Sweetening Awareness: A Playful Interaction with Sugars in Food for Children

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Abstract

The aim of this project was to create a tool for six to eight-year-old children that allows them to learn about sugars in food in an easy and entertaining way. Sugars are present in a wide range of food products and coincidentally, health issues potentially related to sugars (like diabetes type 2, obesity, tooth decay or cardiovascular disease) are on the rise; not only in adults but alarmingly in children as well. Although several ways to learn about the content of a food item exist, they usually are rather complex, not made for young children or do not feature interactive elements that could invoke motivation or fun. Considering that many unhealthy products target young children specifically, a tool for a younger audience could therefore be a valuable addition.

Multiple existing approaches to educate children about sugars and nutrition were analysed to identify the elements for a new tool to create awareness. The resulting prototype, in the form of an app for smartphones, was given to school children of the targeted age group to play and interact with. The app allowed participants to retrieve information about a product's sugar content by scanning its packaging's barcode. The experience was enhanced by adding gamification elements that tried to capture the participants' attention and motivation. The results of this case study showed that young children are indeed able to interact with food related information if presented in an adequate way. Subsequently, most participants declined to include items high in sugars within the app and, instead, opted for "healthier" alternatives once they learnt about the actual sugar content of a product. While this behaviour showed that awareness about sugars in food could be established, more research should be undertaken to understand how long this awareness can be sustained, after children interacted with this app.

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Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Signed _____   Date 07/12/2017

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In memory of my late father Martin.

Ethics Approval

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1 Introduction

When we look at what problems the world is facing today, it quickly becomes evident that a lot of issues are caused by ourselves. Some actions induce obvious chain reactions of trouble, while others happen in ways we cannot immediately grasp or see. Often, our behaviour is based on knowledge or motivation (Hoffman, 2015): Either we do not know that a certain action results in a problem or we do know but do not care enough about it for several reasons. Educating about or enforcing specific behaviour tends to result in undesired outcomes as we humans generally do not like to be told what to do (Baranowski, Buday, Thompson, & Baranowski, 2008; Brehm, 1989).

So how can awareness about a problematic behaviour and its consequences be created when such difficult preconditions exist and are faced?

As an example of a problem that many countries are facing, this project explored the potential side-effects of sugars in foods and drinks, and tried to find a way to create awareness in children about it. Sugars are present in many consumables nowadays. Coincidently, diseases like obesity, diabetes type 2 and others are on the rise. More and more medical experts (e.g. Kelly and Swinburn, 2015) and scientists (e.g. SugarScience, 2014) believe that there is a correlation between these health issues and high intake of sugars. If that is indeed correct, then it would make sense to make people more aware of the potential risks of sugars. Ideally this should happen before the consumption of sugary products has become a normality or certain lifestyle choices have been established. In other words: Increased awareness should be created at an early age.

The nature of this topic is incredibly complex. Therefore, it was very important to find a simple and engaging way to present the relevant information to young children. While there are already nutrition labels and sometimes health star ratings on food packaging, they are not easy to understand (e.g. too detailed) and sometimes confusing (e.g. certain breakfast cereals with higher sugar content receive a higher health star rating than cereals with lower sugar content; Consumer NZ, 2016). Also, other "methods" such as pamphlets, videos, apps and games exist, but they usually are consumed "away" from the actual food products and limited or no interaction takes place (e.g. only reading text or swiping fingers over a tablet screen vs. actually handling sugary items). Rather than telling the users which foods they should be aware of, the proposed educational app will ask them to explore a variety of items and let them decide themselves which products they want to use as part of the game experience. Combining several activities like touching and grabbing the products, seeing the simplified sugar content within the app, and making own decisions, will trigger multiple senses and hopefully create a richer experience. By basing the design of the app on a gamification framework, important content can be approached and experienced in a more entertaining and motivating way than traditional and non-interactive alternatives can offer (Breuer & Bente, 2010).

The goal of this study was to explore if the proposed way of creating awareness can be effective. In order to consider the multiple aspects of such a complex topic, mixed research methods were used to gather and analyse the data.

1.1 What is <u>not</u> the goal of this project?

It is not the intent of this project to make people get rid of sugars completely. As with many other ingredients, it is about the consumed amount that can cause problems. Sugars in small amounts and used with consideration, are not regarded as a problem (Lustig & M.D, n.d.).

Also, the app developed for this project does not act as a diet or general health planner. It does not guide a user through a weight reduction, diabetic or other kind of diet.

2 Context and Literature Review

2.1 Sugars

"... we retain Stone Age bodies that crave sugar but live in a Space Age world in which sugar is cheap and plentiful." (Lieberman, 2012)

2.1.1 The history of sugar in a nutshell, or: How did sugars become a potential problem?

Evolution

There are several aspects that contribute to why humans have been eating sugary food. It all started with fruits. Around for millennia, their sweetness attracted a wide range of animals; including humans and apes. It provided these mammals with energy and in turn their seeds were scattered around to new places which increased the survival of the fruits. Depending on location, fruits became very sparse and the mammals were either forced to move to other areas or had to adapt. It is believed that this threat caused a mutation in these animals which resulted in their bodies trying to store as much energy as possible in the form of fat. Equipped with this new backup feature, survival during the next winter period was much more likely (Palmer, B., & Gulliver, K., 2012).

Industrialisation

Sugarcane, the plant that sugar (originally) was made of, has existed for thousands of years. First reports date back to around 8000 BC. Initially it was used for ceremonial and medical purposes. When countries in the Middle East started to create a whole industry around sugar, it gained traction and everyone in the world wanted to get their hands on it. Sugar was seen as one of the most valuable "spices" and only the rich were able to afford it. With the age of exploration, and later imperialism in full swing, Britain and France used their newly acquired territories to set up sugarcane plantations around the world. Countries were completely transformed and native inhabitants wiped out to make space for more plantations. Millions of African slaves were shipped to these new locations and lost their lives in order to cover the ever-increasing demand for sugar. The upscale in production resulted in cheaper prices and eventually sugar became available to everyone. (Cohen, 2013).

Increase of serving sizes and changes in food

With industrialisation and improvements in agriculture, higher quantities and more choices of food products could be produced. Over time, it became easier to get food, eat bigger portions and drink instead of eating nutrition (Young & Nestle, 2002). Changes in work environments and

lifestyles also caused people to spend more time sitting. These factors combined have resulted in the current situation that many people consume more energy than their bodies actually need - not to mention, are able to process (Ministry of Health, 2015).

The situation has become so bad, that some medical experts believe that "exercising away" bad food/ overweight is not going to help to solve these problems (Kelly and Swinburn, 2015). What some of the implications of a high sugar diet can be, will be discussed in the next section.

Figure 1. Example of how people are enticed to eat more. Photo by author.

2.1.2 What is the relation between sugars and health issues?

It is really complicated to get a clear understanding of the side effects of sugar as there are many conflicting guides[1], studies[2] and opinions. What is clear however, is that several health-related issues have been increasing - in adults as well as in children:

Obesity

The latest update of the New Zealand Health Survey revealed that 11% of children in New Zealand under 14 are obese and 21% are overweight (Ministry of Health, n.d.). In other words, one third of children are already having or will develop weight related health problems. Kelly and Swinburn (2015) predict in a journal entry of the New Zealand Medical Journal, that 80% of obese children will turn into obese adults. Coincidentally, one in three adults in New Zealand is

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[1] For example: Does the daily maximum intake of sugars include all (free-form) sugars or only added sugars? (SugarScience, n.d. vs. American Heart Association, n.d.)
[2] Can all studies be trusted? (Union of Concerned Scientists, 2014 vs. SRAS, n.d.)

obese - not just overweight (Ministry of Health, n.d.). These weight problems are attributed to unhealthy food, primarily to the high intake of calories through sugary meals and drinks.

In a report of the Ministry of Health NZ (2009), the costs for direct obesity related treatments were estimated at 460 million NZD in the year 2004.

Diabetes

Diabetes is the fastest growing disease in New Zealand. It is becoming more common in children and type 2 diabetes is linked to obesity (NZ Ministry of Health, 2013). While in the past it was assumed that sugars only indirectly cause diabetes (type 2) through weight gain, newer studies found a direct correlation between sugar intake and increase of developing diabetes type 2 (Basu et al, 2013)[3]

In a study in 2008, the health care related costs for diabetes type 2 were estimated at 600 million New Zealand dollars (Ministry of Health, 2009).

On a global scale, the International Diabetes Foundation (n.d.) approximates that over 415 million people worldwide have diabetes with many more undiagnosed.

Tooth decay

According to statistics from 2015, depending on area and ethical background, between 40-60% of children under the age of 5 years in NZ suffered from oral health problems (NZ Ministry of Health, 2017).

In the annual New Zealand Health Survey (results 2015-16) the government wrote: "About 29'000 children had teeth extracted due to decay in the past 12 months." (Ministry of Health, 2016). In a 2017 news article, dentist R. Beaglehole was quoted saying: "The number one reason children have their teeth taken out is because of a high sugar diet, especially sugary drinks." (Stewart, 2017)

Heart problems (cardiovascular disease)

In addition to dental problems, a high sugar intake can also cause children to suffer from heart problems - a condition normally associated with adults. The American Heart Association released a statement in 2016 regarding the risks of children taking in too much sugar and concluded that even lower daily intakes than at the time recommended, could contribute to higher cardiovascular disease risks (Vos et al, 2016).

It is important to consider that multiple factors contribute to these health issues and a variety of solutions should be considered. However, seeing that so many problems are associated with

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[3] There are two types of diabetes: Type 1 and type 2. While the first one is unaffected by sugars, more and more studies and experts believe that there is a strong connection between high sugar intake and diabetes type two (Digitale, 2013; Lustig, 2016)

high sugar intake prompted the idea to create a tool for children that could build up awareness about the sugar content in foods at an early age. This way, in theory, better informed decisions could be provoked and the potential of suffering from the listed issues might eventually be reduced.

2.1.3 Do sugar related problems affect everyone?

In New Zealand, the above problems are more common in Māori and Pasifika people. Also, areas with lower/ no incomes are at higher risk (Ministry of Health, n.d.). However, it is important to mention that these health problems are not limited to certain ethnicities, countries (International Diabetes Foundation, n.d.) or income groups. Therefore, it would make sense to educate "everyone", no matter where they are from or in which socio-economic areas they live in.

Due to time and resource constraints, the study described in this thesis was only of a relatively small scale (n = 10) and did not specifically focus on cultural differences and aspects. Future work could elaborate on those aspects and larger numbers of participants

2.1.4 What is the standpoint of the sugar industry?

In general, the sugar industry believes that their products do not cause health related issues and provide or discuss various supporting research on its websites (e.g. SRAS, n.d.). [4]

At the same time however, changes to product lines were made to offer customers low or no sugar alternatives to the original (high sugar) products. Some manufacturers even substitute sugar with different sweeteners like stevia in certain items (Coca-Cola, 2017).

Also, some members of the sugar industry decided to update their marketing policy towards children. Yet, looking at the fine-print of these promises, the question arises whether that is really going to make a difference in a real-world scenario as they still underlie limitations. Some of the restrictions of these policies are:

● An audience must consist of a certain percentage of children under the age of 12.
● "Existing company - owned, brand equity characters are not covered by this commitment. In addition, in primary schools, menus or displays for beverage products offered for sale, charitable donations or fundraising activities, public service messages, and items provided to school administrators for education purposes or for their personal use are not covered." (ICBA, 2015)

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[4] Note that certain research came under scrutiny as it turned out that the involved researchers received funding from the sugar industry (O'Connor, 2016)

This standpoint and the action taken show that the sugar industry has to adapt to the changing consumer requirements if they want to stay in business. It indicates how powerful educated choices can be. Hence the importance of creating awareness in consumers. The resulting reaction could be more effective than imposing new rules or bans.

2.1.5 What are sugars?

Figure 2. 61 Names for Sugar as listed by the University of California (2013). Graphic created by author with www.wordclouds.com

Sugars can come from many different sources and are nutritionally speaking empty calories (McGill, 2014). That means, they do not contain anything other than "energy" which, when not needed, is stored in the form of fat (New Zealand Nutrition Foundation, n.d.). This can result in problems if we consume more energy than we actually use. Unused energy is stored in the body, which may struggle to produce insulin to process the consumed sugars. There are various kinds of sweeteners (natural, added, artificial, etc.) that can also be made up of different elements. Sugar found in fruit for example, is made up of glucose and fructose (Gearing, 2015). To make things even more complicated, there are over 60 names for sugars that are used on packaging by food manufacturers (University of California, 2013). This is why it is possible that some sugary items do not contain the word "sugar" in their ingredient list at all. Instead, words like honey, dextrose or corn syrup may be listed - which are simply other names for sugars and once broken down, are again empty calories. Using unknown or healthy sounding names suggests that there is no sugar present. The nutrition label in such a case would still show the overall number of sugars included in the product but the total amount would likely not equal to zero. Also, the label does not reveal how much natural or added sugars were used in a product.

This can cause further confusion because the recommended daily limit of sugar intake is often referring to "added[5]" sugars and not to the total amount. As an example, the recommended amount for four to eight-year-old children is 12-24 grams of added sugars (Hutton, n.d.). How is a consumer supposed to calculate different sugars if the nutrition labels do not clearly show a distinction?

Whether making this separation is really necessary or not, will be discussed in the next section.

2.1.6 Are added sugars worse than natural sugars?

There are discussions whether added sugars are the only problematic form of sugars or if naturally occurring sugar can cause issues as well (Gearing, 2015). For example, a whole apple is considered as healthy despite containing around 14g of sugars. This is because it is also made up of vitamins and fibre. Both are important and good things for our body. If that apple is turned into an apple fruit juice, the fibre has almost disappeared and the fruit cells end up damaged. The final product is water with a lot of fruit sugars (= empty calories). Given that drinking a glass of fruit juice is easier and done faster than eating a whole fruit, one can quickly consume excessive amounts of sugars and energy (Gearing, 2015).

Why is this important for this project?

- If the developed app classified an apple as unhealthy simply based on its amount of sugars, it could send a wrong message. The last thing this project wants to achieve is to make children stop eating fruits. Therefore, a solution had to be found that reveals the sugar content and, depending on item, rewards a user with a bonus (whole apple = bonus, fruit juice = no bonus). This way, positive choices could still be encouraged[6].

- Explaining the different sugars is a complicated task and the decision was made to only deal with the total amount of sugars for a start. The reason behind this is, that the first step of creating awareness was about understanding which items contained sugar and how much of it was present. Once this realisation can be achieved, awareness can then be expanded to other factors like the types of sugars and how the body deals with them.

2.1.7 Are sugary drinks the only offenders?

While sugary drinks are an easy and fast way to consume a lot of energy, they are not the only offenders. Sugars are "hiding" almost everywhere - even in items we would not necessarily

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[5] Added sugars usually do not include naturally occurring sugars like honey, lactose or fruit concentrate.
[6] More about the app and how items were classified can be found in the development chapter.

consider as sugary products. As a quick example, the following table shows the potential sugar intake of a child with commonly available products.

Note: Each item's sugar amount was based on one serving.

Breakfast	Morning Tea	Lunch	Afternoon Tea	Dinner	Dessert/ Snack
Flakes + a cup of milk	Muesli bar	Lunch-box (incl. drink)	Banana on toast	Chicken sweet sour noodles	Custard yogurt
5.8g[7] + 9.4g[8]	10.8g[9]	39g[10]	16.5[11]	35g[12]	13.8[13]

Table 1. Example of a child's sugar intake in one day

The total sugars of the example in the above table amounts to **130.3 grams/day**. This is a mix of natural and added sugars. If the natural sugar (of processed items) results in "normal" sugar as well, then the example shows that the limit was exceeded almost 5 times. Hence the importance to treat natural sugars with caution. For example, adding (processed) fruits to muesli bars or flakes does not turn these items magically into a healthy meal.

2.2 How to create awareness?

2.2.1 How to find out about nutrition information?

It can be argued that the sugar content of an item is often listed on its packaging as part of a NIP (Nutrition Information Panel) and therefore consumers can make their own decisions whether to buy the item or not. While this is true for adults and older children, young kids cannot read or understand these labels. Coincidently, a lot of sugary products target exactly this age group. The kids only see the appealing cartoon character or bright colours on the packaging and want to have it instead of the "boring" apple or carrot.

Reality is, even for adults these labels are not easy to understand (Maubach & Hoek, 2010). The provided information assume that a consumer already knows a lot about nutrition, how they are digested or what their roles in the body are.

A consumer might ask the following questions when reading a label:

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[7] Kellog's Special K Original
[8] Home Brand Standard Milk 2L
[9] Mother Earth Oaty Slices, Afghan
[10] Pickles & Davies (2016)
[11] 1 Banana + generic white toast
[12] Hughes (2016)
[13] Thomas the train Vanilla Custard

- What does Kj stand for? How many calories is that? What is a calorie anyway?
- Do "sugars" include things like honey as well?
- If sugars and fats are considered unhealthy, are the other listed items bad as well?
- What does fibre do?
- If all the items listed on the labels are added up, do they result in 100% (of the content)? Not? Why not?
- Why is this so complicated!?

To be fair, the government (Food Standards Australia New Zealand, 2015) and other institutions (New Zealand Nutrition Foundation, 2017) provide guides where some of the above questions are answered. But apart from comprehending the labels, another problem is that most people do not have the time to analyse and compare each item before putting it into the trolley. Even the clearest information becomes useless if it is not seen.

In a 2010 study about parents' reaction to nutrition labels and formats, the researchers noted:

"*As many participants shopped quickly, felt under time pressure, and were distracted by other stimuli, their ability to read, interpret and use complex information was limited. Easily understood label formats could simplify their shopping expeditions.*" (Maubach & Hoek, 2010, p93)

This poses the question whether the labels are designed as effectively as possible. Also, is it really necessary to list all the information or could it be streamlined? Or could there be two labels: A short one attached to the front (for quick and easy readability) and a comprehensive version at the back (for people who want to know more)?

Maubach & Hoek's (2010) study about food labels found that most participants preferred a simplified version of nutritional information on packaging, while food manufacturers believed that a label with more detailed information was better as it could help consumers to compare more details and hence make a better decision. It is "interesting" that manufacturers believe to know what is better for consumers, when studies and statistics show that complex or complicated labels are not understood or read.

2.2.2 What are alternatives to standard nutrition labels?

Because it is indeed difficult to grasp nutrition information, several alternatives have been introduced and promoted. The following paragraphs briefly discuss two systems:

Traffic light labels

There are multiple versions of traffic light nutrition labels used around the world. It is added to the front of the packaging and basically shows a minimised and rearranged version of the "normal" nutrition label. In addition, different colours are used to symbolise the health

classification (e.g. red = too much of a certain ingredient or green = amount is acceptable). Multiple studies around the globe have found more or less positive impacts on consumer behaviour with this version of nutritional content information (Emrich, Qi, Lou, & L'Abbe, 2017; Sacks, Veerman, Moodie, & Swinburn, 2011).
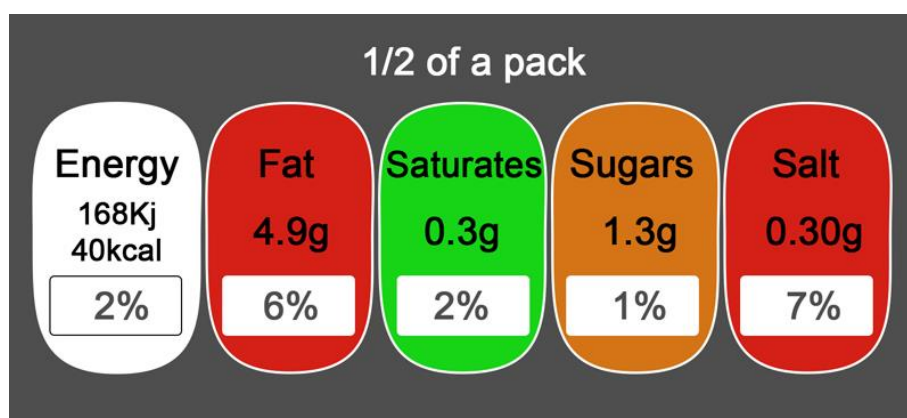
Figure 3. Example of a traffic light label used in Europe. Graphic by the author.

This additional nutrition info system is not officially used in New Zealand. Instead, the so called "Health Star Rating" is in use.

Health star ratings

The New Zealand government introduced this system in 2014. It is similar to the traffic light label and uses stars instead of colours.

Figure 4. Example of a health star rating. Photo by author.

The system has attracted two main criticisms:

● It is not compulsory for food manufacturer to add the rating to their packaging. This is of course very convenient for producers of unhealthy products.

- More stars do not necessarily mean that a product contains a low amount of sugars. The system takes several aspects into consideration to decide if a product is unhealthy or gets more stars. It does not only rely on an item's sugar content. This has the consequence that certain items with higher sugar amounts still get a higher star rating than a similar product with less sugars (Consumer NZ, 2016). For example, a popular breakfast cereal product bases its star rating by assuming that it would be consumed with milk. The combined rating results in 4.5 stars. Yet, the product without milk would only be awarded 1.5 stars (Nadkarin, 2017).

Another, smaller critic point raised with the health star rating is that it only works within the same food category. E.g. a breakfast cereal cannot be compared with a muesli bar.

Partly due to the above reasons, a survey in 2016 by the health promotion agency (Brunton, 2016) found that only 39% of participants trusted the health star rating.

To conclude: The existing systems in place (in NZ) either do not work or have not the desired impact on consumers. They need to be replaced or altered to achieve more recognition and trust. This view is also shared by The Dentists Association and Consumer NZ (an independent source for consumer information), which recently urged the government to introduce mandatory sugar labels (Clayton, 2017).

Either way, it is questionable whether a revamped version would keep younger consumers in mind and tried to create a design that could build awareness for children as well. An app on the other hand would allow for a fun and interactive exploration of the topic that could go beyond reading percentages and numbers.

After all, it is bizarre. Other products that contain unhealthy ingredients need warning labels and even underlie age restrictions and yet, sugars which indirectly or directly affect millions of people's health get a pass? Or could perhaps a tax, like existing on cigarettes, help ease the problems?

2.2.3 Could a sugar tax solve the problems?

As awareness and prevention campaigns are not working as intended, more and more people and organisations are calling for a sugar tax (Fizz, n.d. ; Sacks, Veerman, Moodie, & Swinburn, 2011). Such a measure is believed to cause consumers to think twice about whether they want to buy sugary food products or chose a "healthier" alternative instead (Rochman, 2012). A positive aspect of a tax is, that aside of potentially reducing sugar intake and therefore reducing health issues, it still gives consumers a choice[14]. Sugary items would not rigorously be banned

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[14] Offering a choice is incredibly important as later chapters about "reactance" and "empowerment" will discuss.

and could still be purchased.

Several countries and states have already implemented a sugar tax. One of the most discussed results are from Mexico[15], which showed that purchases of sugary drinks declined by 10-17% after the tax was introduced and sales of untaxed items increased (Rivera, 2016).

The New Zealand Government (Gardiner, 2016) reviewed multiple studies about sugar taxes and found that:

1. Lower income groups would suffer more from a sugar tax because they tend to consume more sugary products than other income groups.
2. Sugary items were simply substituted with other unhealthy and untaxed products
3. A sugar tax could work if used together with other measures and if the tax was set high enough.

It can be argued whether a lower income (in countries like New Zealand) automatically forces people to buy sugary products. There are healthy alternatives that are not necessarily more expensive than junk food. E.g. drinking tap-water is cheaper than consuming fizzy drinks and would not lead to such high numbers in tooth decay. It poses the question if indeed a lower income is to blame for consumers' choices or if there are other important factors that can lead to this situation (time, budget planning, awareness, motivation, etc.). If a factor like insufficient education about nutrition was the reason, it would support the idea of creating better ways to educate people and also touches on finding number two of the above list: Replacing one bad product with another one. Both points imply that the concept of health and nutrition was either not understood or cared about by consumers.

Also, applying a tax to only one kind of unhealthy food would be questionable. Apart from being unfair to food manufacturers, it also suggests that, for example, untaxed chips were healthier because they do not come with an "unhealthy" (sugar-) tax attached. Again, if the understanding is the problem, choices need to be made simpler and not more complicated.

For finding number 3: Creating clearer food information and nutrition awareness programs could be considered as additional and supporting measures when introducing a sugar tax and hence could help to create a robust method fighting unhealthy food choices. Once consumers really know and understand what is in their food, what healthier options are or how to grow/cook it themselves, then a clearer assessment can take place. If consumers still end up reaching for unhealthy (and unnecessary) items, then it is their free choice. But they will have to pay a higher price for it. Objecting a tax because it may disadvantage groups that cause the problems in the first place (manufacturers and consumers of unhealthy products) but at the same time asking

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[15] Similar taxes were introduced in Denmark or Chicago (USA) and were later abandoned (Dewey, 2017). Therefore, some consider these taxes as clear failures (Fooddrinktax.eu, n.d.).

the general public to fund the consequences of unhealthy lifestyles is unfair and is not going to improve the situation. Also, introducing a new tax for problematic food does not mean that existing taxes on healthy food could not be removed. If nutritionally good food was cheaper and consumers understood why they should choose it instead, a fair and useful solution could be created (University of Auckland, 2015).

That leaves the question, if the government cannot impose stricter rules or easier to understand labels, what are alternative ways to address awareness about sugars in food? The next sections will discuss some possible approaches.

2.2.4 Why not addressing the parents?

To address the parents[16] seems like a very logical thing to do. After all, they are raising their children, buying the groceries and have the authority to tell their kids what to eat and what not. However, in reality there are a few pitfalls that make it difficult to make such an approach successful.

- According Swinburn and Kelly (2015) "Nine out of ten parents of obese children aged 2 to 4 years believed that their children were a of normal weight." These parents would never feel addressed if a study or awareness program was reaching out to them to participate. They probably would even feel offended if someone told them their child was obese/overweight.

- According Whitaker, Wright, Pepe, Seidel, & Dietz (1997), if one of the parents is overweight, the chance that the child will be overweight as well doubles. Like in the above point, if parents are not aware of or "mind" their own weight, then how can a prevention program reach them, let alone involving them in exercises (physically and mentally)?

- An awareness program would be very difficult to schedule. Nowadays it is not uncommon for both parents to be working. Partaking in a study or doing "homework" for a project is very likely not high on a "to-do" list for parents coming home exhausted from work.

- Many schoolkids eat lunch at school and not at home. While in many cases the parents/guardians prepare the lunchbox, it is difficult to actually track what the child ate and what not (threw away, shared, traded with others, etc.). Even if a parent chose

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[16] The role of the parents is certainly important and can have positive impacts on their children. A study by Hursti (1999) for example, found that parents indeed can have a positive influence. However, this requires parents to provide healthy food options to begin with and they also need to act as good role models when it comes to eating habits.

nutritionally perfect food items, it may not be eaten by the child if it does not understand why a "healthy" lunchbox is better than the other kids' box filled with "yummy" chips and sweets. The child may feel even ashamed and might get bullied for being a "health nut".

- Statistics unfortunately show that potentially sugar related diseases are increasing and whatever is currently used to create awareness is arguably not working as intended. In the past, mainly adults (e.g. parents) suffered from these health issues and now more and more children do so as well. Can we therefore trust adults to make the right choices for their children if they do not know how to look after themselves in the first place?

This is not meant as an insult. Plenty of times I have bought food for myself and for my child and only later realised that it was full of sugars or in other ways unhealthy. There are multiple reasons why we as parents choose unhealthy food, like:

- the packaging was misleading (e.g. product claiming to be "all natural"),
- we buy it because we know that the child is going to eat it (better that than eating nothing or having a big argument over it)
- no time to read the labels carefully enough
- perhaps we used to eat a certain item when we were young and it never seemed to be a problem back then
- the content / serving size of a product has vastly changed and we never noticed it.

All the points raised above are a strong argument for creating a tool that could help us find out about the sugar content of a product before we buy it. Or even better, if our kids could use such a tool by themselves. After all, telling a child what to do has often not the desired impact. But if the child can find out things by him/herself in a fun and educational way, it may become easier to understand why something can be unhealthy and cause problems. This is perhaps better than using argumentations like "it is bad because it is sweet! Period!".

2.2.5 Why starting with children?

First: It "reduces" one step if children can be educated directly, instead of having to first train the parents and then hope the knowledge will somehow trickle down to their offspring.

Second: Humans are behaviour driven and it is incredibly difficult to change once we feel accustomed to a certain lifestyle or cannot find better (= easier) alternatives (Hardcastle et al., 2015). Adding to this already challenging circumstance a substance that is said to induce cravings (Schaefer & Yasin, 2016; Avena, Rada, & Hoebel, 2008), it may seem a wise idea to break free of this potentially problematic combination as early as possible.

Third: As mentioned in the previous section, parents often do not have the time to "update" their knowledge. This is very different for kids, especially in a school environment. Addressing a topic like sugars in food at a school is convenient for everyone:

- The kids are there already and do not have to be convinced/invited to attend a "training".
- Everyone gets to do it, no matter if someone is overweight or not. No one is singled out (not body shaming certain kids). Just because a child is not obese now, does not mean that it will stay this way. According to statistics (Ministry of Health, n.d.), one third of the people living in New Zealand is overweight and as a country ranks at number three in the world in this unflattering category (OECD, 2017).

Considering that children spend a lot of time at school, increasing the focus on food there could play a key role in tackling the health problems that are currently faced. [17]

Fourth: Instead of top-down, there could be a bottom-up flow of knowledge. This is perhaps a bit of a romantic vision but imagine the following situation: The kids play with this project's app and scan the food packaging at home. They realise that some of the items result in a low score (= contain high amounts of sugars). So, they ask their parents to buy food that gives them more points (= contain less sugars). Now the family has to figure out which items that could be. Result: The family starts looking at alternatives, discusses food/sugars and creates awareness about which products contain how much sugars. After all, it is not uncommon that children can influence the consumer behaviour of their parents.

Author and educator Marc Prensky, who coined the term "Digital Natives"[18], believes that in order to change the world for the better, the focus should be on educating the children, so they can start re-forming their surroundings in positive ways:

"Today's newly empowered kids can now accomplish important tasks in the world at far younger ages. From the very start of their education, we should be fusing "thinking skills" and "accomplishing skills" into an education with a direct, hands-on connection to the world and its problems." (Prensky, 2017)

In order to empower the children to cause change, they first need to be made aware of the problems that need to be addressed. According Prensky (2001), this should ideally be done with tools the children are surrounded with and accustomed to (e.g. technology, games, etc.).

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[17] I am aware that this would provoke a backlash as some parents may see this as interference by the "nanny-state" (Edwards, 2015).

[18] People who are born into a world that is surrounded by digital technology and hence interact with it differently than the people who grew-up before them (Prensky, 2001).

Unhealthy food is fun!

As commented in a news article by marketing expert Bodo Lang (as cited by Edmunds, 2017): "...cartoon characters, games, and celebrities are often used for nutritionally poor products."

A similar observation was made by Elliot (2015) in the article "'Big Food' and 'gamified' products: promotion, packaging, and the promise of fun": "Fun is strategic marketing for Big Food because the very sentiment of fun distracts from questions of calories, nutrients, and origin while promoting consumption." (Elliott, 2015, p356)

Exactly because a lot of unhealthy food products target younger children, it would make sense to give the kids a tool that allows them to see through all the marketing and gamification attempts by food manufacturers.

However, cartoon characters, games, etc., are not only used to promote "bad" purposes. The next sections look at attempts where these marketing tools were used in positive ways.

2.2.6 What types of media could be used to educate children?

The selection of educational books, tv-shows and games is overwhelmingly large. This section gives a brief overview of the most common media types used to educate children.

Books

Libraries provide easy access to books for a large part of the population. There is a variety of styles available that are suitable for many different age groups. The downside of books is that they are usually consumed in a "passive" way. Other than looking at the pictures, perhaps lifting flaps to discover hidden content and of course reading the text (if already possible), there is not that much to do. This type of media may struggle to create motivation in younger kids, especially over a prolonged time.

Examples: From learning about numbers and letters, to emotions, to how to interact with other kids, the offer is immense. However, in my experience, more serious topics like sugar, smoking, or pollution are usually less used in stories for children.

Videos (tv-shows, movies, YouTube clips, etc.)

This type of media can induce a lot of excitement and can keep kids entertained for a long time. With the additional sound effects, music, voices of different characters and animations, it triggers more senses than a book and therefore can capture our attention - no reading skills necessary.

However, this kind of consumption is so effortless for us that we may shut off our brain and again, absorb this media too passively. While there are programs that, for example, ask children to get up and help the protagonist by exercising along with them, the story usually continues -

no matter if the child followed the instructions or not. It plays nevertheless and no interaction is really happening or necessary.

Notable mentions:

- Bo on the go: When the main character runs out of energy, it asks the viewers to participate in small physical exercises that "help" the character to recharge and continue the adventure (*Bo on the GO!,* n.d.).

- Doc McStuffins: Uses common health related topics to take children's fears of visiting the doctor (for example; Disney junior, n.d.).

Games (physical, digital, mixed media, etc.)

Playing games offers a lot of interaction in different ways (Games for Change, n.d.), be it physically (building a sand castle, playing board games, etc.) or digitally (with desktop computers or tablets). It is entertaining, unforced, triggers multiple senses, can combine the previously mentioned media types into one and can support important learning steps such as problem-solving skills, risk taking and collaboration (MacKay, 2013). This is why this type of media offers such a great potential as a tool for creating awareness and was therefore eventually selected for this project.

Examples of games used to educate children:

- Veg Patch Match Game: This board-game teaches children about fruit and vegies and also explains where they come from (Orchard Toys, 2017)
- Solusville, a healthy neighbourhood: Is an online game that introduces children to the food groups, ways to stay active and other health related topics (Nourish Interactive, 2017).

A later chapter of this thesis will talk more about how game elements were identified and applied to make a method for awareness creation more fun. But first, the next section will look at what kind of media format was chosen for this project and why.

2.2.7 Could an app be used to create awareness?

Figure 5. The basic concept of the proposed app (without gamification elements). Figure by author.

There are over 3 million apps on Google's Play store (Statista, 2017) - what makes this one different?

While there is a plethora of apps available about food, none to my knowledge[19] combines real world products with a scan function[20] and educational game elements, especially for children. While I am personally not a fan of children being "glued" to their tablets and phones all day, I have come to accept that this part of current times (to some extent) and I won't be able to halt this progression with a project like this. But, I might be able to trigger a thought or experience that then evolves into awareness. Rather than fighting this technology I would like to use it to do something useful with it.

The decision to use a smartphone as the main device for this project was made for several reasons. Phones have become an everyday object that we carry around with us wherever we go. It has become normal even for kids to own or at least have regular access to tablets or smartphones. A survey by the National Literacy Trust called "Early Years Literacy Survey", found that over 70 percent of children aged 3-5 years have access to a touchscreen device at home (Formby, 2014). Later, in their second annual survey, the percentage increased to over 90% (Formby, 2014). Another study published by the American Academy of Pediatrics arrived at similar findings, stating that around 75% of the kids under the age of four already had their own mobile-device, which they used without the help of their parents (Kabali et al., 2015).

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[19] Searching app stores, google (incl. scholar) and YouTube did not reveal a product that did exactly what the proposed idea tried to achieve (research was carried out in 2016). There is of course the chance that very similar concepts exist (or existed), but the lack of clear search results implies that they either were not very popular or not officially released.

[20] The smartphone analyses the barcode on a product's packaging with the help of its inbuilt camera.

This is important for my own project because it shows that children are well versed at handling these devices and to some extent, to the featured software (e.g. user interfaces to navigate through games, educational apps and so on) before they even start school. Not only will they be ready to use mobile devices, they also will almost certainly have access to a device that can play an app like the one developed during this project.

Other apps that share similar concepts

Researching apps sold on the Google Play Store and on Apple iTunes quickly revealed that there are already plenty of apps that can give comprehensive information about a food's content and potential alternatives.

Examples that use barcodes to provide more information:

- Codecheck[21]: Shows nutrition information and relevant health information for millions of products sold in Europe. A New Zealand/Australian alternative exists and is called FoodSwitchNZ[22].
- Shop Savvy[23]: Compares prices of products
- Buycott[24]: Informs users of ethical related processes used to create products

However, they are mainly intended to be used by adults. Children could theoretically use them but likely would get bored quickly because there is nothing more to do or explore after the item was scanned. Of course, these items are designed to give busy shoppers a quick overview and are not about prolonged interactions.

There certainly are fun games or apps that teach children about nutrition. Yet, they usually do not use a function to integrate actual food products (and their nutrition info) that the children interact with on a daily basis or might see in their local supermarket.

Example apps that educate about nutrition:

- iLearn with Bo[25]: Introduces the different food groups to children (Peterson, 2013)
- Awesome Eats[26]: Lets children interact with different kinds of food groups (Whole Kids Foundation, 2015)

Then there are games that use a barcode scanning function but do not use it to represent real "values". Normally they simply transform the result of the scan into a number and then this

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21 https://play.google.com/store/apps/details?id=ch.ethz.im.codecheck
22 https://play.google.com/store/apps/details?id=nz.co.bupa.foodswitch
23 https://itunes.apple.com/us/app/shop-savvy-barcode-scanner/id338828953?mt=8
24 https://play.google.com/store/apps/details?id=com.buycott.android
25 The app is not available in NZ
26 https://play.google.com/store/apps/details?id=org.wholekidsfoundation.awesomeeats

number represents a certain category (e.g. points, weapons, level-ups, etc). It does not matter if the scanned barcode belonged to a vegetable or a t-shirt - the game does not care about the actual product.

Games that use barcodes within a game environment:

- Barcode knight[27]: Scanned barcodes influence choices that can be made in the game
- Skannerz: Was a game that used its own device to scan barcodes (Skannerz Wiki, n.d.).

Bridging worlds

A great example of an app that was able to combine the real world with digital content was Pokemon go. Thousands of people were flooding the cities, parks and even the streets in order to find and fight Pokémon with their camera phones (Weber, 2016). From kids to adults, everyone seemed to be playing this game. By combining fun (collecting and fighting characters) with exercise, it successfully bridged two worlds. Due to its popularity, the developers of the app have been able to raise 200 million US Dollars to produce another app based on the same concept (Heath, 2017)

A New Zealand based example in this category is GeoAR. This app adds virtual game elements to physical places (like parks) that can be explored through mobile devices. It motivates children to get outside and search for digital items hidden in augmented realities[28] (GEO A.R., n.d.).

These two examples show that fusing the real and the virtual world can work very well and may be able to attract children to take part in fun, healthy and educational exercises.

2.2.8 Why using this app to create awareness?

Retail food products are mostly encountered either in the supermarket or at home. In other words, we usually see them before we buy or before we consume them. As explained in the chapter about nutrition labels, consumers tend not to read details about the food that they are about to buy. Once the products are at home, information on the products' packaging are rarely noticed anymore. Therefore, two crucial chances to double-check what we feed ourselves or to our children are missed. With an app like the one proposed in this project, parents could concentrate on grocery shopping while their child scans every product before it gets put into the trolley. Children who do not go shopping with their parents could scan the items in the cupboard at home and remind their parents to buy healthier products next time. Why should children be interested in doing that? Because the gamification elements used in the app create a virtual

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27 https://play.google.com/store/apps/details?id=com.magiccubegames.barcodeknight
28 Augmented reality in this case means, the physical world was enhanced with digital content (basically layered on top of it with the help of a mobile device).

world around the actual topic and the children can collect points for scanned items and progress to higher levels. But only if the inspected products contained low amounts of sugars.

Also, such a tool could help a child to understand food labels without the need of advanced reading skills. This is important because, as discussed earlier, children are a big target group for unhealthy food products like chips and sugary items.

In addition, this app could ideally be part of a school project about nutrition, where children are asked to scan food products for a few weeks and then the results would be analysed and discussed with other children and teachers. This way awareness about sugars could be created and even extended.

2.2.9 Why using an Android based device?

In one of the previous sections I established that most kids nowadays own or have access to a mobile device. The next step was to identify a suitable platform the app can be distributed on. While the perfect solution would be to support all major mobile phones to guarantee that everyone could use the app, due to time constraints of this study, only one platform could be selected. Android was chosen for the following reasons:

Costs

Some operating systems run on devices that are expensive (like Apple's iPhones) and therefore unaffordable for certain income groups and especially for children. Hence, a large portion of potential users would automatically be excluded if such a platform was selected.

Android devices on the other hand have a much larger price range and cost as little as 50 NZD, which make them a much more viable option. However, the lowest priced devices may not be powerful enough to run every app or may lack features that are essential (like a camera that is good enough to read small barcodes[29]).

Most used devices (worldwide)

According to Gartner (2017), a leading research and advisory company, the most sold mobile devices in the fourth quarter of 2016 were using an Android based operating system. The numbers showed Android ahead with 81.7%, followed by Apple's IOS with 17.9% and Microsoft's Windows at 0.3%. W3Schools.com (2017), a popular website for web and app developers, lists similar results in their own statistics about what kind of mobile phones connect to internet sites the most. Leading the pack is again Android with 73.3%, IOS coming in second at 22.4%, followed by Windows at 3.5%.

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[29] Budget phones use cameras with a fixed lens. This can make it difficult/impossible to focus on thin barcodes. Result: A barcode cannot be scanned.

With these results in mind, if one had to choose a platform that could reach as many people as possible, it would have to be Android. Development for other platforms could follow after this project can prove that the used concept was indeed successful in creating awareness about sugars.

Contra electronic devices at schools

More and more schools have started with e-learning and "bring your own device" initiatives. While a growing research base supports the idea of learning through play and interaction with technical devices (Wainwright, 2013; Sung, Chang, & Liu, 2016), there is also criticism that children do already spend way too much time on devices outside of school and some studies show that working on electronic devices did not necessarily improve learning (Coughlan, 2015). Another problem is that not all games, even specific "educational" games, can actually promote learning outcomes (Berdik & Sadler, 2015). Simply converting paper-based exercises into digital versions does not automatically result in an improved learning experience. Also, is it very important not just to hand out devices and games and then hope the children will learn everything by themselves. Interaction with teachers, parents and classmates are still required to assure that a greater understanding of the topic in question can be formed and sustained (Wright, 2010).

The next chapter will try to give an insight into why it is important to educate in a way that does not feel forced. How much fun can an activity be that appears dull, asks us to do the opposite of what we usually like to do or directly tells us that we are wrong in our thinking? That would not make for a motivating and successful undertaking.

2.3 Reactance, or: Why do we not like being told what to do?

As suggested in the introduction, teaching people with the intent of behaviour change, or even through application of force may not result in the desired outcome. There are reasons for that and one of them is called "reactance" by psychologists. Whenever people feel their freedom is impacted or at risk, they block-up or even do the exact opposite of what they were asked to do. According Jack W. Brehm (1989), the creator of the reactance theory, this perceived "threat" applies to:

- space (e.g. asked/required to change the flat/ the country),
- objects (e.g. forced to give away a toy/ choose a different food product) or
- opinion and behaviour (e.g. being told what to do: "Stop doing this! / activity "x" is not as bad as you think").

Another quote summarises the dilemma of this project quite well:

"It is, I believe, the implied threats that make specific losses so motivating. Whether the attempt is to induce the consumer to take a particular product or service, to change or even improve an old product or service, or to eliminate an unprofitable product, to the extent that freedoms to have other products or services may be threatened by implication, consumer responses are likely to be negative." (Brehm, 1989, p75)

Therefore, just implying certain food products/ingredients are not that great or trying to replace a beloved product (with a healthier version) may cause objection by the consumer - in this case, by the children or their parents.

Food manufacturers are aware of consumers' potential reactance and use the concept of "freedom" to their own advantage. For example, the Continental Food and Beverage, Inc., believe that the consumers' choice of beverage should not be regulated by the government because it is up to the individual person to decide how much sugar she or he wants to have in their diet (Sifferlin, 2012). The intended help by the government is cleverly distorted to make their actions look like an attack on the freedom of choice, rather than on sugars and the potentially connected health problems. Reading through forums and comments sections of sugar related topics (Catchpole, 2017) quickly reveals that this tactic works. Many people oppose well intended measurements like a proposed sugar-tax or healthy food policies at schools (Edwards, 2015).

Using reactance as a tool works so well that even "freedom advocacy groups" have been formed. When, for example, New York's government tried to ban soda-drinks larger than 16 ounces, protests and anti-campaigns flared up with arguments like:

"*We are hoping to send not only a message to <u>stop this intrusion into our personal lives</u> and small businesses but also the general idea that they have done this consistently, <u>telling us where we can and cannot</u> smoke, telling you how much salt you can have on and on and on...*" (May, 2012)

In this case, a single change to one specific food group (sugary drinks) is immediately connected to other ingredients, products or lifestyle choices in order to widen the potential threat to an individual's freedom. It creates fear and anger about aspects that were not even part of the proposed ban. Yet, because this change could lead to future changes and bans, it creates panic and objection.

Figure 6. Example of how consumers are enticed to eat less healthy food. The advertisement reads: "When you don't feel like quinoa". Photo by author.

In the above Figure 6, additional choices are introduced to "remind" consumers about their freedom and that it is okay not to eat healthy food [30]all the time.

In summary, no matter if governments (Sifferlin, 2012), the World Health Organisation (World Health Organization, 2015), medical experts (Kelly & Swinburn, 2015) or independent advisors (Health Navigator New Zealand, 2017) are convinced that sugars cause extensive health problems: If people feel their ability/ right of making a free choice is taken away from them, they will push against change.

So, how can change, or at least awareness be formed? One opinion is by not taking away choices and inviting target groups to discover by themselves why sugars can become a problem. This approach touches partly on other concepts like "Choice Architecture" and "Nudges" by Sunstein (2015). Sunstein believes that it is inevitable to steer consumers into positive directions in order to overcome bad or uninformed choices, which otherwise could lead to big issues (like health problems). As with reactance, it is important to still offer choices and respect the people's decision, even if they do not choose the constructed choices. Therefore, the attempts need to be honest and not misleading (Sunstein, 2015).

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[30] Quinoa, a grain, is considered a healthy super food (Oaklander, 2015). Baked beans on the other side can contain 13g of sugars per serving (e.g. OAK baked beans in tomato sauce), which is more than half of a child's recommended daily intake.

The next chapter will look at a way this could be achieved with the help of a method called "gamification".

2.4 Gamification

2.4.1 What is gamification?

"*Effective gamification is a combination of game design, game dynamics, behavioural economics, motivational psychology, UX/UI (User Experience and User Interface), neurobiology, technology platforms, as well as ROI-driving business implementations.*" (Chou, 2015)

Or in simpler terms:

"*gamification is the craft of deriving fun and engaging elements found typically in games and thoughtfully applying them to real-world or productive activities*" (Chou, 2015)

While people have added game elements like score keeping or competition to otherwise dull tasks for centuries, the first considered gamification attempts in modern times occurred around 100 years ago. Some companies started to give away stamps or free toys to their customers to reward and entice them to come back again (Smith, 2014; McCormick, n.d.). Nowadays, the method of adding game elements to non-game related actions/ topics is used in many different areas: From product marketing, to employee training, to research and education projects.

According Gartner (2012), gamification is often used for 3 specific reasons:

1. Changing behaviours
2. Developing skills
3. Enabling innovation

The idea behind creating awareness is to first build new skills (knowledge). In this case, learning about sugars in food and to some degree, the potential side-effects of them. Second, this newly acquired skill can then be used to make better informed food choices. The result could manifest itself in a change of lifestyle. Therefore, the above domains (number one and two), fall directly into the scope of this project.

Terminology: Many different terms and categories have evolved around "entertainment education" or short "edutainment" (Breuer & Bente, 2010). While I believe that it can be interesting to explore the different facets of this genre, even if it just to make a decision whether a digital product should be added to the "app" or "game" section of an app store, I preferred not to get lost in terminologies and instead work on the project. Or to say it in the words of Chou (2015):

"*I would rather spend my time learning about and harnessing the power of games to change the world for the better, instead of debating over classifications of terms. What good have you created in the world when you spend your day arguing if something is "a game made for traveling" or "travel gamified"?"*

Examples of gamified studies

For this thesis, the focus was narrowed down to examples that applied gamification to health and food related topics.

- **Playing for Real Video Games and Stories for Health-Related Behaviour Change:** Baranowski, Buday, Thompson, & Baranowski (2008) reviewed 25 studies about gamified enhanced behaviour change attempts in children. These studies included topics about diets, exercises, medication administration and others. The conclusion was that: "*Playing most of these behaviour-change video games led to a broad spectrum of desirable outcomes from knowledge increases, to attitude changes, behaviour changes, and other health-related changes.* "(Baranowski, Buday, Thompson, & Baranowski, 2008, p77)

- **Gamification of Dietary Decision-Making in an Elementary-School Cafeteria:** This (non-digital) project used gamification to increase the intake of fruit and vegies in school children. By combining adventure stories with the school setting, children were encouraged to try and eat more healthy foods. Increased consumption meant that the character in the stories received more energy, thus were able to capture the villains. The researchers concluded that the children's fruit and veggie consumption "*...increased significantly above baseline levels when a low-cost, behaviourally based gamification intervention was introduced.*" (Jones, Madden, Wengreen, Aguilar, & Desjardins, 2014, p6)

2.4.2 How was gamification used in this project?

According Gartner (2012), 80% of gamification attempts go wrong. The main reason for this is poor design that does not include enough aspects that can create a relationship between a product and the user or fails to create a task that can keep a user invested and motivated long enough. Chou (2015) calls this kind of design a shell of a hollow product.

To prevent this from happening, the ideation of this project's app was based on the so called Octalysis framework (level1), developed by Yu-kai Chou. It urges developers and designers to pay careful attention to 8 important cores of gamification. If not all of them are addressed adequately, the gamification attempt is likely to fail - especially in the long run. This comes to no surprise, then, as mentioned in the intro of this chapter, gamification deals with many factors like: visualisation (presentation and user interface of a product), behaviour (interactions,

motivation, executing tasks), conceptualisation (choosing a topic, selecting the right data, creating a structure and rules to follow), etc. If one of these parts is flawed, then the whole experience is at risk. Even worse, it may not be possible to understand in the end, which of the parts caused a negative experience for the user. E.g. Was a project not able to create awareness about a specific topic because the concept itself was flawed? Or did it fail because something in the app did not work as expected (technical issues)? Or was there something wrong with the instructions and the user never even reached the core of the concept (design mistakes)? Or was the story/ reasoning of the experience not suitable for the target group and the user just did not care to play all the way to the end?

The 8 core drives of gamification by Yu-kai Chou and how they relate to this project[31]:

1. **Epic Meaning & Calling**
   The idea behind this core is to create an experience where a player can feel special. It motivates participants to be part of something that is "bigger" than them.

2. **Development & Accomplishment**
   This core is about creating a motivation and challenge for the user to play the app and especially, to provide a reason to keep on playing it - encouraging the player to explore new things and to progress further within the app.

3. **Empowerment of Creativity & Feedback**
   This core touches on an important aspect discussed earlier: Reactance. People, and especially children, like to exercise their free will. Unfortunately, kids often do not know which choice is best for them. Making a choice on their behalf (and potentially against their will) can easily result in tears and frustration. Not because the chosen option was wrong but because the child did not get to make it itself.
   Other aspects of this core drive are about "boosters" and "leveling up", which are concepts to keep players motivated. Due to time constraints, those features could not be considered in detail and will have to be revisited for a later version of the app.

4. **Ownership & Possession**
   Chow (2015) states that if users become invested in an experience, they start to care and try to improve what they already have achieved. In other words, motivation can be invoked by providing features that make a player feel in charge.

5. **Social Influence & Relatedness**
   Comparing things like scores and level progress can create motivation by competing

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[31] Note, not all aspects of the Octalysis framework were included or examined in depth. Partly due to time constraints and partly because not all aspects were applicable for this project.

with others.

Chou (2015) also lists the role of a mentor under this drive which is about helping and guiding others to reach a certain goal.

6. Scarcity & Impatience

This drive is about creating a desire for users to achieve a certain level or to unlock a (rare) special item BUT making it very hard or impossible to do so immediately.

Not being able to get something, even if we may not have wanted it in the first place, can invoke a craving to prove that we are indeed capable of getting it (Chow, 2015)

7. Unpredictability & Curiosity

An experience can appear interesting because not everything about it is revealed in advance. This motivates users to explore and try out different actions.

8. Loss & Avoidance

The last drive is about creating a situation where players feel that they have invested too much time or gained too many points that they do not want to throw it all away and instead keep on playing.

To summarise: Convincing people to spend their valuable time with a certain product is hard. Especially if the topic is not something they are usually familiar with or are interested in. Gamification can provide methods to minimise these hurdles and has the potential to keep users motivated long enough so they can actually take away a learning experience.

Explaining how gamification was used in this project marks the end of this chapter. With all the background information about this project gathered, it is now time to look into the actual development and creation process of the app.

3 Research Design

Deciding on a methodology was informed by the following factors:

- The chosen topic is very complex and many aspects are responsible for its existence. In order to get a better understanding of how and why the current situation with sugars has arrived at where it is, different methods needed to be considered. Numbers and statistics can tell how big a problem has become for example, but it can be difficult to comprehend how these numbers came to be. Hence, qualitative and quantitative data needed to be gathered and analysed.

- Several parts of this project were subject to different opinions and experiences. Researched studies, best practice guides or results of case studies, they all were partly based on interpretations. Other researchers or different participants could have led to alternative results (especially when working with children).

- This project focused on aspects that are rather difficult to measure and to prove. It was also expected that the reactions to the app would be different for each participant. There are many factors that impact how a person approaches an experience like the one in this project and also how he/she reacts to it during and especially after. Cultural background, existing knowledge, or available options at a participant's home could be some of them. This is important to realise because even if this project was able to make a positive impact on a child, it is probable that the previously stated factors may "overturn" the caused reactions. The child's behaviour or opinion could then revert back to the same state it was prior to interacting with the app used in this project.

- Furthermore, the project and its results were likely going to be influenced by myself and the involved people. Other researchers may therefore arrive at other findings and may not reproduce the same results.

Eventually, a mixed methodological approach was used to take these diverse factors into consideration (Sheffield Hallam University, n.d.; Sanjari, Bahramnezhad, Fomani, Shoghi, & Cheraghi, 2014).

A similar choice was made for the research methods. Since this project touches on many different areas like nutrition, psychology, child development, education and gaming, I felt that it was necessary to approach this project from multiple angles to get the best possible understanding. Using more than one method helped me to collect, create and analyse additional information, which would not have been possible with one method alone (Lobe, Livingstone, Ólafsson, & Simões, 2008). Of course, this also meant that not each aspect could be researched and analysed in depth, unlike a single topic/ method may have allowed.

The used methods were:

- Practice Based Research
- Case Study

3.1 Practice based research

By building prototypes, I was exposed not only to the production side but also to the testing and experiencing side of the process. This allowed me to inform myself and improve the app further based on the discovered findings. Learning through experimentation showed me potential pitfalls and elements that could cause confusion. Envisioning and speculating alone about a possible app would never have led to the same important findings.

Prototypes, issues and ideas were also shared and discussed with my supervisors who provided valuable feedback which influenced multiple aspects of the study.

Throughout the creation process, relevant research shaped the process and included areas like:

- nutritional information (sugars, food labels)
- health statistics,
- gamification
- research and children
- ui/ graphic design for kids,
- age group related information
- etc

While I understand the creation process of this project to be practice based, I see the output as practice led research (Creativity and Cognition Studios, n.d.). The former was about creating new or extending existing ways, the latter is a product that may be used to initiate changes within a certain environment. However, while I made use of methods commonly used in practice based/led research (such as reflecting on actions, observation of participants or research through practice), I still felt that it was rather difficult to "match" the results of this project to outcomes of a qualitative approach. Let alone, trying to put experiences felt by users into clear numbers for a quantitative analysis.

A potential solution for this dilemma may be found in the usage of "Performative Based Research" (Haseman 2006). In this research form, the results are presented in symbolic data instead of text or numbers (Haseman, 2006). In the case of this project, this would be in the form of the app and the caused user experience. For example: A quantitative approach may shine light on how many participants know what sugars are. A qualitative questionnaire may show why a participant likes a certain type of food. A performance based approach allows a participant to interact with different kinds of information and is prompted to do something with it.

This in turn can trigger again further consequences. Reading about the scanning of a product versus actually scanning it in person and then decide what to do with the results, is a very different experience than just writing down an answer or ticking a predefined checkbox.

Also, information in the app can be displayed in various ways. If too literal approaches are used, then it may impact the motivation of a participant negatively. E.g. using a text that reads: "Too much sugar is bad". But if the information is symbolic and gamified, the participant may be more open to the experience. E.g. too much sugar can be symbolised by losing points, by fighting (more) monsters or by offering alternative (less sugary) products to scan. Creating something like that with other methods would be rather difficult to achieve.

"Awareness" is a difficult concept to measure - it may be created for a short or long period or not at all. For example: The awareness lasted as long as the user-test took place and at home, it stopped. Does that mean awareness was created or not? Did the app work or not? For such a situation, it could be said that the project – creating awareness - became into being what it named (Bolt, n.d.). Perhaps not for all students and not for a long duration but while experiencing the app, awareness was created.

Once the approach and direction was chosen, work could start with the preparation and development of the app. The following sections will focus on these aspects.

3.1.1 Feedback loop

To guide me through this project, several important measures were put in place. To keep track of past and upcoming tasks, a personal development log was kept. It featured 3 main sections:

1. Task,
2. Option or problem
3. Conclusion and action.

The 3 sections were informed by literature, prototyping and input of my two supervisors.

All of these measures formed a constant feedback loop that ran throughout the project.

3.1.2 Ethics approval

Since the concept was dependent on actual user feedback, an ethics application was required. Although working through the ethics-forms helped to structure and design the intended case study, it also posed a lot of questions which were very difficult, if not impossible, to answer at an early stage of the project. Therefore, the decision was made to postpone the ethics application and with it, the case study as well. I felt that it was necessary to create a prototype first which not only could help inform the project but also aided to attract the interest of a primary school for collaboration purposes. This proved to be tricky because without ethics approval, it was still not allowed to gather information (the kids feedback to the prototype) that could have been used to

inform this study. Therefore, I ended up building the prototype without user feedback to respect the requirements and subsequently met with a school (to demonstrate and discuss a potential collaboration). With all the information gathered that was needed to design the case study, I returned to filling out the ethics forms. Once the study was approved by AUTEC, I was able to undertake the case study.

Rearranging all of the above aspects resulted in having to drop the initial idea of following a participatory design approach (e.g. getting children involved at an early stage and meeting with them multiple times). Also, there was no time left after the case study took place to actually implement what was learnt through the collaboration with the school.

3.1.3 Design and development of the app

The creation of the app was roughly divided into two main phases:

1. **Exploration and experimentation phase**
   This phase was about researching popular games and game mechanics. It also included rapid prototyping which was done with a software called Unity.

2. **Implementation and fine-tuning phase**
   Once the concept and its goals became clearer, work on turning the core idea into a more appealing and interactive experience began.

Both stages were informed by the feedback loop mentioned in a previous section.

Exploration and experimentation phase

The initial idea was to display all major parts of a nutrition label. Therefore, the first design concepts tried to envision a gameplay where all of this information could be integrated and interacted with.

Several popular games and mechanics were researched to find inspiration for a suitable concept. Influenced by the old school classic Tetris (Wikipedia, 2017) and the popular game Candy Crush[32] (King, 2017), a very basic visual mash-up was created:

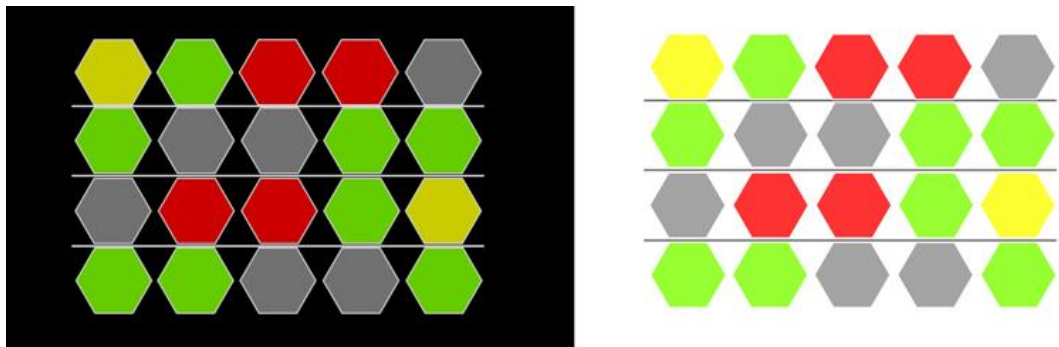[32] https://play.google.com/store/apps/details?id=com.king.candycrushsaga

Figure 7: Early concept for the game mechanics of the app. Image by the author.

The different colours represent different nutrition and the task would have been to arrange the objects in a certain order to get rid of them.
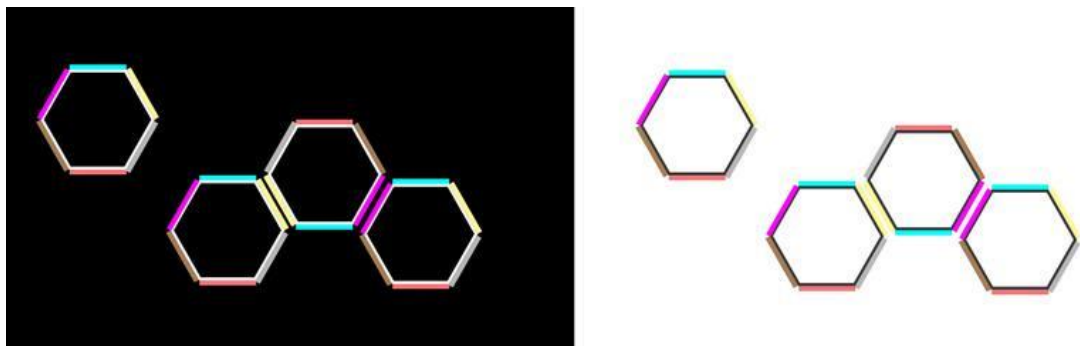
Figure 8: Another early concept for the game mechanics of the app. Image by the author.

In this version (Figure 8), the elements could also be rotated in order to dock onto the same elements. Again, the elements were representing different nutrition.

Figure 9. New design approach. Image by the author.

The next iteration (Figure 9) was inspired by how diabetes organisations advise how to choose food groups and how much of them should be used per plate (Health Ed, 2011). Instead of all nutrition, only 3 food groups were used: Carbohydrates, Proteins and Vegetables.

While these ideas can work well on an abstract level, it was difficult to link them to the actual problem. How does moving and rotating blocks create awareness about nutrition and their effects on the human body? It did not, especially for younger children.

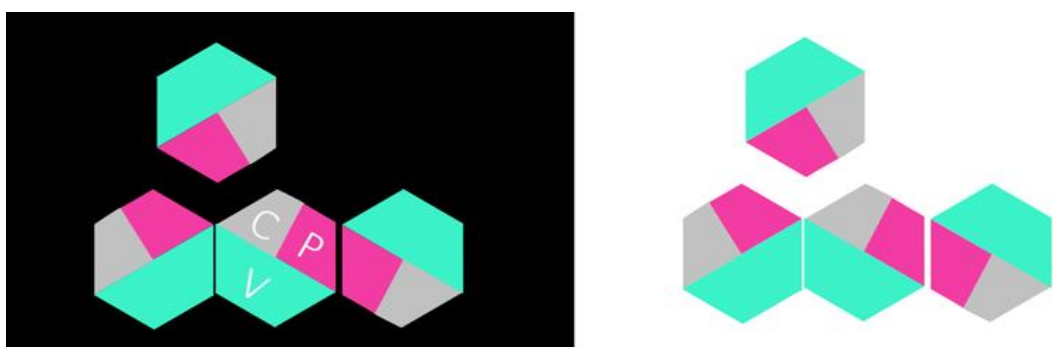Thus, a very different approach was taken in the next version (Figure 10). This time, inspired by the game Farmville (Zynga, 2014), the task of the player would have been to organise the nutrition into their different categories. Similar to looking after a garden, the idea was to look after one's body on a microscopic level.
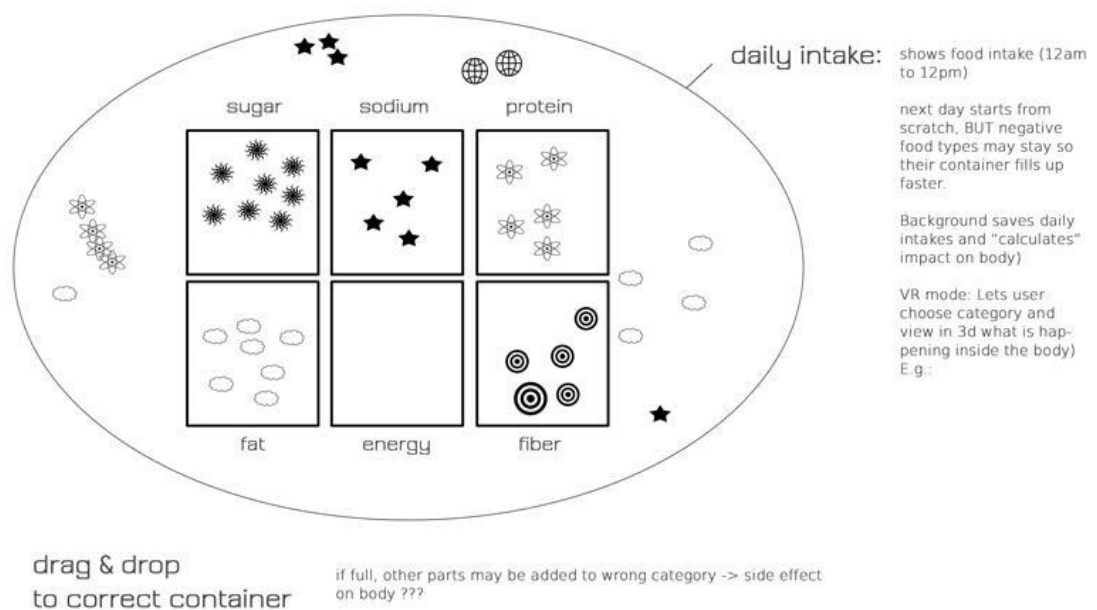

Figure 10. Concept draft: Using scanned nutrition information as a "microscopic garden". Image by the author.

In order to make the concept more tangible, the design had to be less abstract. Therefore, the choice was made to use design elements that actually represented real world objects.
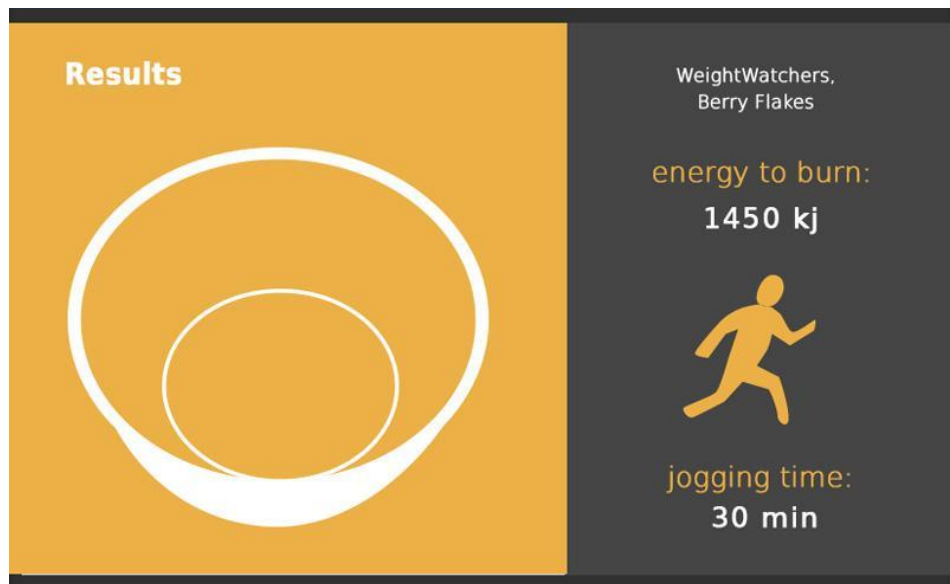
Figure 11. Early version of the app's design. Image by the author.

As shown in Figure 11, the scanned data was now visualised "inside of a bowl", suggesting that the user was sitting at a table and inspecting the content of the scanned food. On the right, additional information explained what the user would have to do to exercise away the consumed energy (if it exceeded recommended amounts).

When testing a very simple prototype based on the above concept, one issue became apparent which was never thought of during the design phase: While holding the device in landscape mode, fingers could block the camera on some devices. Also, depending on the size of the device, holding it with one hand was not comfortable and balancing issues were the result. In turn, this impacted the functionality of the scanner because the hand was too shaky and barcodes could not be read.
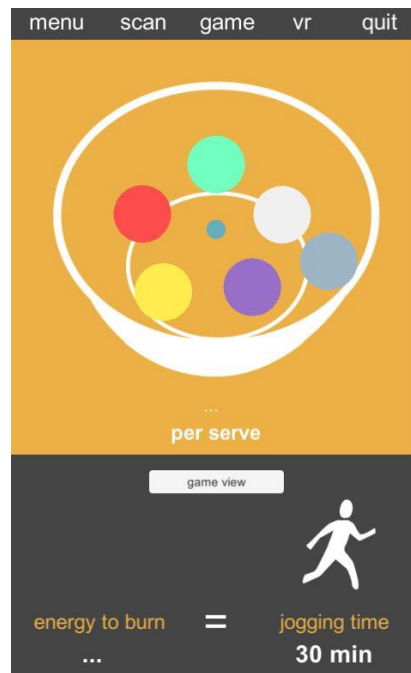
Figure 12. Due to usability issues, the format was changed from landscape to portrait mode. Image by the author.

The design still did not feel right as it tried to accomplish too many things. My supervisors suggested to focus only on parts that were really relevant to the topic. So, I questioned whether the "activity" part of the displayed information was indeed helpful. While physical exercise is an important aspect of health, the app's intention was not to act as a fitness trainer. Consequently, this part was removed.

Still, having so many nutrition elements with their behaviour and roles to integrate, posed the question whether it could confuse the user more than it actually raised awareness. On one side, there was the complexity of dealing with multiple elements. On the other side, there was the limitation of the available space on the screen. Considering that a young target group may be overwhelmed by too much information and will be playing the game on a small smart-phone screen, resulted in the decision to simplify the concept further. Research identified the rise of (potentially) sugar related health issues. Subsequently, the focus was put on sugars only.

Figure 13. Early prototype with focus on sugars. Image by the author.

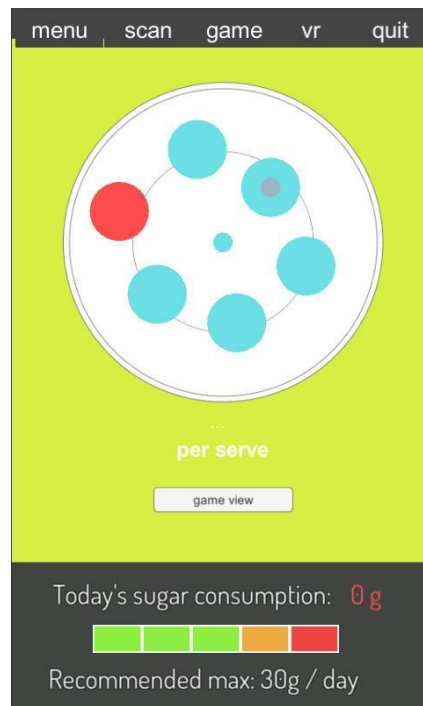In the above version (Figure 13), the idea was to still keep all of the other nutrition elements as a way to compare their relative proportion to sugar. In addition, a graphic was implemented that displayed the scanned amount of sugars and the recommended daily intake.

Although focusing only on sugar made things simpler, it still did not answer the question of how and especially when to use the scanned information inside the game. Should the game run continuously and the scanned data would simply impact it in a certain way? E.g. Almost like in a self-sustaining simulation where the scanned nutrition information impacts the system slowly over time. Or should the scanned data have a more immediate function? Like impacting a game character's health depending on the amount of sugars?

Although building simple prototypes confirmed that bringing nutritional data of food labels into Unity was achievable, experimentation alone was not going to answer these questions. A framework was needed that could address this challenge and extend the concept so it could attract and sustain a player's interest.

Implementation and fine-tuning phase

With the help of gamification and the Octalysis framework, I was able to create a "world" around the topic's concept. Subsequently, more and more game elements and scenes were added to the prototype.

Besides creating a "gamified" experience, the overall goal was to make the app child friendly as well. The following points were important factors that were considered when building the app:

- **Implementing colours and adding sounds and music**

  Sounds and colours are classic elements used when designing for children. They offer a quick way to attract a player's attention. The use of these aspects was suggested in the researched literature (e.g. Gelman, 2017; Marbelis, n.d.) and also by a staff member at the collaborating school.

  Note: In order to provide the participants of the case study with a more exciting experience, my supervisors suggested to include third party graphics to improve the look of the app and speed-up the build process.[33]

- **Using meaningful symbols instead of lots of text** (Gelman, 2017)

  Especially because the children's reading skills were still minimal, using text was not really helpful. This made it even more important to use design elements that were able to convey a clear meaning.

- **Keeping the structure simple and provide options only when really necessary** (Gelman,2017).

  Initially, each main area of the app (home, map, scan and score) could be reached from within any point of the game. As this would have enticed users to randomly push these buttons and thus break the flow of the game, these buttons were removed. Instead, simple forward and backward arrows were added to minimize the structure and keep the players on a clear path.

- **Including hints that helped a player to progress through the app.**

  E.g. Making important objects blink can help a user to know what to do next. In addition, spoken instructions were added that could guide a user through the app (Gelman, 2017; Chou, 2015.).

The above summarised "actions" were applied throughout the app. How and why exactly each specific scene of the app was created will be discussed in the following sections.

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[33] For details about these graphics please refer to Appendix A7 Used third party images.
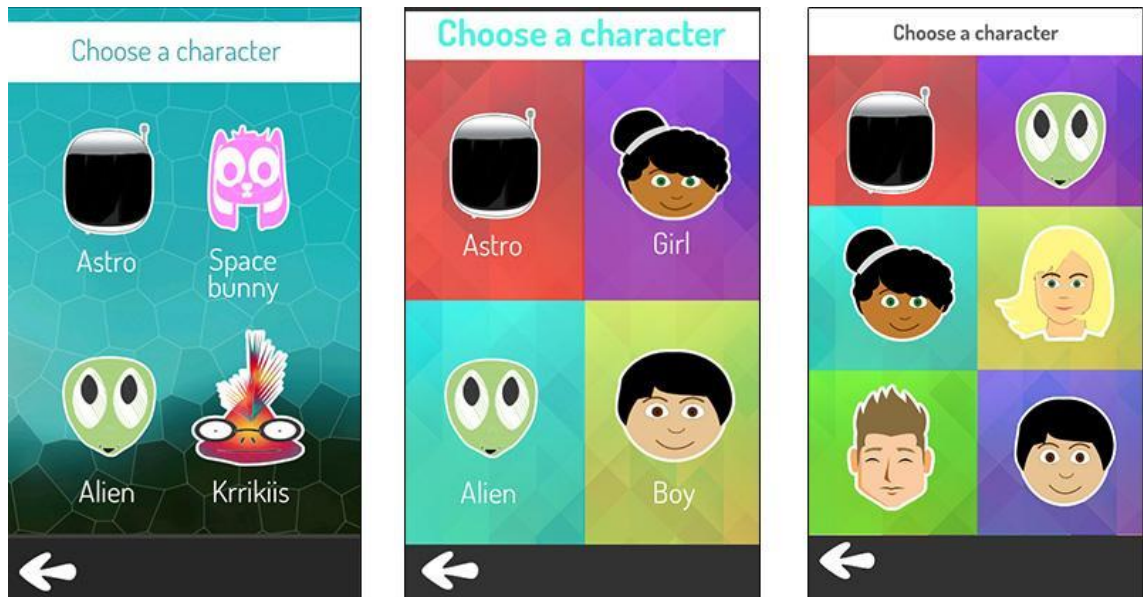
Avatar selection

Figure 14. Avatar selection screen, from early to final version (from left to right). Image by the author.

A character selection screen (as displayed in Figure 14) was added so players could choose by themselves as what they wanted to play. As aliens do not necessarily have to look like green Martians or monsters, more humanoid looking avatars were included as well. This offers players to play the game as someone that either looks similar or completely different to them, which is helpful for creating motivation but also to establish a connection between the app and the player.

Relates to Gamification Core Drive 4: Ownership & Possession

Providing multiple avatars to choose from can connect a user to the story. E.g. The avatar looks like me = I am part of the game = I should care about this. It hopefully encourages the users to try extra hard to find items low in sugars, so that the alien can fly back home.

Learning how much sugars their favorite snack contains and how fast more sugars are consumed than it is recommended per day, could trigger a reaction where players want to guard and protect their health. By examining more food items and eventually accepting the "healthier" ones, more points can be collected, which suggests the player's own health can be improved as well.

Letting players choose an avatar also supports the creation of empowerment (see core drive number 3).

Map
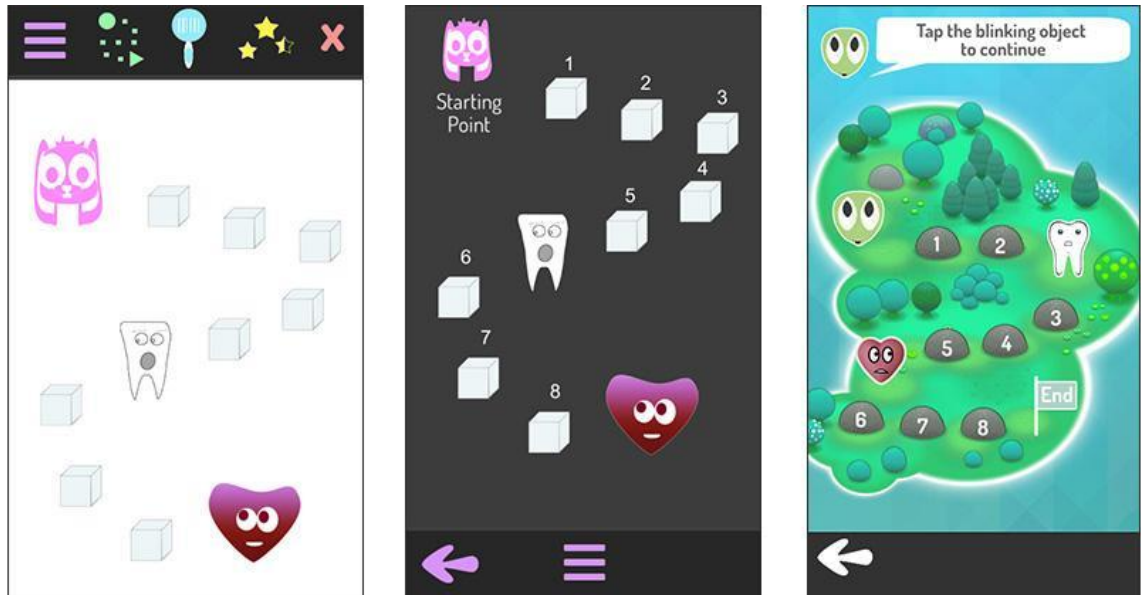
Figure 15. Map Screen, early to final version (from left to right). Image by the author.

A map was added to give the players a reference point (Figure 15). It shows them where they are and where they need to go next. It basically creates a journey. Part of creating such a journey required the implementation of graphics that matched the story of the game. The final design suggests that the user is wandering around on earth to find suitable food. Since New Zealand is made up of two islands, the map used an island to create a connection to the real world (implying that this story could actually be happening here and now to a player).

Levels (the cubes or rocks in the above graphics) show the users that there is more to explore and motivates them to keep playing the game. Each level's task is to scan a food item. By scanning items, points can be collected. Therefore, creating a motivation to scan more products.

In addition to the normal levels, mini games were included as well. They are meant to entice players further to keep on scanning items in order to unlock bonus levels. Only after a certain amount of normal levels are reached, players can get to these mini-games.

Relates to Gamification Core Drive 2: Development & Accomplishment

This core was implemented by

- adding scores (encouraging the children to scan and explore more items),
- presenting various levels to reach (creating an urge to reach all available stages)
- offering bonus mini games, that progressively get more difficult (attracts the kids to keep playing to unlock additional content).

Relates to Gamification Core Drive 7: Unpredictability & Curiosity

The mini games can feed the children's curiosity. They offer something unknown that has to be explored.

Mini game 1

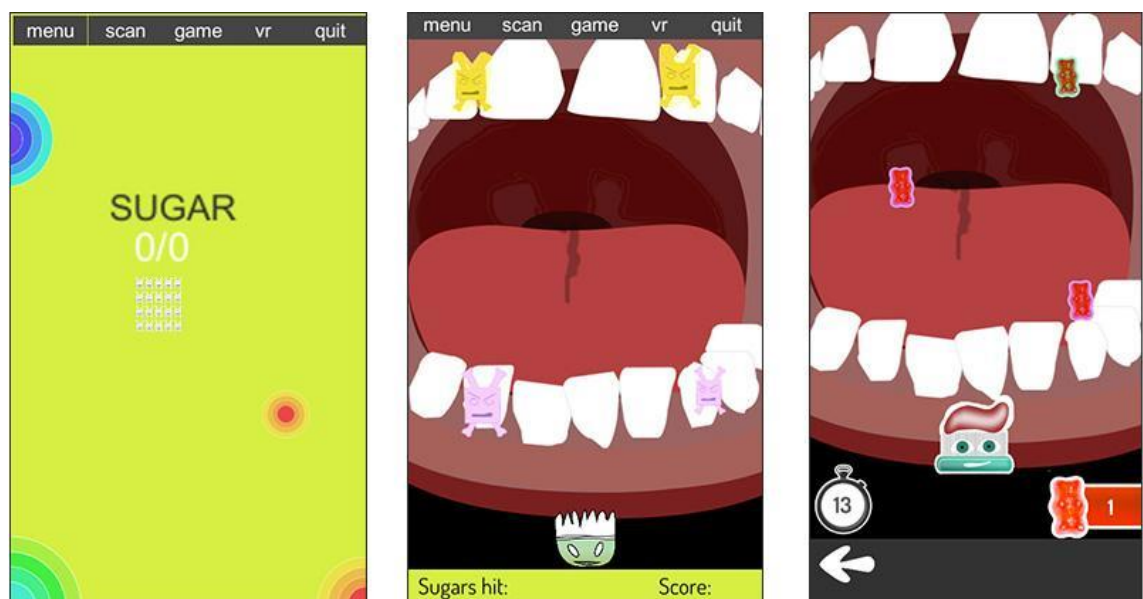*Figure 16.* Mini Game 1 - Tooth decay, from early to final version (from left to right). Image by the author.

The idea behind the mini games is to introduce the children to potential side-effect of sugars (as shown in Figure 16). In the first game, the amount of sugars found in the scanned food item is translated into sugar monsters that then attack the teeth. The player's task is it to swipe off

these monsters with the brush. Each destroyed monster earns the player a point. A timer was added to create a bit of pressure and to make the duration of the game clear.[34]

Swiping and flicking to control the objects was chosen because I had observed many toddlers interacting flawlessly this way with other games. If such a young age group could do that, I thought older children should have no problems either. One of my supervisors suggested to change the swiping into a brushing motion, as this would be closer to actually brushing teeth.

Initially, sugar cubes were used to depict the monsters. Because this is not a very common form of sugars in New Zealand, the graphic was replaced with one of a gummy bear. While this kind of candy is not 100% made of sugar, it represents something that is sweet and that tends to stick to the teeth. Hence, the connection to sugar could be made easier. Ideally, such specific and important graphic choices should be made with feedback of the actual user group in mind for a final version of the app.

> ### Relates to Gamification Core Drive 6: Scarcity & Impatience
>
> If players scan enough items, they can unlock mini games. By not making the games available right away, it creates a motivation for the users to play at least until they reach the first mini game. Despite the children not knowing the content of the mini-games in advance, they might still be keen to reach and play them. The factor of not knowing what the games entail, increases the desire to find out even more what the fuss is all about.

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[34] This was also helpful for composing the background music to a fixed length. This will be explained further in a later chapter.

Mini game 1 instructions
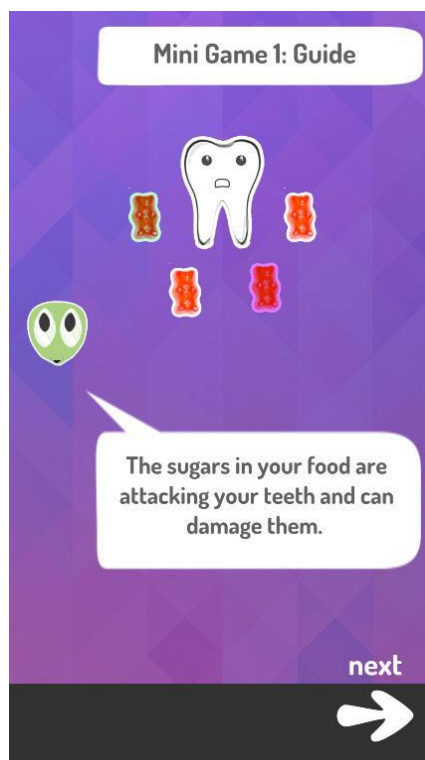
Figure 17. Mini game 1, the first page of the description for the players. Image by the author.

To increase the chance that players with limited/no reading skills could use the app as well, spoken and written descriptions were added for each game. In addition, instructions for all mini games included a simple animation of how a player had to interact with the app (displayed in Figure 17).

Relates to Gamification Core Drive 5: Social Influence & Relatedness

This core was implemented by using a "mentor". The alien of the story "talks" to the user and provides instructions about what to do next. Using a mentoring feature in this way can guide a user and at the same time can also build a connection and trust between the app and the user.

Mini game 2

Figure 18. Mini game 2 - cardiovascular disease and the many names of sugars. From early to final version (from left to right). Image by the author.

The second mini game was about how potential side-effects of sugars can impact the heart (Figure 18). The players have to swipe off the continuously increasing amount sugar cells that attacked the heart. The sugar monsters of the previous game were now digested and therefore appeared in a different form. Depending on how many sugar cells hit the heart, the faster it started to beat. Every time the player destroyed a cell, a point was awarded. In addition, a text and a voice announced one of seven different names for sugar that are commonly used in food products. The idea was to almost nonchalantly introduce these names so the children would subconsciously remember them and somehow felt familiar the next time they heard or read about them. Thus, slowly increasing awareness about the different names as well.

The game was made busier in order to be a little more challenging than the previous mini-game. Also, the resulting increased pressure was meant to symbolize the stress that potential side-effects of sugars (e.g. obesity) can put on the heart. The difficulty of this level was slightly increased by making it a tad faster, having more things happening at the same time and changing the swiping control a little. To give players time to adapt to these changes, the timer was increased.

The "final" prototype included only two mini-games. The amount of levels and mini-games was limited due to two reasons:

- There was the risk that the children were not going to enjoy the app at all. Hence, it did not make sense to build dozens of levels and bonus games without testing the app with the intended target group first.

- The project involved a lot of tasks. Thus, there was not enough time for further extensions.

Mini game 2 instructions
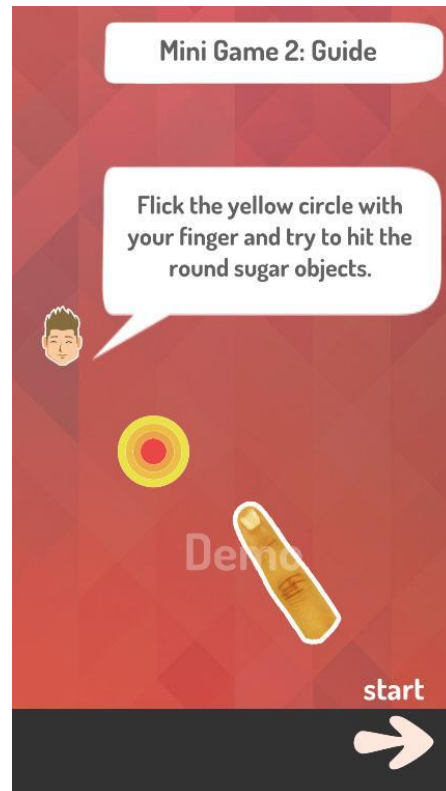
Figure 19. Mini game 2, instruction page for players. Image by the author.

As with mini game one, all instructions for the game were provided in written and spoken format.

Scanning or choosing an item
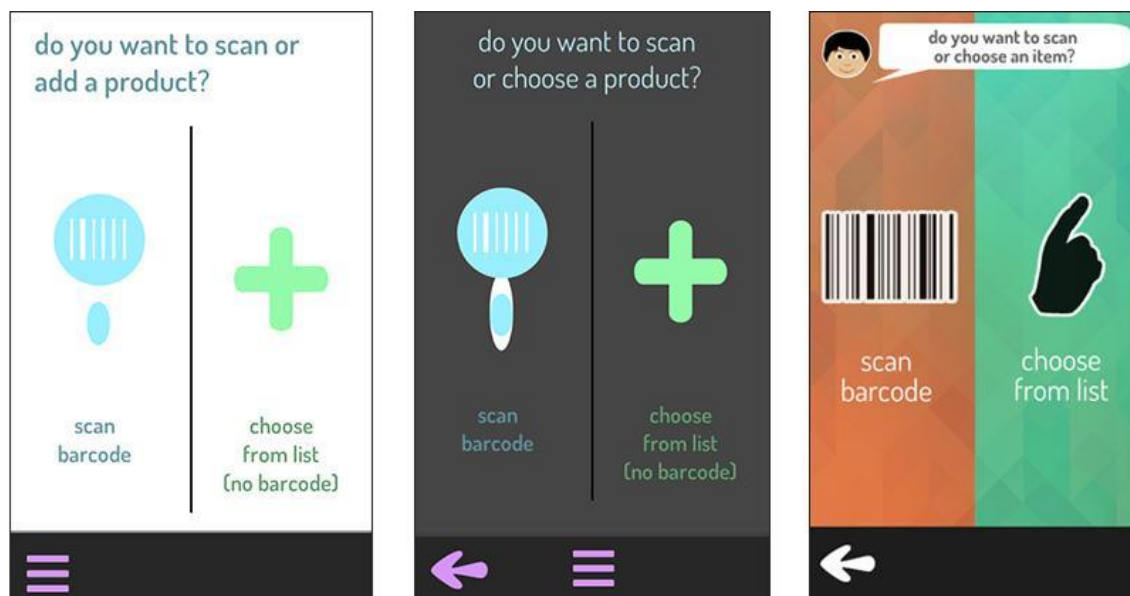
Figure 20. Scanning or choosing screen, from early to final version (from left to right). Image by the author.

As many food products do not come with a barcode, an option had to be added to choose from these items as well. After all, many barcode-free items tend to be healthier than processed and packaged foods (e.g.: vegetables, fruits and nuts[35]). Therefore, it was important to let the users interact with these items too.

Relates to Gamification Core Drive 7: Unpredictability & Curiosity

Although children may be familiar with a lot of food items and packaging, they usually do not know how much sugar is inside of these products. Before scanning an item, the content is unknown to them and the resulting score therefore unpredictable. This situation may stir the curiosity in children to find out how much sugars their favourite snack contains. From there, the search might extend to find better alternatives, which are again unknown and will have to be explored as well.

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[35] Note: Nut-products were not brought to the user study to prevent allergic reactions.

Choosing a product
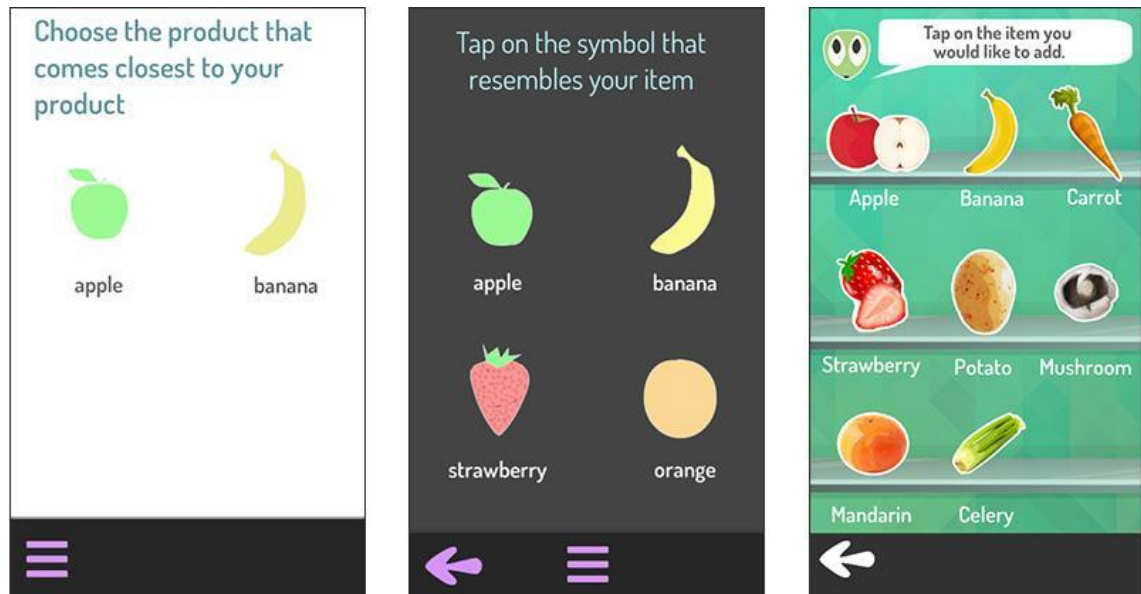
Figure 21. Choosing a product, from early to final version (from left to right). Image by the author.

Including a section with products without barcodes had the advantage that a clearer distinction between healthy fruit and non-healthy fruit items could be made in the back-end of the app. Rather than using a complicated algorithm that could differentiate between a product that contained fruit but was not really fruit (e.g. apple vs. apple juice vs. muesli with apple slices), two separate databases were used. One contained foods with barcodes, the other one items without. This way, real fruit could also be assigned a fruit bonus. Otherwise some items would have resulted in minus points due to their naturally high fruit sugar content. This could potentially lead to users thinking fruits are unhealthy, which was not the goal of the app at all.

As the main feature of the app was the barcode scanner, only a limited selection of items without barcodes were offered.

Scan function
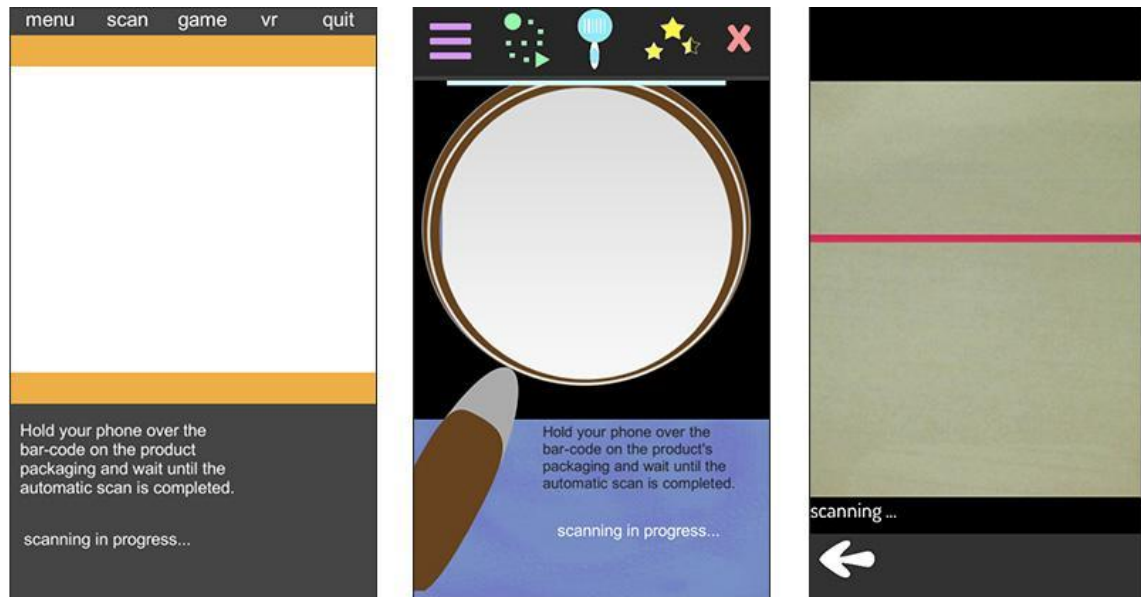
Figure 22. Scan function, from early to final version (left to right). Image by the author.

For the app to be able to identify an item, each product's barcode was entered into a database manually. Since the initial prototype included all nutrition information of labels, the decision was made to keep collecting all of these data for all subsequent versions as well. However, relevant for the final app were the following entries:

- Id (automatically assigned as a unique key)
- Barcode number
- Product name
- Type (food or drink)
- Sugars (total amount)
- Serving size

The barcode feature itself was based on an open source plugIn called Zxing (ZXing.Net, 2017). Rather than trying to build a scanner from scratch, it made sense to use what was already available and alter it so that it worked within the context of this app.

The design of this feature followed to some extent the story of the app. Initially the story was about a treasure hunting adventure but later was changed to a science fiction story about an alien. So, the magnifying glass was replaced by a minimalistic scanner. Eventually, most decorations were removed to keep the screen as clear as possible.
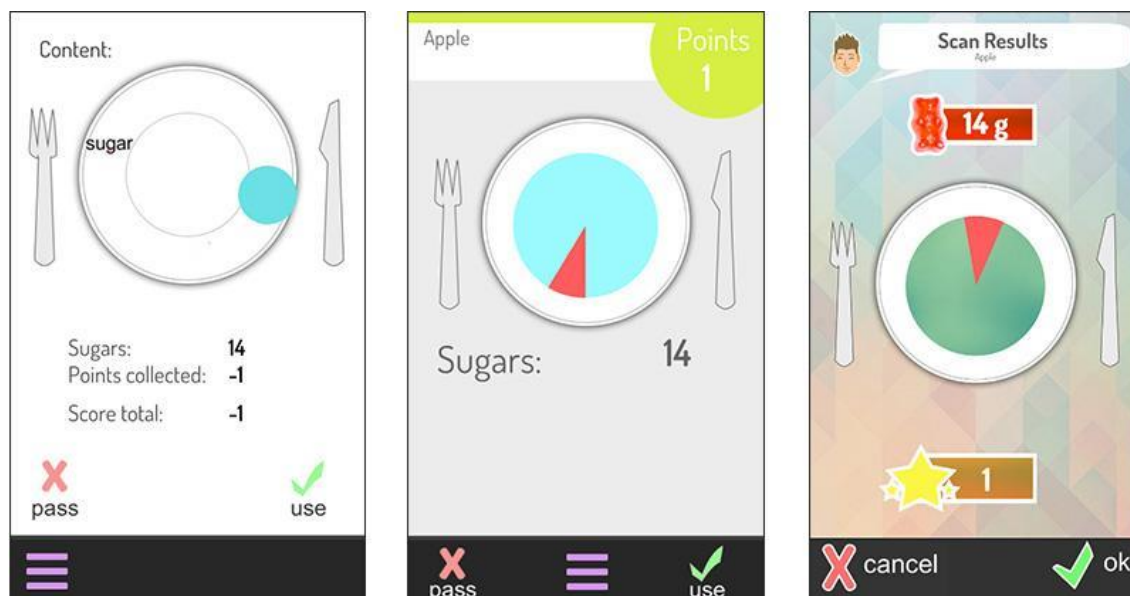
Scan results

Figure 23. Scan results, from early to final version (left to right). Image by the author.

The results screen can arguably be seen as the most important of all. This part of the app decided if the scanned information could be understood by the users or not. It was difficult to avoid the same mistakes the nutrition labels have been making: Displaying too much information. During the design and build process, items were therefore subsequently removed or minimised to keep everything simple and clear. Additionally, the relevant information was displayed in stages and not all at once:

1. **The sugar amount of a scanned item.**
   The actual amount was rounded up or down in order to avoid long numbers. E.g. 8g was easier to read for young children than 7.67g. Also, quantity wise would it not have made a big difference as sugary items often tend to be high in sugar by more than just decimal points.

2. **Depending on food type, either a plate or a glass was used to visualise the percentage of sugars inside the scanned item.**
   This was done to provide another visual alternative to displaying numbers only. The New Zealand government often uses spoons to show how much sugar an item contains (Health Ed, n.d.). Initially the idea was to follow this concept but I decided that it might be too confusing to understand for younger children. Because:
   First: they would need to know how much sugar fits on a teaspoon (e.g. 4 grams).
   Second: they would need to count the spoons that are displayed.
   Third: they would need to multiply the spoons times 4 to figure out how much sugar there was in total.
   Also, if one teaspoon equals to 4 grams, how would the symbol for a spoon look like if

the sugar amount was only 1 gram? Like a short line? Especially on small screens, such a concept may cause some read- and comprehensibility issues and was therefore decided against.
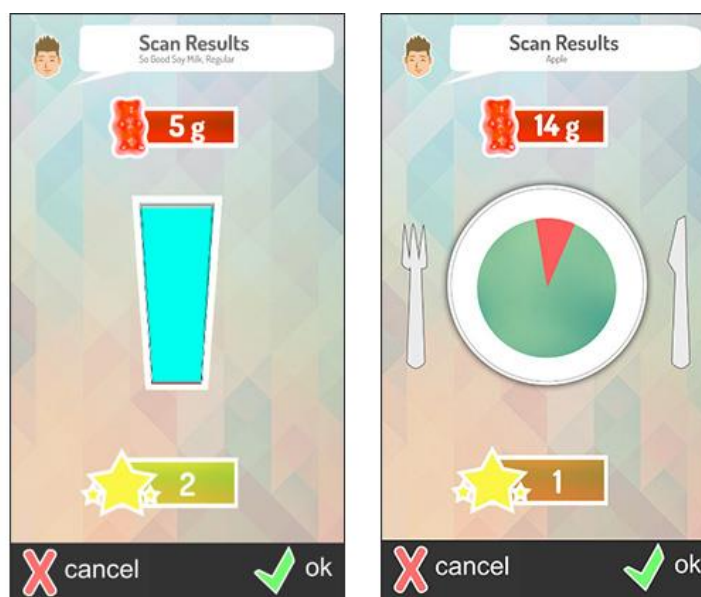

Figure 24. Sugar content of an item is either displayed on a plate or in a glass. Image by the author.

3. The resulting points that could be won or lost if the scanned item was accepted.

The parts above appear one after the other, from top to bottom, guiding the user's eyes through the information. At the end, the option of accepting or declining the scanned item is offered.

The point-system was based on how much sugars were inside of a scanned item. A product was considered high in sugars if the quantity was over 6 grams per serving. Everything over this threshold resulted in minus points (more sugars = less points). Items between 0 and 6 grams were rewarded with 1-3 points. Items with a fruit bonus were awarded another 3 points. This way, certain fruits could still provide points despite containing higher amounts of sugars.

It was a bit tricky to find a balance because a lot of items were close to that 6 grams limit. Using even lower maximums would have resulted in many items being classified as too high in sugars. Potentially, healthy products with naturally occurring sugars (fruits and salads for example) could therefore be seen as unhealthy which was not the intention of this app. A resulting issue with this approach was that certain items received points despite being high in sugars. E.g.: One serving of pure sugars would still award points regardless of its content being made up of 100% sugars. This was possible because the serving size was only 4 grams, hence not reaching the limit of 6 grams to be "punished". A future version of the app would need to take this into consideration and use a formula that calculates the points according sugar content per serving size.

Relates to Gamification Core Drive 3: Empowerment of Creativity & Feedback

The app offers the choice of accepting and declining an item, after the child scanned and discovered the sugar content of a product. In theory, items with a lot of sugars are "bad" and therefore should be declined or not even be scanned in the first place. However, placing the decision in the child's own hands, creates a situation where the child has to go through a number of thought processes (how much sugars is too much? Does the current item have more than the last one or the one laying next to it? How many points can I get with this item?). Eventually the user has to make a decision (do I want to accept it? Or should I try to find another, better item?). No matter how the child decides, it was its own choice and this is what can make the child feel empowered.

Relates to Gamification Core Drive 6: Scarcity & Impatience

This core was implemented by limiting the number of times a scanned item could be used (max. 2 times). This measure made sure that players were not simply scanning the same item over and over again to quickly reach the end or only interact with one product.
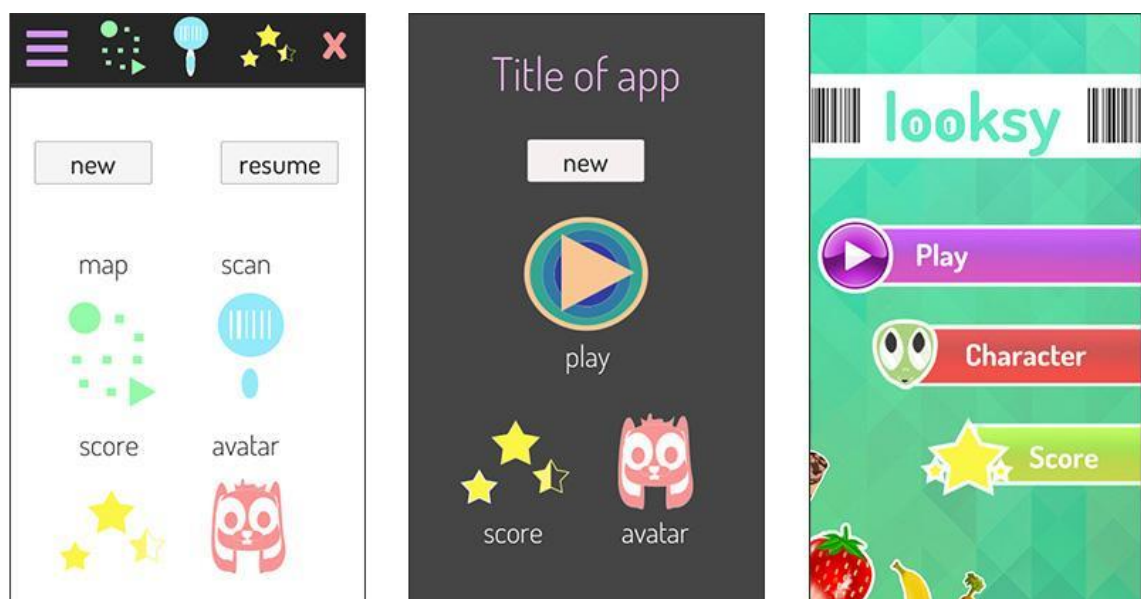
Title screen

Figure 25. Title screen, from early to final version (left to right). Image by the author. Image by the author.

According to Gelman (2014), it is important for young children to be able to quickly access their score and also can choose/change avatars. Therefore, in addition to the play button, shortcuts to the score and the avatar screen were identified as the most critical links and subsequently were put on the title screen for easy reachability.

For the case study however, structural changes were made to prevent the children from getting distracted by the menu at the very beginning. For example, resuming a game made sense if a player stopped playing for the day and then wanted to continue with it on the next morning. But in a case-study setting, such a scenario was not given as the app test would only last around 20 minutes. Consequently, this option was removed.

As for starting a new game, it was undesirable that the children would start a new game on purpose or by accident. Hence, this option was hidden and only visible to me. This way I could restart the app if there was a problem or a student had finished the game and wanted to play again.

Also, there was no score to inspect at the beginning of the user test. Hence, showing all of these options did not make sense. Therefore, instead of beginning with the start screen, the children were directly greeted with the avatar selection. From there, they jumped right into the map and the scanning activities. However, they still could access a reduced start screen throughout the game to check their score or change the avatar.

Score overview
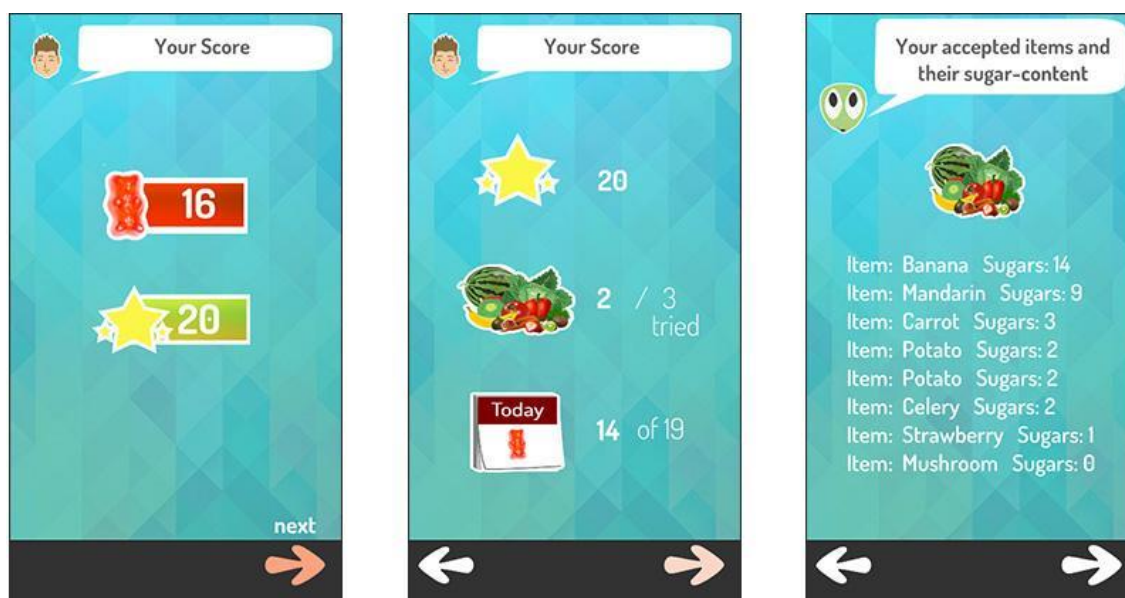
Figure 26. Different types of scores in the game. Image by the author.

Depending on where the score is accessed, a different version of it is displayed:

Image on the left: This very minimal version of score is shown after each mini game. It only shows how many sugar items were destroyed and how many points the player had collected overall.

Image in the middle: This is the score seen when accessing the start menu or at the end of the game. It shows:

- the total score,
- the amount of accepted and scanned items in total
- The amount of accepted sugars

Image on the right: At the end of the game, all accepted items are listed again (ordered according sugar content).

> **Relates to Gamification Core Drive 5: Social Influence & Relatedness**
>
> This core was implemented by adding competition elements, which required some caution as children competing against each other can result in the losers being mocked and bullied. Especially since the app is about health, low scores could be associated with overweight or being poor (too poor to buy healthy food). However, competition can be positive and can cause children to scan and explore more items, which would not only result in higher scores but also in (hopefully) more knowledge about food.

3.1.4 The role of sound in the app

Since the app of this project may be played at a school or even a supermarket, it was important to be aware of immediate surroundings. Almost everyone has experienced a situation where other people played with their phones in public places, creating a lot of noise with the volume of their phones fully cranked up. Because such scenario could potentially happen with the app of this project, I almost did not want to include any sounds at all. However, research and staff at the collaborating school stressed how much children love sounds in such activities and how it can help to attract and motivate them. Hence, the decision was made to include a variety of sounds in the app (music, effects and spoken instructions).

As explained in a previous chapter, for a gamified experience to feel complete, it ideally affects a user in many ways. Sound has the ability to create emotion, set an atmosphere or simply can be used to give aural feedback to a user's input (Changizi, 2009). There is however the dilemma that sounds can be very distractive and repeatedly played can quickly make someone feel annoyed or nervous. Therefore, it needs to be used very carefully and placed where it really is useful or necessary. After all, the goal of sound/ music is to support or intensify the movie/game and not to distract from it. Unless of course the intended purpose of the whole experience is indeed to create music or a lot of noise.

The composition[36] process was heavily influenced by the goal and story of the app. At an early stage, the concept was about sending kids on a hunt for points and treasures. This prompted the idea to compose a short theme song that could invoke a feeling of excitement, sunshine and adventure to attract the children's attention. While often the music in apps gets muted after it was heard a few times, a theme song can sometimes stay in our mind for a very long time and can be identified instantly. When we look at the app theme songs of Angry Birds or Peppa Pig for example, it can be noticed that they both sound very "positive" (happy) and are not overly complicated. They both also make use of "quirky" sounds (the flute at the beginning in Angry Birds or the whistling in the Peppa Pig shopping app). This creates a happy mood and also makes these app songs (and with it the app) stand out from the others.

A short theme song for this app was created that tried to invoke memories of sunshine and happiness. A (sampled) accordion was used as the lead instrument to feature a "quirky" sound element as mentioned earlier.

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[36] Software used: Cubase 8 Pro (Steinberg, n.d.) and Komplete 10 (Native Instruments, n.d.) to compose the music, Audacity (Audacity, n.d.) to manipulate the spoken instructions and effects, Voice Record Pro to record my voice for the sound effects and instructions (https://itunes.apple.com/ca/app/voice-record-pro/id546983235?mt=8).

[Link] To listen to both draft versions of the theme music please click this link
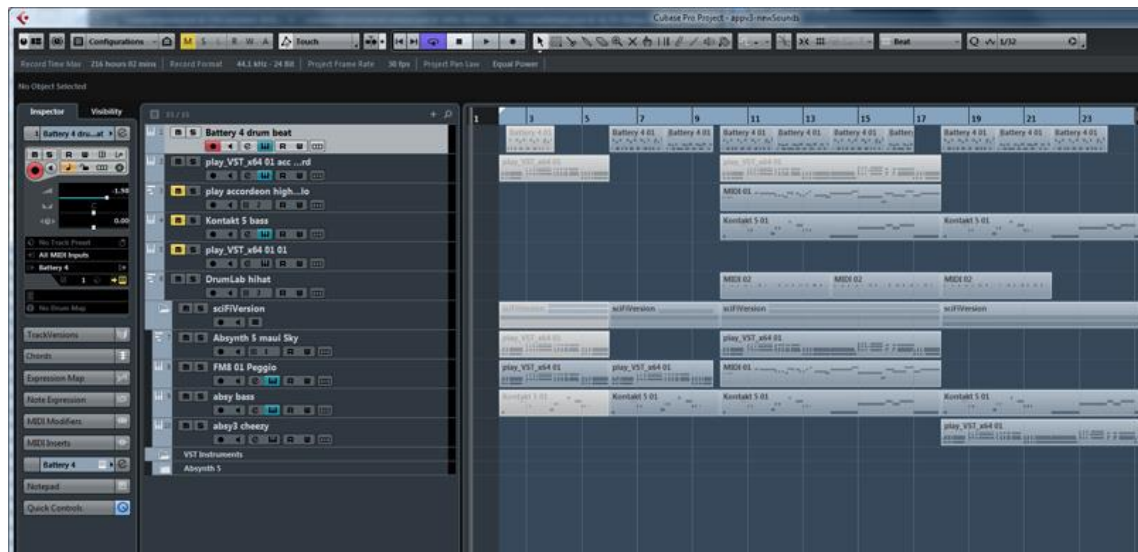https://youtu.be/L2ZIwljzMTk

Figure 27. Example of theme music composition draft in Cubase. Image by the author.

Once the story of the game changed from hunting treasures to helping an alien, the sounds had to change as well. Acoustic instruments were replaced with synthesizers to make the sound more "sci-fi" like. Due to factors discussed in the following section, the work on the theme song was halted and the focused was placed on other sounds that seemed more important.

Important factors to identify

- **Which parts of the game needed or could benefit from music and sound effects?**
  Since a player is required to jump between different game-scenes rather quickly, it did not make much sense to either use music that started new in every scene or kept playing throughout different scenes. This would have caused different sounds to overlap and ending up confusing and irritating the player. Also, this would have required a lot of music to fill out the game for as long it took a user to play through it. Alternatively, loops could have been used, which again would have resulted in an annoying and repetitive game experience.
  Therefore, the decision was made to only use music for scenes that had a fixed time to be completed and could not be skipped. This allowed the music composition process to follow clear guidelines and limitations. For example, mini game number two lasted exactly 45 seconds. The task of the music in this case was to reflect a) the pressure caused by the countdown and b) to musically symbolise the ever-increasing amount of sugars appearing on the screen. All of that without distracting the player from the events going on in the app. It took several attempts to find the right balance and eventually the musical composition was minimised and played at a low volume level (while still being audible enough). The first few drafts were also sounding a bit too scary or noisy and could have made users feel stressed and uncomfortable. As a result, the final version

was tweaked again to give a more positive and uplifting feel.

[Link] Three musical ideas for the app can be listened to by following this link
https://youtu.be/cs9jKA0Tr2g

- **How many times did the sounds occur in the app?**
  Certain tasks like pushing buttons are part of every scene and every action of the game. Multiple tests with different kinds of sounds (short or medium length, melodic and single tones) showed quickly that the frequent use of these buttons became incredibly annoying. Also, did they slow down the progressing of the game because each scene had to wait until the pressed button's sound finished playing. This would have worn out a player's patience and could have had a negative impact on the whole experience. The only sound effect kept in the end was the noise for the barcode scan function. It helped to amplify the impression that the phone was indeed scanning for something. Also did it help to make the scan scene appear different than the standard "take picture/video" function on a phone.

- **What is the hierarchy of the sounds?** (if multiple sounds were present in one scene). This aspect became especially important once the decision was made to use spoken descriptions for each scene and task in the game. It was likely that not all children could read the written instructions. In such a case, the audio guide became like a lifeline for these players and under no circumstance could this orientation guide get obscured by sounds or music.
  The end hierarchy therefore was as follows: Spoken instructions > sound effects > music.

3.1.5 The story

An alien called Looksy was flying around the universe, when it suddenly ran out of food. It had to make an emergency landing on planet earth and is now asking the player for help. The alien needs foods that are low in sugars to survive. It can only fly back home once the player has collected enough supplies of suitable food items.

While the story and its character are imagined, the items that a player has to scan are real. Items that a player might be eating every day. Therefore, this "hybrid" situation could create motivation for the player to a) help out the alien and b) explore products that he/she never inspected in detail bevor.

Initially the story was more like an extended version of a task: Find treasure and collect points. This was not very exciting sounding and also gamification wise not very convincing. Why should a child do that? Although children of the target group are said to enjoy collecting items just for

the sake of it, this factor alone would not have been able to create enough motivation for a child to interact with the app for a prolonged time. Therefore, a more convincing story had to be created to draw potential users in and keep them invested until they fulfilled their mission.

Relates to Gamification Core Drive 8: Loss & Avoidance

Considering that the app is a limited prototype, there is not too much to lose or avoid for a player. Of course, the main reason for the app is to improve health, or in the case of young children, to stay healthy. So there is a precious "state" that needs to be protected.

In addition to the health aspect, there is also the story, which could encourage children to keep playing and not giving up. Because if they stopped, the alien would never be able to fly home but it was their job to try and make this possible.

Relates to Gamification Core Drive 1: Epic Meaning & Calling

This core was implemented through motivating children to "become" invested in the concept by

- asking them to help an alien to fly back to its home planet (using a narrative to "draw" the kids in).
- improving or saving their own health through learning about potential health issues (now or in the future).

3.1.6 The name of the app

The name "Looksy" is based on the word "look-see" or "looksie". The meaning is defined as:

"a visual inspection or survey; look; examination" (Dictionary.com, n.d.)

Since the aim of this app is to "examine" food products and "look" through tricky marketing attempts, I found that this word was a perfect way to summarise the key points of this project. It also sounds more child friendly than "inspection" or "examination". Turning "look-see" into "Looksy" made it appear more like a cute name, especially for an alien character.

3.2 Case study

Designing an app for kids from the viewpoint of an adult is prone to wrong assumptions and misunderstandings. While I was able to base my decisions on research related to children and on my own experiences as a child, the intended target group may still not react in ways that were predicted. It also needs to be taken into consideration that children in the recent years have been growing up vastly differently than the generations before them. Exposed to technology almost from birth, these digital natives (Prensky, 2001) may be more tech savvy than the children who participated in some of the studies or guidelines mentioned in this thesis. Therefore, the only way to truly find out if my concept could work in a real-world scenario, was to let the intended target audience test it out by themselves.

As not all schools or parents believe that electronic devices should be used to teach children, I felt that it was necessary to collaborate with a school that was open to new approaches and supported learning through experimentation. Working with a different school or setting could therefore result in different findings.

In addition, this case study also served to give insight into the knowledge of young children in regards of sugars in food and how they interact with the developed app.

The case study itself required its own set of research methods and based on literature, a mixed approach was chosen (Hershman,2017). The following approaches were used

- Questionnaire (qualitative and quantitative)
- Card sorting exercise (qualitative)
- Testing the app (performative, qualitative and quantitative)
- Feedback session (qualitative and quantitative)

In-depth information about each of the methods can be found in the following chapters.

3.2.1 Research and children

Children's' answers tend to be influenced by several factors and may produce skewed results. From the location, to the study's environment, the people being present, the chosen materials, the way questions were formed, there were multiple aspects to weigh-up against each other when it came to design a study for this age group (Borgers, de Leeuw, & Hox, 2000).

The following sections will provide a brief overview of the different aspects that were considered when preparing the research with children. Since the case study was only one part of many in this project, it was unfortunately not possible to evaluate and include a wider range of information in the available time.

3.2.2 Choosing an appropriate age group

One difficulty about designing a product for children is that they all develop differently. Some faster or later than others. Even within the same age-group, big gaps can occur. Therefore, it might be unwise to develop one single app and hope that all children, from toddler to teen, interacted with it the same way or took away the same learning experience (Gelman, 2014). Researchers, designers and developers decided to create different age categories in order to understand and address this existing diversity. Also, app stores have implemented similar categories so their catalogue can easily be filtered according target/ age group. [37]

For example:

Apple:

- 5 and under,
- 6–8, or
- 9–11 (Apple Developer, n.d.)

Google:

- 5 and under,
- 6-8, or
- 9 and older (Google Play Store, 2017).

Children's development

Jean Piaget, one of the most well-known and cited Psychologists when it comes to children's development, created the following sequential stages (Piaget, 1964; Psychology Notes HQ, 2017):

1. 0-2 years, Sensorimotor Stage
2. 2-7 years, Preoperational Stage
3. 7-11 years, Concrete Operational Stage
4. 11+ years, Formal Operations Stage

Some of these ranges are also divided into substages (Borgers, de Leeuw, & Hox, 2000), which partly overlap with the age groups used in app stores:

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[37] Using these classifications for an officially released app comes with restrictions like not using in-game payment options or links that lead out of the app (Apple Developer, n.d.). The app developed in this project follows these conditions but because an official release is not the aim of this project (at this stage), this thesis will not focus on aspects like app store guidelines etc.

1. 0-2 years, Sensory-motor intelligence Stage
2. 2-4 years, Preconceptual thought Stage
3. 4-8 years, Intuitive thought Stage
4. 8-11 years, Concrete operations Stage
5. 11-16 years, Formal thought Stage
   16 years, Cognitive stages completed

As mentioned, children do not develop exactly the same and therefore do not follow Piaget's stages precisely (Borgers, de Leeuw, & Hox, 2000). However, these phases can give some rough indications regarding an age at which children are most suitable to be exposed to a project like the one in this master thesis.

Stages 1 and 2 (0-4 years olds) appear to be too early for children to properly interact with the topic of this project. Relatively "simple" tasks like answering questions or holding the smartphone (steady enough to scan the barcode) may be very difficult at this age. Even if they could do all the tasks, they may not be able to understand the purpose of them and the learning effect would be very low. Also, evaluating the collected data may not reveal clear or useful results. These aspects minimise the suitability of this age range as target group.

Stages 4 and 5 (8-16 year olds). Children at this age are likely able to answer all questions, handle most tasks (Gelman, 2014) and understand consequences of their actions and decisions but they already might be too "shaped" by life. They have developed certain behaviours and preferences that would be difficult to change or give up. In other words, these age groups may not be ideal as a target group.

Stage 3(4-8). This stage appears to be better suited because children at this age are old (or developed) enough to understand simple logic and are very curios. At the same, time they are not already too "fixed" in their behaviour or preferences.

Considering that most children in New Zealand start primary school at the age of 5 (officially at the age of 6), it would make sense to divide this age group further to make sure that at least some basic reading and writing skills are present (Ministry of Education, 2017). This is not only helpful for reading and answering questionnaires but also essential to understand instructions and results confronted with while playing the app.

McGee & d'Ardenne (2009, p17) reviewed multiple studies about how to do research with children and found that it is generally suggested that: "Children as young as 7 can take part in survey research but the research must be tailored to their specific needs and be as flexible as possible". For other research methods (like observation or drawing) children under 6 could participate as well (Lobe, Livingstone, Ólafsson, & Simões, 2008). McGee & d'Ardenne (2009) also state that younger kids are prone to influences and that from the age of 7, they start to understand how to give answers that make them look good, rather than reflect the truth. In other

words, if participants are too young, their answers may not be "pure" or are difficult to understand. If the children are too old, they may be too clever and provide information that may not be accurate.

To make a final decision, more advice was needed and eventually found in a book called "design for kids - digital products for playing and learning". According Debra Levin Gelman (2014), the author of the book, kids behave very differently depending on their age. Gelman suggests that because their attitudes change in roughly two-year cycles, it is important to design very specific experiences for these periods. According her, kids aged between 6-8 tend to

- Be more focused (than younger kids)
- Prefer following steps and instructions (rather than jumping right in like older kids)
- Love to collect items and points (which is great for an app about finding and collecting points)
- Work well in groups

Gelman (2014) also suggests that this age group would be suitable for introducing gamification elements to.

To summarise: With all the research in mind (including personal experiences as a parent), the age group of 6-8 year old children appears to be the ideal demographic for the intended app and case study.

All the age groups come with age specific difficulties and need appropriate attention in several areas. The following sections in this thesis will look at these areas in more detail and explain what measurements were chosen to address potential issues.

3.2.3 Choosing the setting

1:1

In a one on one session, unwanted influences can be minimised. But, such a setting can put a participant in a very uncomfortable situation. Answering the questions of a stranger can be awkward. Also, parents may feel very uneasy knowing their child will be alone with a stranger. Time wise, this option would take a lot longer than doing a study with a group of children.

Working with the child + parent/guardian present (but not directly involved)

In this setting, children may be more relaxed and therefore more willing to answer the questions. However, the chances are that the parent might interfere or even answer the questions for the child (ESOMAR, 2009).

Working with the parent, not the child

In this option, parents are asked instead of the children. In theory, parents know their kids very well, so this process should be straightforward. Unfortunately, several studies found that what parents believed to be true about their child's opinions and behaviour were not always accurate (Lobe, Livingstone, Ólafsson, & Simões, 2008).

Asking the parent about the child and the child as well

As in the previous option, the answer of the parent and the child may turn out to be the complete opposite. It also would almost double the required time to execute and analyse the study and the collected data.

Working with the child + teacher present (not directly involved)

Having a teacher present can make a child feel more comfortable as it is familiar with at least one of the people being around at the study. Kids may also feel more comfortable to ask the teacher for help, instead of the researcher. However, it also introduces another aspect of influence (Lobe, Livingstone, Ólafsson, & Simões, 2008): Unintentionally, a teacher may trigger a reaction by how she/he looks at a participant, by using encouraging words or giving hints if a child seems unsure about a question.

Working with a group

In this setting, children may feel less singled out. They also can find comfort in their classmates and therefore may undergo less stress (Lobe, Livingstone, Ólafsson, & Simões, 2008). The downside is that the children could influence each other or copy each other's answers (McGee & d'Ardenne, 2009). Of course, they also could feel intimidated if grouped with kids that they do not get along well. On the plus side, researching the children in groups would save a lot of time.

Decision

Based on the above research and advice by one of the staff members of the collaborating school, the decision was made to form groups of maximum 6 children each. In addition, one teacher of the school should be present as well. This way, the children are not put in an unknown situation with an unfamiliar researcher alone and hopefully feel more relaxed and open to share their opinions and questions (Mabelis, n.d.). Also, this setting can help to facilitate a group better (McGee & d'Ardenne, 2009).

3.2.4 Choosing a location

As children are susceptible to distraction and influence, the location can play an important part in a study. Luckily the collaborating school did have an extra space available, so the decision was made to let the case study take place in there. This way, the participating group could focus completely on the study's tasks and would not get distracted by other students, devices or objects that are present in the normal classroom.

Choosing the school as a location made a lot of sense because:

- it is a place the children are familiar with
- classmates and teachers are there to make them feel safe
- parents generally have trust in this location and do not need to worry about their child being brought to an "unknown" location
- no additional transport of students or materials is required

3.2.5 Choosing the approach

Considering that children tend to have short attention spans, get bored quickly, and have limited reading and writing skills (McGee & d'Ardenne, 2009), the decision was made to create multiple short and simple tasks go gather qualitative and quantitative data.

Part 1.1 Questionnaire (qualitative and quantitative)

A questionnaire was created with 16 multiple choice questions. The questions and answers were meant to be read aloud to increase the chance that also the younger kids with limited language skills can comprehend the questions and respond as accurately as possible.

The questions were spread out over three differently coloured pages to

a) not overwhelm the children with too much text per page (bore or frustrate them),
b) minimise the chance of accidently ticking the wrong answer-boxes
c) make the process more child friendly and less "strict" (using colours and decorations)
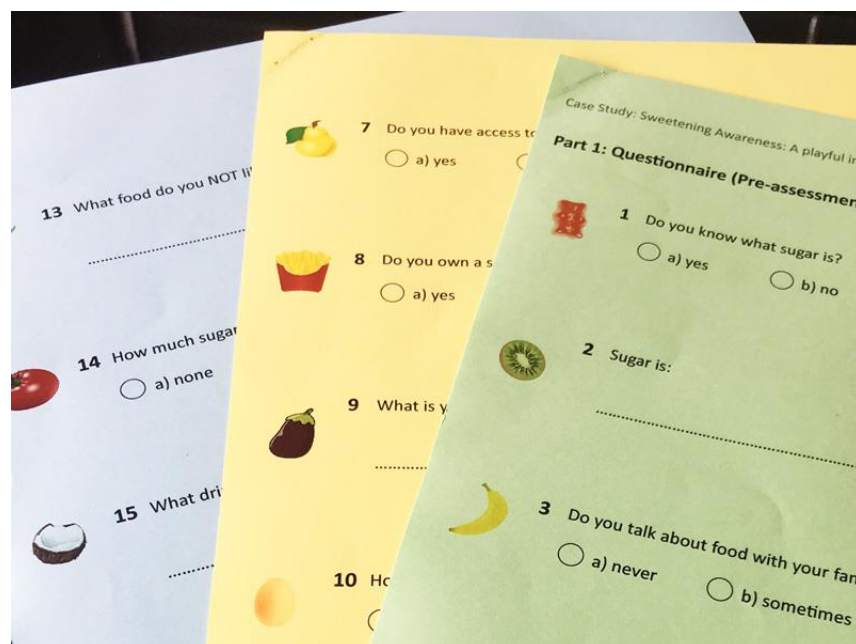

Figure 28. Questionnaire used in part one of the case study. Image by the author.

The aim of the questionnaire was to act as a pre-assessment which could provide insight into the children's knowledge about sugars before exposing them to the app. In a very limited way, it also tried to shine some light on how and why the health situation in this country has arrived at where it is now (sugar related diseases increasing). This was done by including a few questions about food, sugars and shopping within the participant's family environment.

Lastly, the questionnaire also sought to learn whether the participants had access to or owned a mobile device (e.g. smartphone or tablet). This was done to

a) see if the intended target group actually had the possibility to use the proposed app outside of a school environment.
b) to compare the results of these participants with other numbers found in the initial research (about kids and access to mobile devices).

Part 1.2 Card sorting exercise (qualitative)

To break up the rather dry question and answer scenario a bit, another form of exercise was chosen to gather information. Four card sets were created that depict different kinds of foods and drinks that need to be sorted by the participants according sugar content. By putting away the pens for a moment and letting the participants interact with colourful images, the idea was to again reduce the kids' potential feeling of sitting an exam and in turn make them feel relaxed and interested (Lobe, Livingstone, Ólafsson, & Simões, 2008).

The goal behind this exercise was to learn whether the children knew which items contained more sugars than others (assessing knowledge).
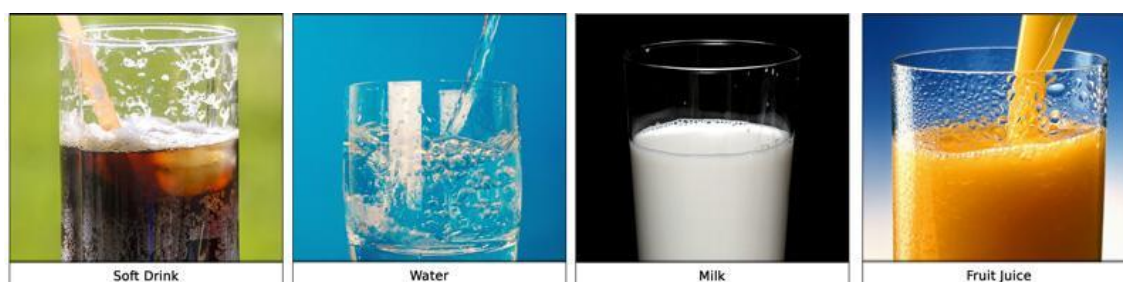

Figure 29. Example of one of the card sets. Image by the author and pixabay.com, used under Creative Commons License Zero.

Part 2: Testing the app (performative, qualitative and quantitative)

For this task, the idea was to let the participants focus completely on the app without having to worry about answering questions or doing very specific tasks. A data logging feature was implemented into the app that could store the decisions made by the participants in the background (consent and assent were given by the parents and participants).
Walking around and scanning items provided an opportunity for the children to revitalise themselves a bit after sitting still during the first part of the study.

The aim of using the tracking feature was to learn whether the app's way of visualising the sugar content could make any impact on the children's item selection process during the test-runs.

Also, the intent was to link back the results to the answers given in the pre-assessment to see whether some kind of learning process took place.

In addition, an observation protocol was prepared to analyse potential

- emerging patterns (e.g. which items were declined/accepted, did the children discuss certain items, etc.),
- usability of app and issues (e.g. was the barcode scan feature working? Did participants get stuck?)
- motivation (e.g. were kids asking to play another round or did they get bored?)

Food items

Around 100 different items with barcodes and 8 products without[38], were collected and prepared. Some of the food choices were based on discussions that took place with the school in advance to make sure ethical considerations were respected.

A wide range of products was included with the intent to cover items that are often used for the following meal times:

- breakfast
- morning/ afternoon tea
- lunch /dinner
- drinks

I tried to make sure that multiple diets were covered (e.g. omnivore, vegetarian and vegan), which are also of importance for cultural and religious reasons. In addition, options within different categories were provided as well. As an example, milk types included: cow's milk, soy milk, oat milk, almond milk and coconut milk. Also, subgroups like regular, organic, lite, etc., were made available too.

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[38] The available screen estate in the app for these food types only allowed space for 9 items. If fully utilised, it may have implied that there were even more items that could be reached by swiping the screen to one side. Using 8 products and an empty space suggested that these items were the only possible choices.
All the barcode-free items were placed together away from the other items with barcodes.

However, for a future study, it might make sense to either

- provide a smaller range of items so the participants can focus better or
- ask participants to bring some of their own products to the case study that they often use. This would make sure that they interacted with objects they really use at home.

Part 3.1: Feedback session (qualitative and quantitative)

For this part, another questionnaire was created. Once more, to make sure that everything was understood by the children, the questions and answers were designed to be read aloud. This time, some open questions were included so the participants could write down their opinions rather than just ticking boxes.

This exercise was done to find out what the kids thought about their experience with the app. E.g. what did they like, what would they change, would they recommend it to friends, etc. The goal was basically to establish whether the app had the potential to be used by the intended target group or not.

Figure 30. Questionnaire to gather feedback about the app. Image by the author and pixabay.com, used under Creative Commons License Zero.

Part 3.2: Drawing exercise

To keep up the participants' patience and motivation, the last part of the study was designed to gather feedback in yet another form. Because especially at this age, children may not be able to express themselves well enough in written form (Lobe, Livingstone, Ólafsson, & Simões, 2008). Therefore, the idea was to let participants draw their ideas and suggestions on a big piece of paper, and thus providing an alternative way of sharing their feedback.
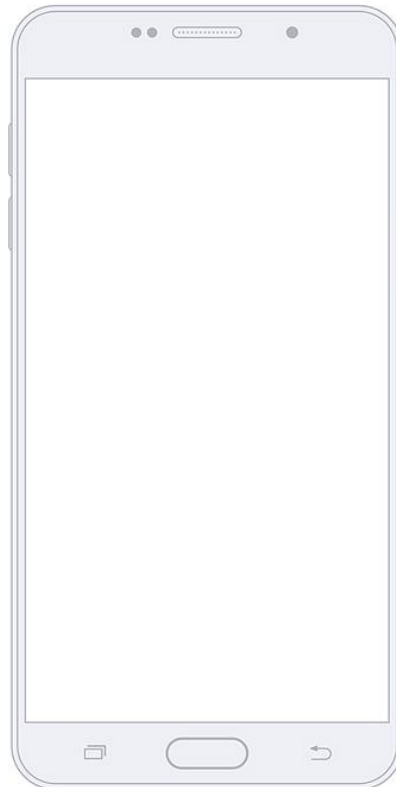
Figure 31. Template for students to draw on. Adapted from "GalaxyNote5-Portrait-Standard-x2", by Wilson, M. http://sketchsheets.com/. Used under Creative Commons License 4.0, *https://creativecommons.org/licenses/by/4.0/legalcode*

Overall this may seem like a lot of tasks and resulting data. However, the goal was not to simply compile as much information as possible. It just felt necessary to assess such a complex topic from many different angles in order to not only gather the "numbers" but also to understand the "how and why" these numbers turned out this way. Furthermore, it was very challenging to create exercises that could gather useful information and at the same time were still fun for the children so they did not lose their motivation quickly.

3.2.6 Case study - overview

Police Vetting

Before being legally allowed to work with children in New Zealand, police vetting had to be applied for. This was kindly carried out by the collaborating school.

Recruitment process

The parents and guardians of potential participants were invited to a presentation about the case study. This allowed them to familiarise themselves with the topic and the researcher. It also offered an opportunity to ask questions or voice concerns directly.

Figure 32. Presentation at the collaborating school for the parents of potential participants. Photo by the author.

A briefing-pack was provided for each child and contained:

- detailed information about the case study,
- assent form for the children, to be signed by the parents/guardians,
- consent form for the parents,
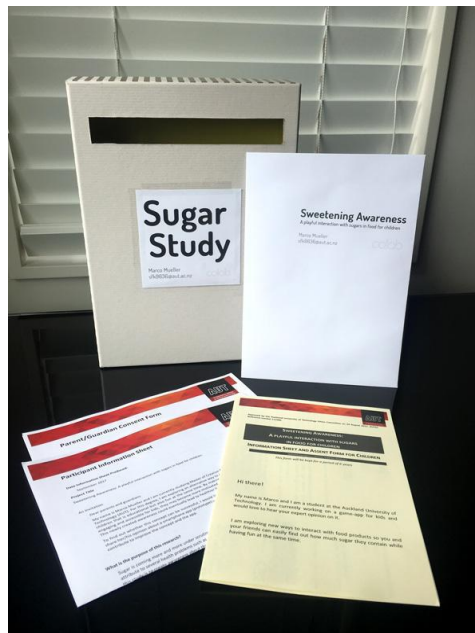
Figure 33. Info pack for students and parents. Photo by the author.

Signed consent and assent forms had to be returned for a child to be allowed to participate in this case study.

Participants attending the case study

Number of participants: 10, divided into 2 groups of 5 children.

Age of participants: 6-8 years old.

Gender: All male[39]

Cultural considerations

To make sure that the case study was culturally appropriate, the questions, tasks and materials used were discussed with and approved by the school in advance.

Structure

Apart from providing a short introduction and explaining each task and goal, I tried to hold myself back as much as possible in order to minimise influencing the children.

1. Short intro to each group
2. Pre-assessment (questionnaire + card sorting exercise)
3. App test (observation + tracking log of participants' decisions)

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[39] The gender of the participants was not a specific requirement or focus. It just happened to be that the kids in the desired age-group (and present for the study) were boys.

4. Feedback session (questionnaire + idea drawing exercise)

Figure 34. Food and drink products arranged for the case study. Photo by the author.

Throughout the study, the children were allowed (and encouraged) to ask questions at any time to make sure that they understood everything.

Adults present

- One teacher of the school was present for both groups and assisted with answering questions.
- Student researcher (myself)

Duration

60-70 minutes per group.

This was a bit longer than planned but during the case study it quickly became apparent that more time was needed – not necessarily because the children seemed to struggle with the tasks but because they were happy to discuss and ask a lot of things. Since this created a more relaxed and open atmosphere, I allowed it to happen within reason.

Used smartphones

Each participant was given one device.

The devices (Moto G5, 1.4 GHz octa-core processor, Full HD display, 2GB RAM, 13-megapixel camera with auto-focus) were kindly provided by Colab, AUT, for the duration of the case study.

Therefore, no information had to be stored on or retrieved from a participant's personal device, which eliminated potential privacy breaches.

4 Results and Findings

4.1 Results: Questionnaire

1. Do you know what sugar is?

8 out of 10 answered with yes.

2. Sugar is:

There was a wide range of answers which could be grouped into the following categories:

Sugars were seen as something:	Number of similar answers given
unhealthy	*3*
sweet	*2*
we eat too much of sometimes	*1*
that is present in every food	*1*
that can be good or bad, depending on the food type (e.g. fruit = good)	*1*
1 participant decided not to answer this question. 1 participant's answer was difficult to interpret ("0 because it is fruit").	

Table 2. Participants' answers to question 2.

The answers in Table 2 suggest that the kids did not seem to know what sugar is per se (e.g. sweetener derived from cane or beet root, providing a form of energy to the body) but many knew about its potential side-effects (causing bad health).

3. Do you talk about food with your family at home?
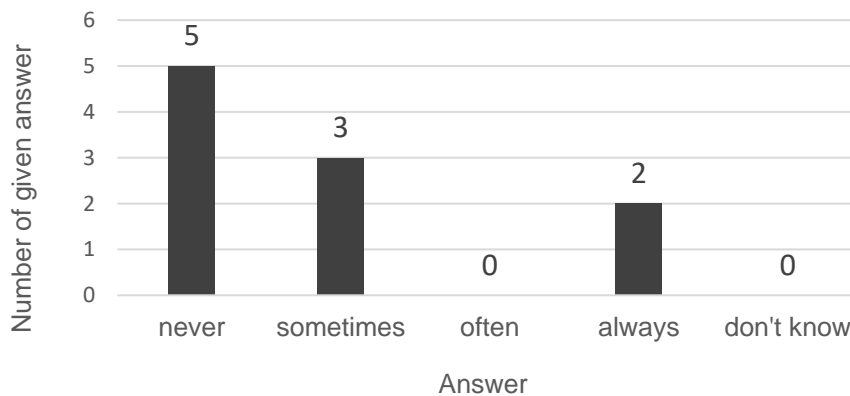
Figure 35. Bar chart showing the results of question number 3 of the questionnaire.

As seen in Figure 35, half of the students never talk about food at home. The rest on the other hand did (either sometimes or always).

4. Do you talk about sugars with your family?
The majority did either never talk about it or did "not know". The answers of question 3 and 4 show that nutrition is not a topic that is discussed widely at home.

5. Do you go together with your parents to buy food?
All children join their parents/guardians for this activity to some extent (always, often or sometimes). This means, children could theoretically use the proposed app and interact with actual food products while shopping.
Unfortunately, it also implies that despite being (somehow) involved in the food buying process, only limited discussions about nutrition seem to be taking place (according to previous answers).

6. If you ask your parents to buy a certain kind of food, will they do it?
The majority of children answered this question with yes (sometimes, often or always). This shows that children indeed have the ability to influence their parents' food choices to some degree. Theoretically, once children created awareness through the app, they could convince the parents to buy food that contains less sugar.

7. Do you have access to a smartphone or tablet at home?
Most participants had access to a mobile device. One student did not know.

8. Do you own a smartphone or a tablet?
The majority of kids does. This is good to know because it shows that children could use the app either with their own device or use someone else's.

The results are also on par with international findings that were discussed in a previous chapter.

9. What is your favourite food?

Most children stated that fruits were their favourite food (e.g. apples, cherries, etc.). Only 3 of the answers could be considered as unhealthy choices (chocolate, cheese burger and lollies).

10. How much sugar do you think is inside of your favourite food?

<u>All</u> children who provided fruit as their answer in the previous question thought that their choice included <u>no sugar</u>. This implies that children believe that healthy food does not contain sugar. Participants who chose sugary products as their answer were more aware of the sugar content and thought their choice either contained an ok amount or a lot of sugar.

11. What is your favourite drink?

Except for one child who chose water, everyone else answered with a type of soft drink (Fanta, Cola) or fruit juice.

The result could imply that the children like their favourite drink because of its sweetness (high sugar content in it).

12. How much sugar do you think is inside of your favourite drink?

Unlike in the previous question, children were more aware of the high sugar content of soft drinks and answered accordingly (mainly with "a lot of sugar"). But not all. Coke was believed to be containing only a little bit of sugars.

Note: Since the children did not specifically mention whether their choice was a diet or the original version, the latter was used.

13. What food do you NOT like?

The majority of answers included products low in sugars. With half of them being vegetables (tomatoes, mushrooms and onions). But also products like chocolate and tomato sauce were given as answers.

14. How much sugar do you think is inside of that food?

Some students thought that vegetables did not contain sugars, which is a very similar assumption like that fruits did not have sugar in them. In general, the children seem to understand that vegies were low in sugar and items like chocolate were high.

15. What drink do you NOT like?

From milk and water to fizzy drinks, there was a wide range of answers. This makes it difficult to conclude that only drinks low in sugar were disliked.

16. How much sugar do you think is inside of that drink?

The answers showed that in general, the kids knew which drinks contained sugars. Just the amount seemed not to be clear. E.g. Soft-drinks were again understood as to contain an ok amount of sugars.

4.2 Results: Card sorting exercise

Set 1, Breakfast:

4 popular breakfast cereals were depicted: Weet-Bix, Cornflakes, Rice Bubbles, and Buds.

The results were very mixed. The only constant was that Weet-Bix was mostly considered to be the item with the lowest amount of sugar. Which was correct.
To be fair, except for Buds, the other products were all similar in their sugar levels. Also were not all children familiar with each product, which made it difficult to know the correct order.

Set 2, Morning or Afternoon Tea:

The 4 depicted snacks were: Cracker, carrot, muesli bar and apple

Without exception, the carrot and apple were considered to be the items low in sugars, while the cracker and muesli bar were seen as items high in sugar.
Again, it appears that there is a common believe that healthy items do not contain sugars or only very low amounts of them. Which is true for the carrot but certainly is not for the apple. At the same time a cracker, which had the lowest amount of sugars in this group of foods, was considered as high in sugar.

Set 3, Lunch or Dinner:

The 4 cards depicted: Salad, ("frozen") pizza, sandwich and Happy Meal

Most participants chose the salad as the item with the lowest amount of sugar and the Happy Meal as the one with the highest. The sandwich was chosen as the second lowest item in sugar.

Note: Sugar levels can greatly differ depending on the topping or ingredient chosen to make up the food. In the case of the Happy Meal, it was explained that it contained the small versions of a hamburger, the fries and a fruit juice[40].

Set 4, Drinks:

The 4 cards depicted: A glass of water, (cow's) milk, fruit juice and soft drink

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[40] This combination was based on my observations in local MC Donald's restaurants.

Results for this set were the most consistent of all. Only one student thought that fruit juice was the drink lowest in sugar and this points again at a possible schema of fruit = healthy = no sugars.

Soft drink and fruit juice were sharing their position as drinks with the highest amount of sugar. This is understandable as not all soft drinks contain more sugar than fruit juices and vice versa.

Water was mostly chosen as the drink with the lowest amount of sugar.

The card sorting exercise confirmed a pattern that was noticed in the questionnaire: Children tend to believe that healthy items like fruits and veggies do not contain sugar or at least not much of it.

When it comes to more "obvious" products like soft drinks or muesli bars, kids were mostly spot on with their arrangements.

On one side this is good because, despite the fact that fruit can contain lots of sugars, the participants seem to know the difference between healthy and unhealthy. So, it could be argued that the sugar content did not really matter, as long the chosen food was classified as healthy. On the other side, this thinking poses the risk of children falling into marketing traps that suggest certain foods are healthy simply because they contained fruit (e.g. fruit-juice).

4.3 Results: App test, log file

Since not all participants played the app more than twice, the data analysis was focusing only on the first two runs which were completed by everyone.

Comparing the first run with the second, revealed that the accepted amount of sugar decreased in the second round. This could be because the children gained a better understanding of how everything was working and therefore were more critical of the items they scanned.
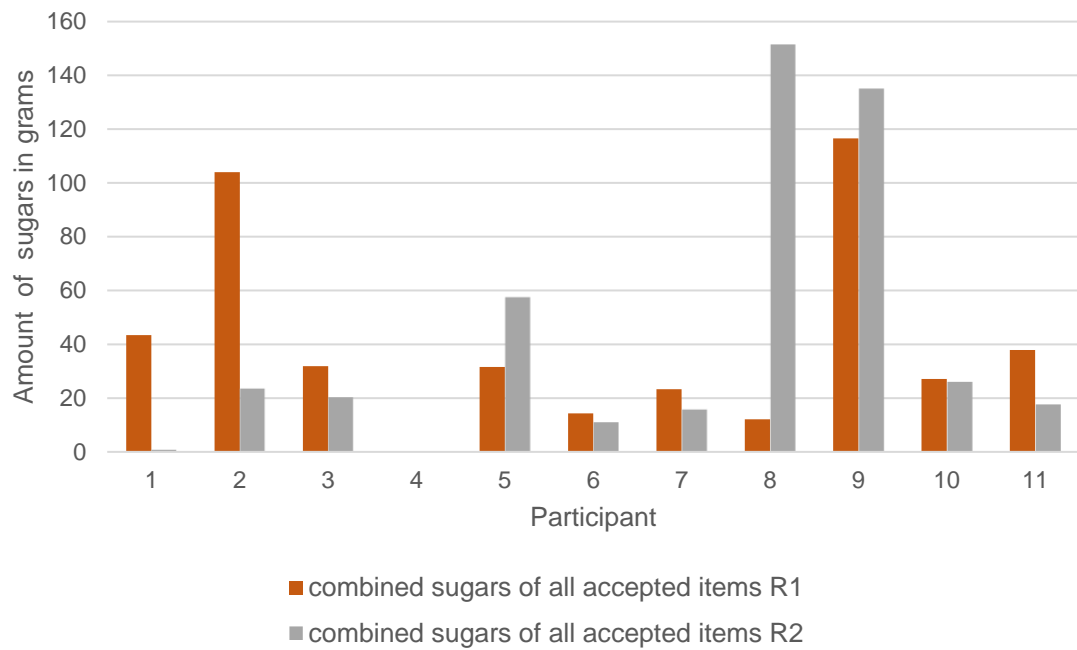
Figure 36. Bar chart comparing the total amount of sugars scanned during the first run vs. the second run of all participants. Note: ID 4 was unused.

Not all participants followed the pattern as shown in Figure 36. Below, in Figure 37, are examples of results that stood out from the rest:

Figure 37. The image shows accepted and declined items and their sugar content. Both runs for participant 1 are depicted (from the run 1 vs run 2 comparison above).

As displayed in Figure 37, during the first run, all items were accepted, no matter how high their sugar contents were. For the second run, only items very low in sugars were accepted. Note: the volume on this student's phone got somehow muted during the first run and was rectified for the second round. This could attribute to the very different results because no spoken instructions could be heard.
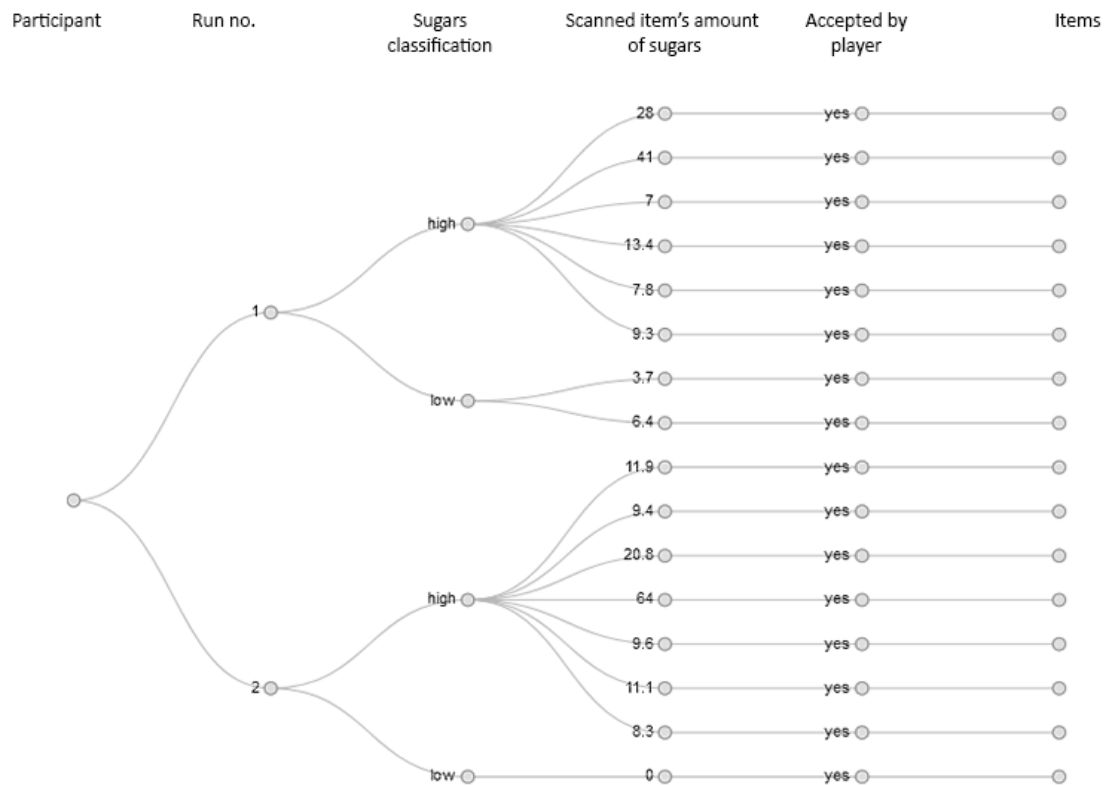
Figure 38. The image shows accepted and declined items and their sugar content. Both runs for participant 8 are depicted.

In both runs of a participant (see Figure 38), every item scanned was also accepted (including very sugary ones). During the observation, some participants could be heard discussing how they are going to scan only items that were high in sugars. Following this approach may explain this particular participant's results.
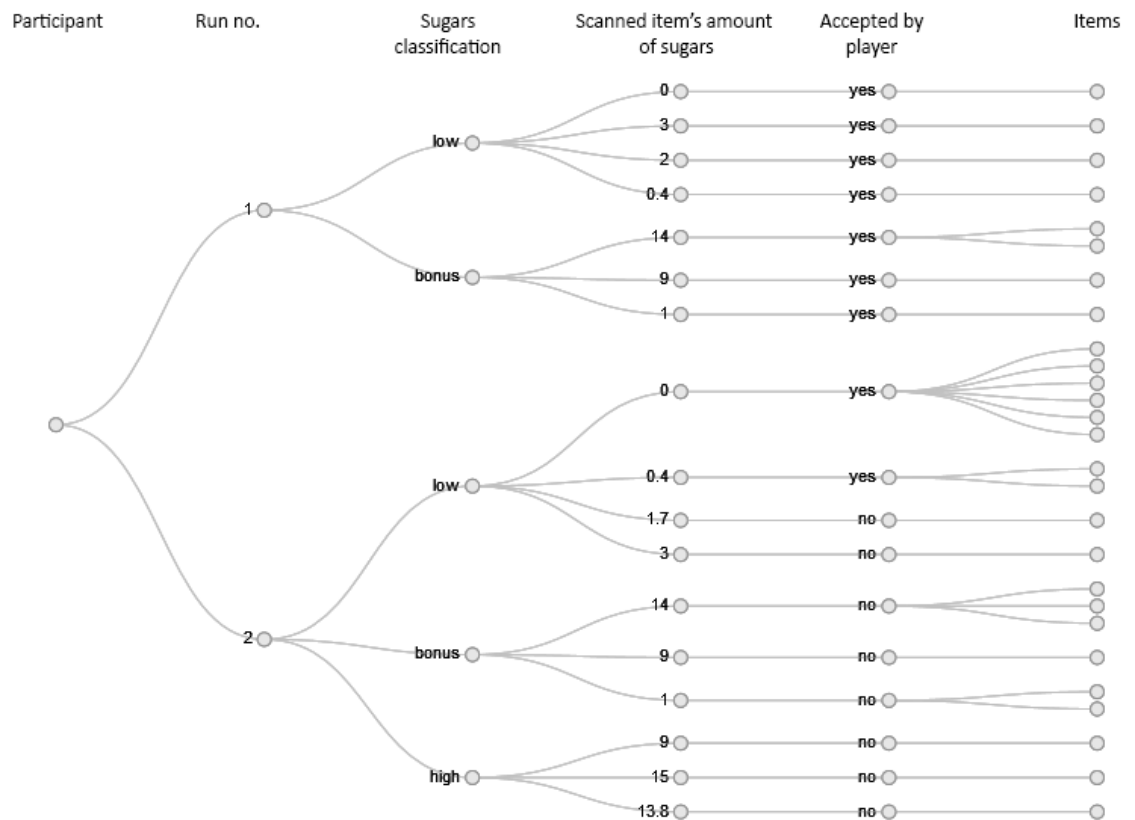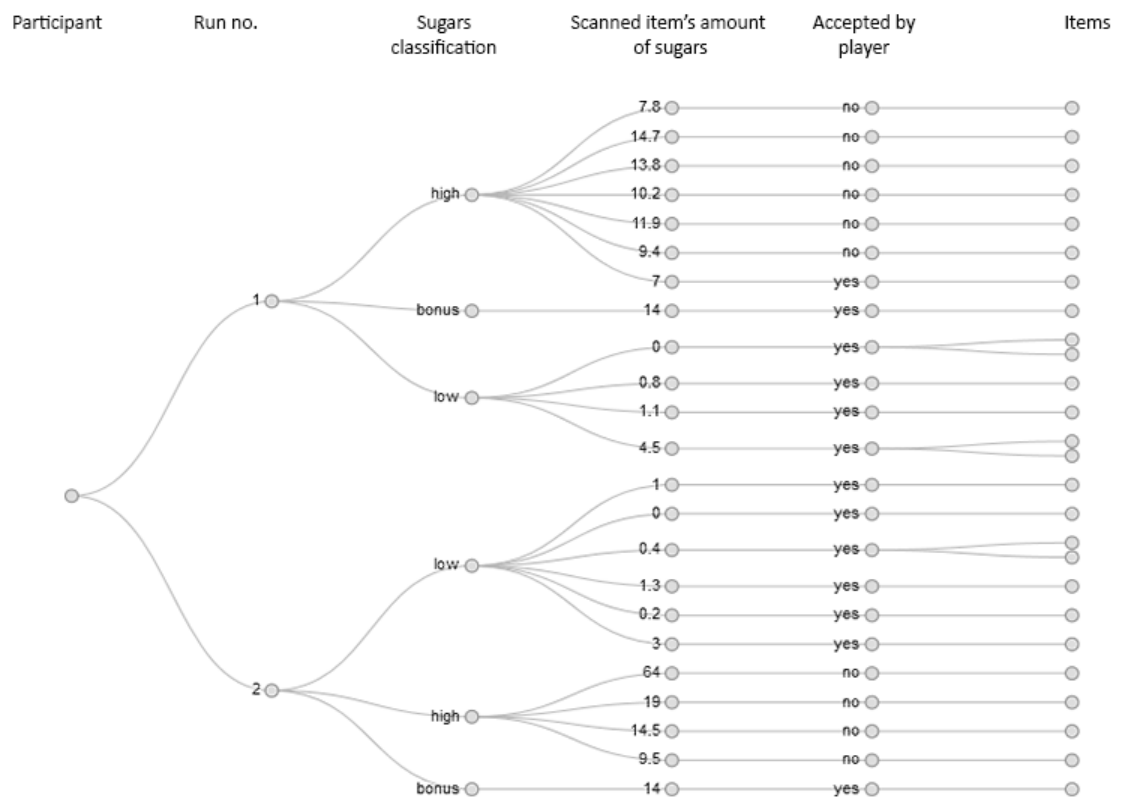
Figure 39. The image shows accepted and declined items and their sugar content. Both runs for participant 3 are depicted.

The above example in Figure 39 shows a more balanced approach used by one of the participants, which was more common in other students as well. In both runs, items were accepted and declined.

In general, most of the time the participants declined items high in sugar and tried to find "better" alternatives. Only if an item included a "fruit-bonus", the children tended to accept the item regardless of its sugar content.

In addition, the following correlations were identified:

The faster the children finished the game, the higher the total amount of accepted sugars tended to be (see Figure 40 and Figure 41). This could imply that a) less time was used to consider the results of a scanned item. B) the results were not clear enough. C) the participant did not care about the results.

Figure 40. First run of all participants, comparing accepted sugars and time spent. Note: ID 4 was unused.
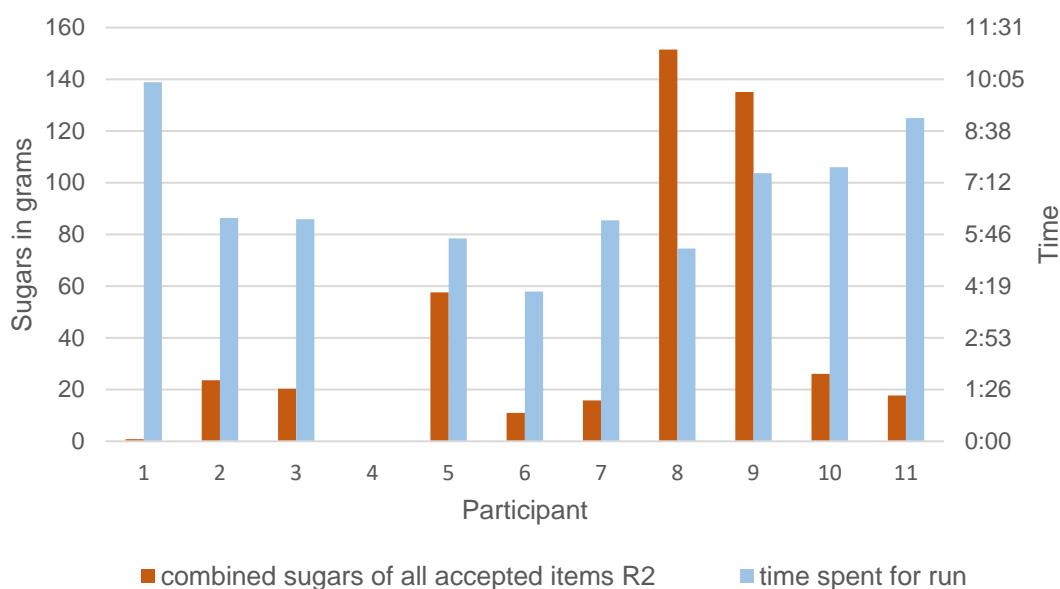
Figure 41. Second run of all participants, comparing accepted sugars and time spent. Note: ID 4 was unused.

Also: If less time was spent to complete the game, the number of scanned items (accepted and declined) was lower as well (see Figure 42 and Figure 43).

Fewer items scanned, often meant that the accepted sugar amount was higher. This suggests that a participant either did not understand that items can be declined or he just wanted to finish the game as quickly as possible (for competitive or boredom reasons). Note: Only 8 accepted items were required to finish the game.
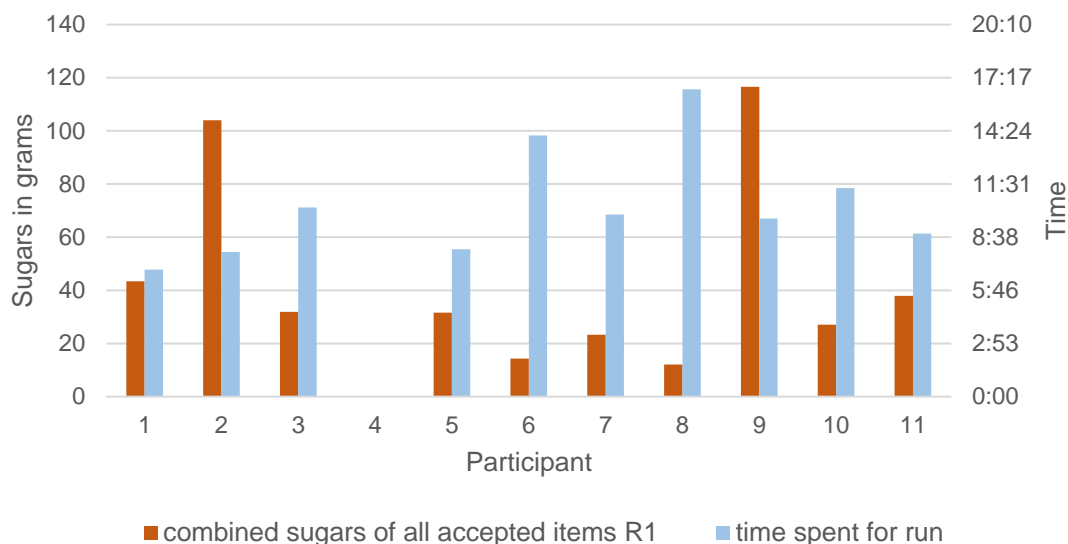
Figure 42. First run of all participants, comparing accepted sugars and number of scanned items. Note: ID 4 was unused.
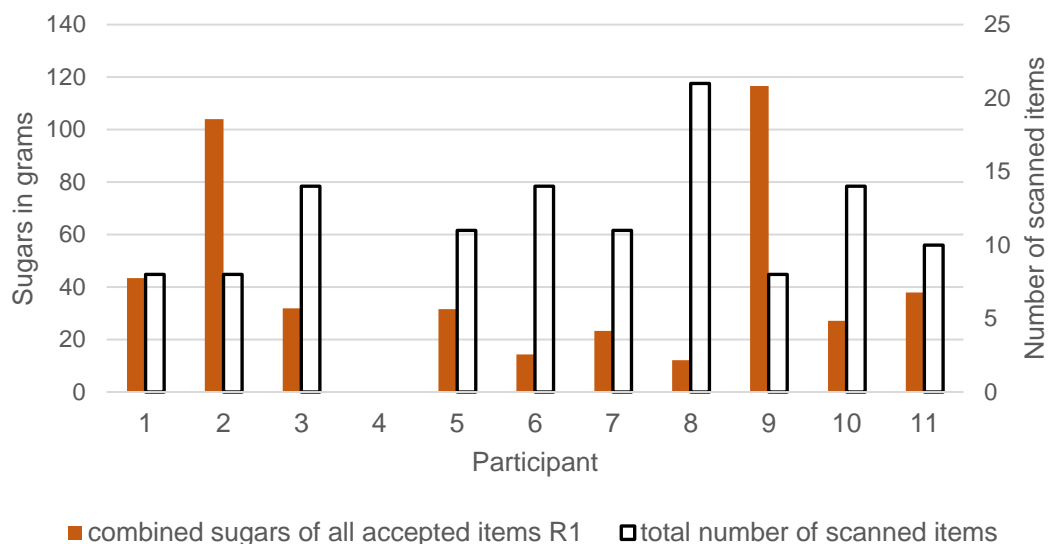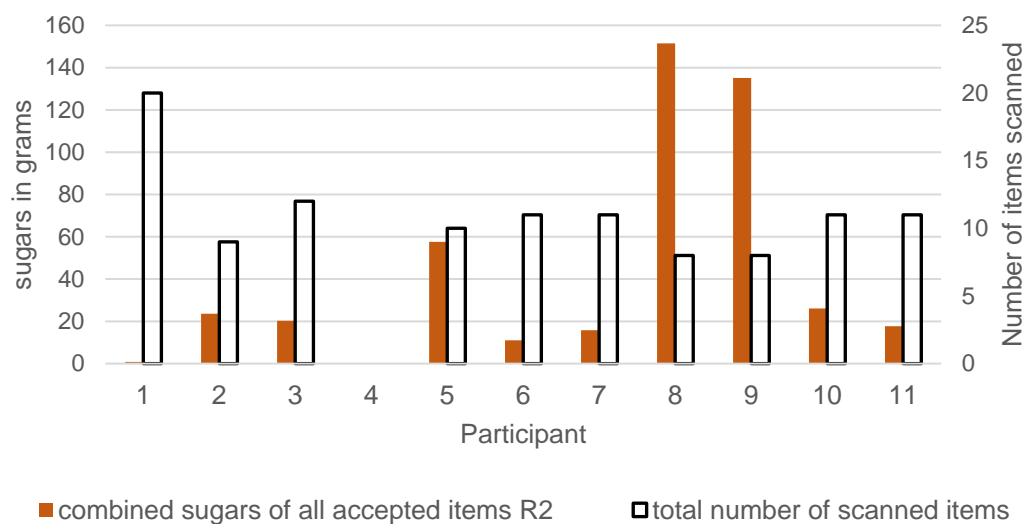

Figure 43. Second run of all participants, comparing accepted sugars and number of scanned items. Note: ID 4 was unused.

4.4 Results: App test, observation

The observation was grouped into categories to "measure" multiple important factors such as motivation, emerging patterns, usability and issues (of technical or conceptual nature).

Motivation:

The children appeared curious and excited to try out the app. Multiple children played through the prototype more than once.

Towards the end of the session, some children started to sit down and mainly used the "choose food" option instead of walking around and utilising the barcode feature. This was potentially due to a number of factors: Tiredness, limited levels of the app, the barcode function not working properly or simply because they wanted to quietly concentrate on the app.

Patterns:

There were several patterns emerging regarding the behaviour of the students:

- Some participants showed the teacher and me proudly or shocked the results of their scans and scores or tried to explain why certain items were better or worse than others. This implied that the app caused the participants to ask questions and think about possible answers. Also, multiple children showed each other where some of the items high and where some of the products low in sugars were.
  If this behaviour can develop within such a short amount of time (20 minutes), it may be possible that the kids would carry on with this attitude at home and spread awareness within their family (as previously imagined in the chapter about children influencing parents' consumer behaviour).

- Some participants tried to scan as many items as fast as possible (trying to beat other students' or their own previous scores).

- Others limited their search to items that specifically contained no or very low amounts of sugars.

- In general, there was a change of how the scanning was approached: In the beginning, the scanned objects were more or less randomly selected. Later, participants became more selective

- Some students decided to turn the concept on its head by systematically trying to scan items that were high in sugar. This is interesting because these students took the app and used it in a way that was not intended. This shows that the concept was not only

understood, but also provoked a self-directed learning process which allowed them to repurpose the game to make it do what they wanted it to do.

Usability and issues:

The most concerning issue was that the barcode function did not always work well enough. This feature depends on the smart phone's camera, which relies on sufficient light to identify barcodes. Sometimes, when the light conditions worsened, the app started to have troubles scanning. In turn, participants lost their patience and some of them started to use the "choose item" function instead. While this problem was not unexpected, it could be a major deal breaker for potential users. The scanning function is an integral aspect that makes this app, or better its concept stand out. Without it, this method of creating awareness loses its potential.

One part that caused confusion was the amount of sugars displayed during the first mini-game. Since the app transformed the amount of sugars of accepted items into sugar-monsters, it could happen that no or only a few of them appeared. E.g. If a participant had scanned items without sugars, then there was nothing to do during the mini-game. This could be rectified with a fixed number of monsters that would appear, no matter how many items were scanned.

The assisting teacher provided me with two other valuable observations:

- The "g" used for grams was not understood by at least one student. This shows how important it is to test every part of an app with the intended target group.
- The number of sugar-names used in the second mini-game were considered as too many. The suggestion was to limit them to 3 to so they could be remembered easier and then introduce more names in later mini-games.

Other issues were minor and mainly related to the limited functionality of the prototype. E.g. Students were not able to start a new game after finishing it or they did not know what to do once they reached the end. This was intentionally set up in this way to prevent accidental restarts through the user. Having to manually restarting the game for the kids gave me an indication about how many children played through the app and how often.

Positive observations regarding usability and app in general included:

- one important observation showed how crucial the addition of the spoken instructions was: During the first test-run, one student accidentally muted the volume on the used device. This was discovered near the end of the first run and was reset before the second test run started. Comparing this student's log file showed huge differences between run number one and two. Initially, the child accepted each item scanned - no matter how high the sugar content was. This changed during the second run and this student actually ended up with the lowest amount of sugars scanned of all the

participants. This showed that the instructions were not just seen as a funny gimmick, but actually made big difference in at least one of the student's learning experience.

- kids could be heard exclaiming things like "this time I will play as an alien/ human/ astronaut". This showed that the avatar offerings were welcomed by the children and also added a so called "re-play" value (changing avatars made the game exciting again even though nothing else had really changed).

- some of the kids mentioned that they really liked the voice used for the instructions and even suggested to add more voices (for each character a different one).

- children were happily bouncing their heads to the music while still being fully focused on the tasks presented by the app. In general, there was neither positive or negative feedback regarding the music which I like to judge as a successful attempt of creating music that supports the main product without distracting from it.

Group 1 vs. group 2:

There were many similarities between the two groups. This is worth pointing out because the introduction for group number 2 included a short app demonstration which was not given to the first group. This was done because the assisting teacher felt that the children could benefit from additional instructions before they started the game.

Also, as the study followed the school's usual routine in regards of breaks, children of group one may have discussed the study with children of group number two during that time. However, apart from spending slightly more time on their first run, the second group did not show significant differences compared to the first group.

There were cultural differences present between the two groups but because ethnicity was not a focus point of this study, no further details are part of the findings section. Future research could emphasise on cultural differences as ethnicity is said to play a role in health-related issues (as mentioned in the chapter "Do sugar related problems affect everyone?").

4.5 Results: Feedback session

Overall, the reactions to the app were favourable. The most popular aspects of the app were the mini-games, the ability to find out how much sugars were in a product and the scanning function. The feedback showed that almost all of the children would play this app outside of the school and 80% would also recommend it to their friends and family. Interestingly, the reasons for not recommending it were not because the app was deemed bad: One student thought the family simply did not have the time to play with the app because they needed to work instead. Hence, no recommendation was given. This small glimpse into this student's family life showed

that one of my initial reasons for not targeting the parents for this project has validity: Many parents do not have the time to deal with this topic.

Another child said it would not recommend it because it wanted to be smarter than anyone else at home and therefore would not want to share this tool (the app) with anyone. This is also interesting from a gamification standpoint as this participant created its own "quest" why he played this app.

Another clear feedback showed that 100% of the participants found it easier to use the app instead of reading the nutrition labels on food packaging in order to find out about sugars in food. It can be argued that the reading skills of the test groups were still limited and therefore expecting the children to read and comprehend the labels was not realistic anyways. At the same time, it shows that children can indeed interact with nutrition information if they are given the right tools or if the information is presented in a way that younger age groups can understand.

The results need to be treated cautiously due to the small sample size and the earlier discussed possibility of influenced answers. In addition, one critic point that could be raised is that including the intended user group at such a late stage in the development process was a very risky move and could have resulted in disastrous user feedback.

On a positive note, considering that the app still received such positive feedback, suggests that the methods used for building the app were well chosen and incorporated.

The big question however is: Did the children learn anything? They seemed to have fun and also rated their experience with the app positively. BUT does that prove awareness was successfully created? Did the concept work?

4.6 Results: Drawing activity

The majority of children suggested to increase the amount of levels or characters in the app and to use additional areas or themes when the game progresses further. Also adding boss enemies was a common wish.

Please note: This part of the research was not directly meant for awareness creation. Of course, a design can greatly impact how information is approached and understood, but the focus of this exercise was to find design elements that could create (more) fun and motivation – as seen from the viewpoint of the target group.
As there was no time left to implement the participants suggestions, no further analysation took place. This does not mean that the results are of no use. A future version of the app should revisit the feedback and consider the implementation of them.

5 Discussion

The previous chapters provided some insights into the promising possibilities of the app, its concept and potential limitations. An important factor to keep in mind is the limited duration the children were exposed to the app and its concept. No wonders should be expected of an interaction with such a complex topic that only lasted a few minutes and only took place once. What the results show, however, is that the children's scanning approaches became more selective and refined after getting familiar with the game and its features. The log files of the children's actions show that items high in sugars were declined most of the time and instead, "healthier" alternatives were accepted. It can be argued that this was only the case because the kids tried to collect as many points as possible and therefore cancelled items that yielded a lower score. In other words, the kids were focused on points and not on sugar amounts. At this stage, it is obviously difficult to measure and demonstrate what the reasoning was. Nevertheless, I would like to think that recognising an item's sugar content went hand in hand with learning about the awarded amount of points. Thus, awareness was successfully created in most participants.

As an example, multiple participants decided to scan a bottle of fizzy drink. The initial card sorting game during part one of the study showed that the kids understood that soft drinks had a higher sugar content than all of the other drinks on the cards. So they knew that this kind of beverage had a lot of sugar but still decided to scan it. After scanning the bottle, they learnt how much sugar was actually inside the item and decided to decline it.

However, these results cannot indicate whether this awareness was sustained and if, how long it lasted for. It also does not mean that children would decline a sugary item in a real-world scenario like they did within the app.

When I enquired about potential impact the study may have had (after about one month the user test took place), I learnt that the children initially still talked about sugars in food and the app. The study also came up when the students were talking about other foods or nutrition. While this interest or awareness was not sustained for long, the teacher believed that a continued interaction with the app throughout the term could lead to a greater and longer lasting impact. This information is encouraging and could mean that the usage of the app, especially on a regular basis, could indeed create and sustain awareness. Future research is needed to understand if this is possible and could focus on the impact of a prolonged exposure to the app.

In regards of age-appropriateness, although none of the children mentioned that the app was too childish or too easy, I could not stop contemplating whether a younger audience might be even more suitable. The addition of the spoken instructions to the game minimised the reading requirements greatly. In combination with the used colours (red = too much sugar, green and yellow = acceptable amount) and the points reward system, I believe younger children could still understand the core of the app's concept. Hence, the age group could perhaps be lowered slightly to 5-6 year olds for a future user-test. After all, the earlier the children are exposed to

what is inside of our food, the sooner awareness can be initiated.

In a realistic scenario, the app would only be used for a short amount of time (e.g. while shopping in the supermarket, before lunch at school, etc.), therefore I do not see a problem with overconsumption of this media, no matter the age. Furthermore, compared to other digital tools, the app works only in conjunction with "real-life" products. Hence, children are still encouraged to move around, explore and interact with the physical world and are not glued to the screen, isolated from their surroundings. I believe this is a good balance.

It is important to consider that all participants in the case study were boys. A future user-test would have to make sure that a similar study would be done with girls as well or at least included an equal number of both genders.

As mentioned previously, cultural factors were not the focus of the study (apart from including a wide range of food and a variety of characters to choose from in the app). Further research could therefore concentrate on specific communities and ethnicities. For example, as Māori are more at risk of potentially sugar related issues in New Zealand (see chapter 2.1.3), a study could be led and executed by members of this community according best practice framework Kaupapa Māori, as per Te Ara Tika guideline (Hudson, Milne, Reynolds, Russell, & Smith, n.d). This way the research can be tailor made and culturally relevant symbolic data could be implemented into the app.

In regards of research methods: Interacting with the app was arguably the most exciting aspect for the participants. Based on the observations and feedback, including a "performative based" part helped the participants to approach and experience the concept of this project in a positive and uncomplicated way. The children seemed more motivated to experiment with the app and the food products than answering questionnaires. I believe this also influenced the "validity" of the answers to some degree, as interacting with the app allowed for a more natural data collection. Absorbed by the app, the participants were less likely trying to give "satisfying" answers to look good. They seemed to act as if they were playing a game in their free-time and not like as if they had to sit an educational exercise against their will.
Using different research methods in combination, helped to get a greater understanding of how the participants think about and interact with sugars. The approaches used before and after the app-test provided great insights that might not had been captured otherwise by only observing the participants or by only having them experience the app as part of a performance.

One potential problem of the whole concept is the reliability of the scanning function. Currently, the only way to minimise this issue is to either scan items in well-lit conditions or to use camera-phones with better low light capabilities. The latter option would significantly increase the cost of a suitable smartphone, which would put this app out of reach for lower income groups[41]. A cost-efficient alternative could be achieved by adding comprehensible sugar labels to food products

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[41] The smartphone used in the study costs around 330 NZD (in 2017).

in a prominent position. This way, the only scanning necessary could be quickly done with the eyes – no smartphones required. However, this may still not entice children to learn about the nutritional content by themselves (due to the missing gamification elements).

Lastly, there are several ways how the app could be improved. For example, at the very beginning of this project, the goal was to use VR[42] headsets to visualise how the consumed items impact the body. This way, an even stronger connection between user, app and food could be made. Although I believe that it was the right choice to abandon this technology for this project, I still can see the potential of it once improvements are made, potential side-effects are minimised (Madary & Metzinger, 2016; Oculus, n.d.; Barrett,2004) and fully interactive versions are affordable to everyone. Alternatively, augmented reality could be used to place digital content on top of the food that was scanned. This again, could create more literal connections between a product and a consumer. For example, users could see how the sugar pours out of an item or during mini-games, sugar-monsters could be fought "directly on" an actual product. Also, the database of barcodes is very minimal at this stage. Since other similar apps exist and some supermarkets have started to show nutrition information on their websites, a collaboration could be sought to connect this project's app with third-party databases. This would increase the number of scannable items from one hundred to a few million.

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[42] VR stands for Virtual Reality and allows a user to experience a digital world in 3d as if he/she was inside of it.

6 Conclusion

The aim of this master's project was to develop a method that could create awareness in children about the amount of sugar in their food. With the help of a mixed research design and a gamification framework, an interactive app for children was developed to create awareness in an entertaining and motivating way. The resulting prototype was tested with school children as part of a case study.

The outcome of this project showed that children are able to interact with and understand nutritional information if presented to them in an appropriate way. Also, the app was capable of entertaining and motivating the children to approach a complex and potentially "dry" topic. Together, these findings indicate that the project's concept is a promising measure to create awareness about sugars in food for children. Future research is needed to look into how and if this awareness can be sustained.

While the app is capable of creating awareness, it does not mean that users of the app will automatically be convinced to change their behaviour. As discussed in this thesis, there are many aspects that play a role when it comes to actually inducing change. An app could be one piece of the puzzle. It could target young consumers, while other measures like easier nutrition labels and added/removed taxes could in addition "nudge" their caregivers to choose healthier products.

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A. Appendices

A1. Ethics approval

AUTEC Secretariat

Auckland University of Technology
D-88, WU406 Level 4 WU Building City Campus
T: +64 9 921 9999 ext. 8316
E: ethics@aut.ac.nz
www.aut.ac.nz/researchethics

24 August 2017

Stefan Marks
Faculty of Design and Creative Technologies

Dear Stefan

Ethics Application:17/286 **Sweetening awareness: A playful interaction with sugars in food for children**

I wish to advise you that a subcommittee of the Auckland University of Technology Ethics Committee (AUTEC) has **approved** your ethics application.

This approval is for three years, expiring 23 August 2020.

Standard Conditions of Approval

1. A progress report is due annually on the anniversary of the approval date, using form EA2, which is available online through http://www.aut.ac.nz/researchethics.
2. A final report is due at the expiration of the approval period, or, upon completion of project, using form EA3, which is available online through http://www.aut.ac.nz/researchethics.
3. Any amendments to the project must be approved by AUTEC prior to being implemented. Amendments can be requested using the EA2 form: http://www.aut.ac.nz/researchethics.
4. Any serious or unexpected adverse events must be reported to AUTEC Secretariat as a matter of priority.
5. Any unforeseen events that might affect continued ethical acceptability of the project should also be reported to the AUTEC Secretariat as a matter of priority.

Non-Standard Conditions of Approval

1. The Information Sheet should mention the information session / presentation in the "how was I identified" section.

Non-standard conditions must be completed before commencing your study. Non-standard conditions do not need to be submitted to or reviewed by AUTEC before commencing your study.

Please quote the application number and title on all future correspondence related to this project.

AUTEC grants ethical approval only. If you require management approval for access for your research from another institution or organisation then you are responsible for obtaining it. You are reminded that it is your responsibility to ensure that the spelling and grammar of documents being provided to participants or external organisations is of a high standard.

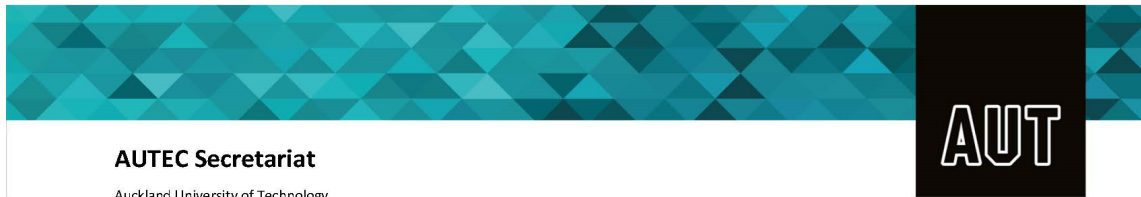For any enquiries please contact ethics@aut.ac.nz

Yours sincerely,

Kate O'Connor
Executive Manager
Auckland University of Technology Ethics Committee

Cc: sfk9636@aut.ac.nz; Ricardo Sosa

A2. Ethics approval for amendments

AUTEC Secretariat

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27 September 2017

Stefan Marks
Faculty of Design and Creative Technologies

Dear Stefan

Re: Ethics Application: **17/286 Sweetening awareness: A playful interaction with sugars in food for children**

Thank you for your request for approval of amendments to your ethics application.

The amendments to the organisational aspects (personnel changes) of the study are approved.

I remind you of the Standard Conditions of Approval.

1. A progress report is due annually on the anniversary of the approval date, using form EA2, which is available online through http://www.aut.ac.nz/researchethics.
2. A final report is due at the expiration of the approval period, or, upon completion of project, using form EA3, which is available online through http://www.aut.ac.nz/researchethics.
3. Any amendments to the project must be approved by AUTEC prior to being implemented. Amendments can be requested using the EA2 form: http://www.aut.ac.nz/researchethics.
4. Any serious or unexpected adverse events must be reported to AUTEC Secretariat as a matter of priority.
5. Any unforeseen events that might affect continued ethical acceptability of the project should also be reported to the AUTEC Secretariat as a matter of priority.

Please quote the application number and title on all future correspondence related to this project.

AUTEC grants ethical approval only. If you require management approval for access for your research from another institution or organisation then you are responsible for obtaining it. If the research is undertaken outside New Zealand, you need to meet all locality legal and ethical obligations and requirements.

For any enquiries please contact ethics@aut.ac.nz

Yours sincerely,

Kate O'Connor
Executive Manager
Auckland University of Technology Ethics Committee

Cc: sfk9636@aut.ac.nz; Ricardo Sosa

A3. Case study part 1.1: Questionnaire

Case Study: Sweetening Awareness: A playful interaction with sugars in food for children

Part 1: Questionnaire (Pre-assessment)   Participant ID: _____

1   Do you know what sugar is?

  ○ a) yes   ○ b) no   ○ c) not sure

2   Sugar is:

  ………………………………………………………………………

3   Do you talk about food with your family at home?

  ○ a) never   ○ b) sometimes   ○ c) often   ○ d) always   ○ e) don't know

4   Do you talk about sugars with your family?

  ○ a) never   ○ b) sometimes   ○ c) often   ○ d) always   ○ e) don't know

5   Do you go together with your parents to buy food?

  ○ a) never   ○ b) sometimes   ○ c) often   ○ d) always   ○ e) don't know

6   If you ask your parents to buy a certain kind of food, will they do it?

  ○ a) never   ○ b) sometimes   ○ c) often   ○ d) always   ○ e) don't know

7 Do you have access to a smart-phone or tablet at home?

◯ a) yes   ◯ b) no   ◯ c) don't know

8 Do you own a smart-phone or a tablet?

◯ a) yes   ◯ b) no   ◯ c) don't know

9 What is your favourite food?

…………………………………………………………………………

10 How much sugar do you think is inside of your favourite food?

◯ a) none   ◯ b) a little   ◯ c) ok amount   ◯ d) a lot   ◯ e) don't know

11 What is your favourite drink?

…………………………………………………………………………

12 How much sugar do you think is inside of your favourite drink?

◯ a) none   ◯ b) a little   ◯ c) ok amount   ◯ d) a lot   ◯ e) don't know

13 What food do you NOT like?

………………………………………………………………

14 How much sugar do you think is inside of that food?

◯ a) none ◯ b) a little ◯ c) ok amount ◯ d) a lot ◯ e) don't know

15 What drink do you NOT like?

………………………………………………………………

16 How much sugar do you think is inside of that drink?

◯ a) none ◯ b) a little ◯ c) ok amount ◯ d) a lot ◯ e) don't know

Page 3 of 3

A4. Case study part 1.2: Sorting cards

Which of the items on the cards have the highest sugar content?

lowest   highest

A5. Case study part 2.2: Observation guide

Case Study: Sweetening Awareness: A playful interaction with sugars in food for children

Part 2: Observation Protocol   Group:

What to observe? Qualitative	based on observation on the left, create question for assessment (CONSTRUCT VALIDITY) Quantitative	
Do they understand how to use the app?	The app is user friendly	not at all limited yes very
What parts seem to cause confusion?		
What questions do they ask?		
Are they excited to use the app	the kids were excited to use the app	not at all limited yes very
Are they motivated?	the kids showed motivation	not at all limited yes very
Are they bored?	the kids got bored	very a little no not at all
Do they lose interest quickly		
Do patterns appear? Fast, slow?	Patterns appeared	not at all limited yes very
What kind of pattern?		

A6. Case study part 3.1: Feedback

Case Study: Sweetening Awareness: A playful interaction with sugars in food for children

Part 3: Feedback   Participant ID: _____

1   What was fun about the game?

_____

2   What would you change?

_____

3   Would you play this app outside of the school?
   ○   a) yes
   ○   b) no

4   Which way do you think is easier to find out about sugars in food:
   ○   a) reading the text on the packaging or
   ○   b) using this app?

5   Would you ask your friends and family to play this game?
   ○   a) yes
   ○   b) no

6   If not, why not?

_____

7   What other ways to learn about sugars in food would you choose instead?

_____

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