and Jörg Thomaschewski. 2017. Design and Evaluation of a Short Version of the User Experience Questionnaire (UEQ-S). *International Journal of Interactive Multimedia and Artificial Intelligence* 4 (01 2017), 103. https://doi.org/10.9781/ijimai.2017.09.001

[9] ANDREW STEPTOE, TESSA M. POLLARD, and JANE WARDLE. 1995. Development of a Measure of the Motives Underlying the Selection of Food: the Food Choice Questionnaire. *Appetite* 25, 3 (1995), 267–284. https://doi.org/10.1006/appe.1995.0061

[10] Hanneke Hooft van Huysduynen, Jacques Terken, Alexander Meschtscherjakov, Berry Eggen, and Manfred Tscheligi. 2017. Ambient Light and Its Influence on Driving Experience. In *Proceedings of the 9th International Conference on Automotive User Interfaces and Interactive Vehicular Applications* (Oldenburg, Germany) *(AutomotiveUI '17)*. Association for Computing Machinery, New York, NY, USA, 293–301. https://doi.org/10.1145/3122986.3122992

[11] Damir Vusić, Robert Geček, and Krunoslav Hajdek. 2017. Color Appearance of the Neon Color Spreading Effect. *Acta Graphica* 16, 2 (2017), 7–13. http://www.actagraphica.hr/index.php/actagraphica/article/view/103

[12] Mieczyslaw Wolfke. 2006. Allgemeine Abbildungstheorie selbstleuchtender und nicht selbstleuchtender Objekte. *Annalen der Physik* 344 (03 2006), 569 – 610. https://doi.org/10.1002/andp.19123441305