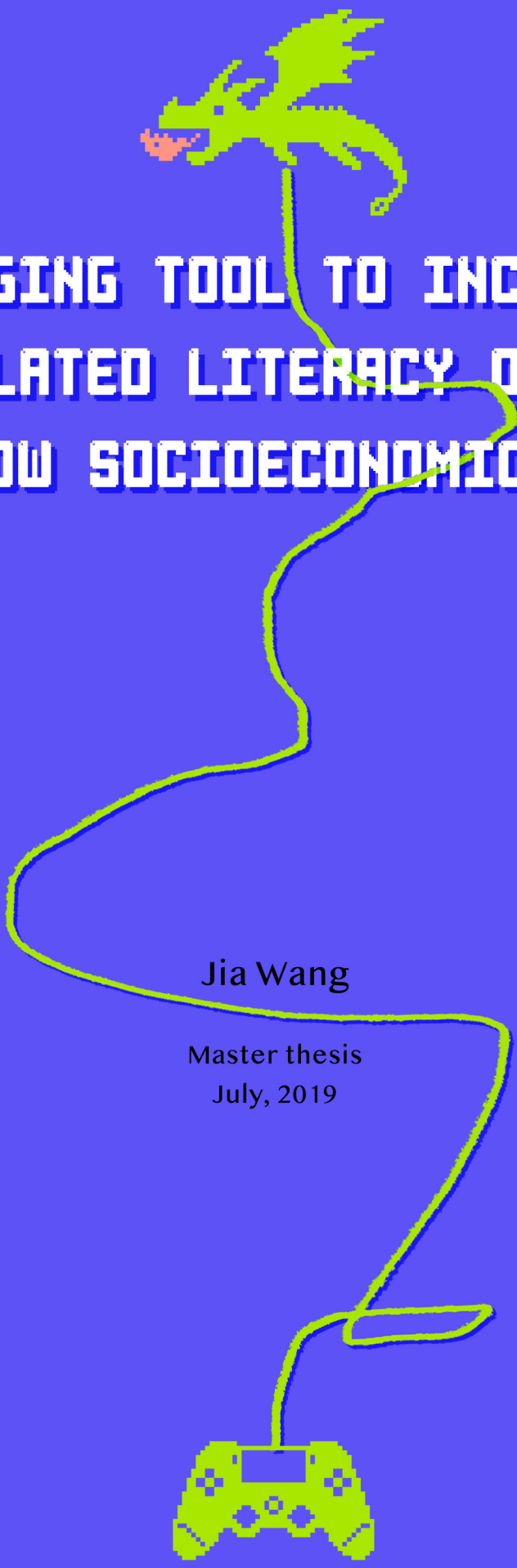
ENGAGING TOOL TO INCREASE FOOD-RELATED LITERACY OF PEOPLE WITH LOW SOCIOECONOMIC STATUS



Jia Wang

Master thesis
July, 2019

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Abstract

The goal of this project is to increase the food literacy of people with low socioeconomic status by conveying food knowledge in an enjoyable, indirect, and unforced way. This master thesis proposes a mobile game which enables the target group to receive food literacy and report their diet through gameplay. The game is about dragon raising; it builds a connection between the game world and the real world by encouraging users to feed their dragons with what they buy and eat in real lives.

As the Figure 1 shows, the project started with literature research and a user survey in the supermarket to explore the factors that influenced people's food choice. The result showed there were mainly two reasons why low SES people were not having healthy food behavior, unwilling to learn food knowledge or report diet: lack of motivation or lack of ability, which is in line with Fogg's Behavior Model. After further research on the characteristics of people with low SES and contextual factors that influence food behavior, the reason became more specific:
1. People didn't have motivation due to the lack of direct feedback about the short-term and long-term benefits of having good food behaviors.
2. People lacked the ability to learn food literacy or report their diet because they were hindered by more pressing matters in their daily life, e.g., financial difficulty, busy lives.

Self-Determination Theory and Persuasive Game Design Model were applied together with Fogg's Behavior Model to help with analyzing the user characteristics and contextual factors. After that, the design guideline was made that the design should focus on simplifying the using and learning process (to increase ability) and deliver food knowledge in an attractive and enjoyable way that may relate to their basic needs (to enhance motivation).

Before entering the design phase, an analysis of existing food informatics products, including dietary apps and gamified healthcare apps, was conducted to find the typical functional features and most frequently used game elements. Personas and scenarios of two types of user groups were also created based on the research results, leading to the design requirements.

During the design phase, creative sessions were carried for idea-generating, followed by two rounds of prototyping test and iterations. Two game concepts with different game elements and design focuses were further developed and tested with users to check to what extent could the concepts meet the design goal and requirements. The final concept was created according to the insights from users' preference and feedback.

In the last phase, the design concept was evaluated with experienced designers and dietitian in related fields to get critical feedback and suggestion. The recommendations and limitations were discussed as well in the end.

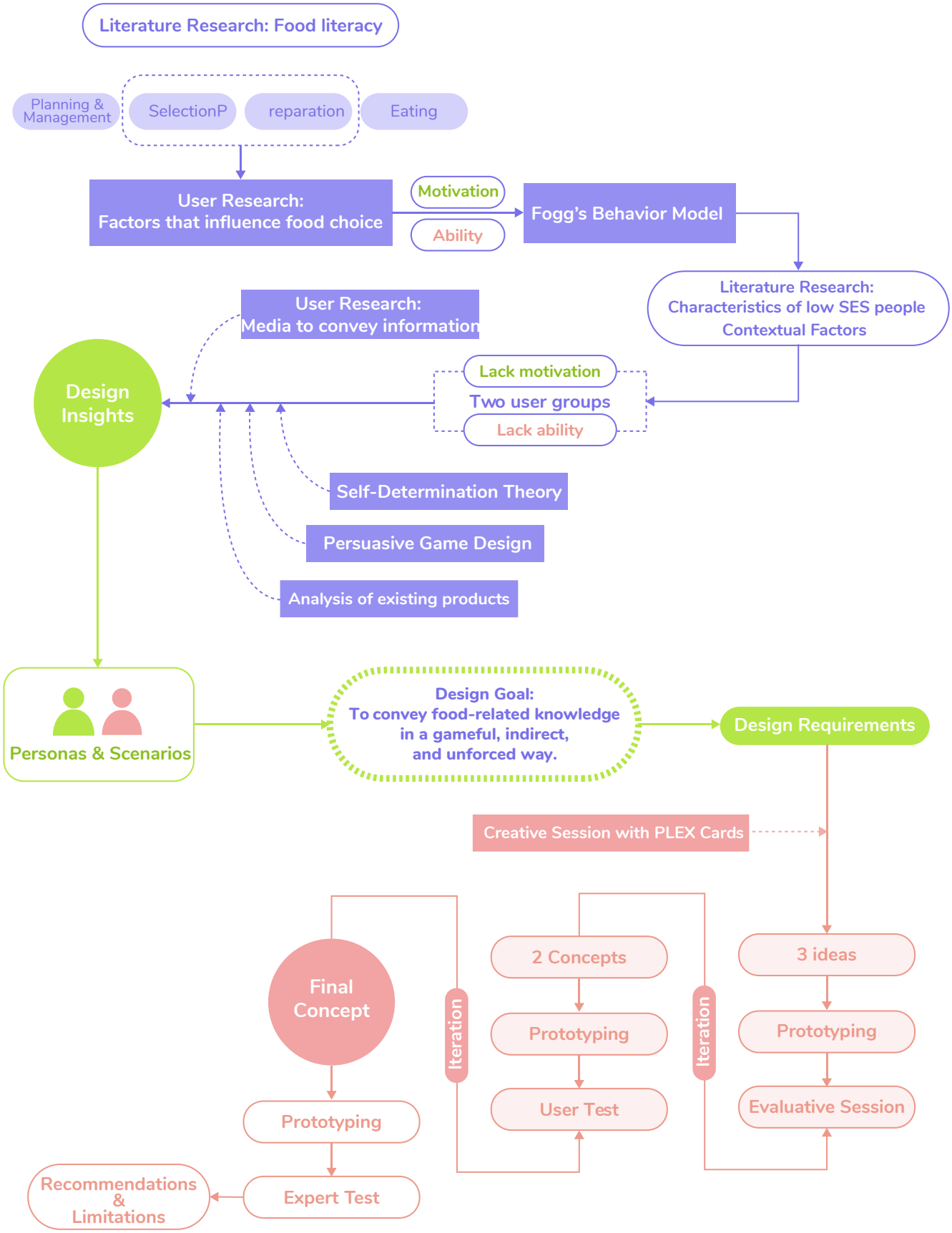

Figure 1. An overview of the whole process of the project

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1 Project Introduction

1.1. Background

Research on digital media and healthcare envisions the role of e-health systems to empower patients taking their responsibility for their health (Mone, 2014). According to the definition of 'positive health' (Huber, et al.,2016), this vision addresses a shift to support the active involvement of people in their health condition.

Food informatics is a specific area of e-health, and it relates to understanding what do we eat and why we eat what we eat. In the context of health nutrition, E-health systems could support people and their care network to engage in the daily management of food behavior, which defined by Axelson and Brinberg (1989) as the act of making choices of one's eating habits, excluding the intake of nutrients.

This graduation project is part of the FoodSampler project, funded by ZonMw's Create Health programme to support healthy and active aging. The FoodSampler research project aims to explore food informatics strategies to engage people in generating contextual knowledge of their food behavior.

So far the FoodSampler Project already has research data about the contextual factors that influence food behavior of people with low socioeconomic status, which includes individual factors (appetite, mood, lifestyle), environment factors (economic, media misleading), social factors and physical factors (location, sensory attributes). According to the preliminary outputs of contextual research from FoodSampler, people struggle with self-reporting activity due to constant judgment and immediate effort of reporting yet unclear direct benefits (positive feedback). Based on the theories and research result, possible mechanisms will be explored and tested during the project to engage people with low SES in food-related data collecting, integrating, and self-reflecting.

1.2. Target users and design methodology

Socioeconomic status (SES) is the social standing or class of an individual or group. It is often measured as a combination of education, income, and occupation (American Psychological Association). Numerous studies have found an inverse relationship between food-related health problem (diabetes, obesity) and education, occupation, and income that is consistent across all adult age groups (Everson, Maty, Lynch & Kaplan, 2002).

The project focuses on vulnerable groups, especially adults with low socioeconomic status (SES) who commonly lack health-related knowledge (Parmenter, Waller & Ward, 2000), and the goal is to increase their food literacy by making them feel engaged in collecting relevant and meaningful data around food behavior and its context.

One way to prompt people to be more active in data collecting and reflecting is to create design intervention based on the self-determination theory. The theory claims that people have three innate psychological needs: autonomy, competence, and relatedness. These needs motivate people to initiate behavior to determine what are essential for their well-being. Persuasive and motivation theories, gamification strategy, and behavior change techniques will also be used in this project to trigger motivation of providing and

consuming knowledge. The overview of how the design intervention will work and desired consequences are illustrated in Figure 2.

1.3. Project goal

In the current situation, individuals having a low- SES tend to have a less healthy lifestyle compared to medium and high SES individuals. Their eating habits are a part of their unhealthy lifestyle. Several dietary tracking tools have been proved ineffective, given their lifestyle, social, environmental, and individual factors, which often take priority over their need for a lifestyle change. Most of the existing food informatics focus on quantifying food intake, require high cognitive and time effort but do not provide a clear short-term feedback or benefit, therefore users are inactive in providing data and processing knowledge (Herrera, Natalia Romero, et al., 2018).

The project aims to explore strategies to evoke people's active engagement in providing and consuming information about their health, by enabling an active process of knowledge, awareness, reflection, and action around food choices. Design research will be conducted to find how the current value(autonomy, competence, relatedness) that low SES people have can be used to increase their food literacy.

During the project, the following questions

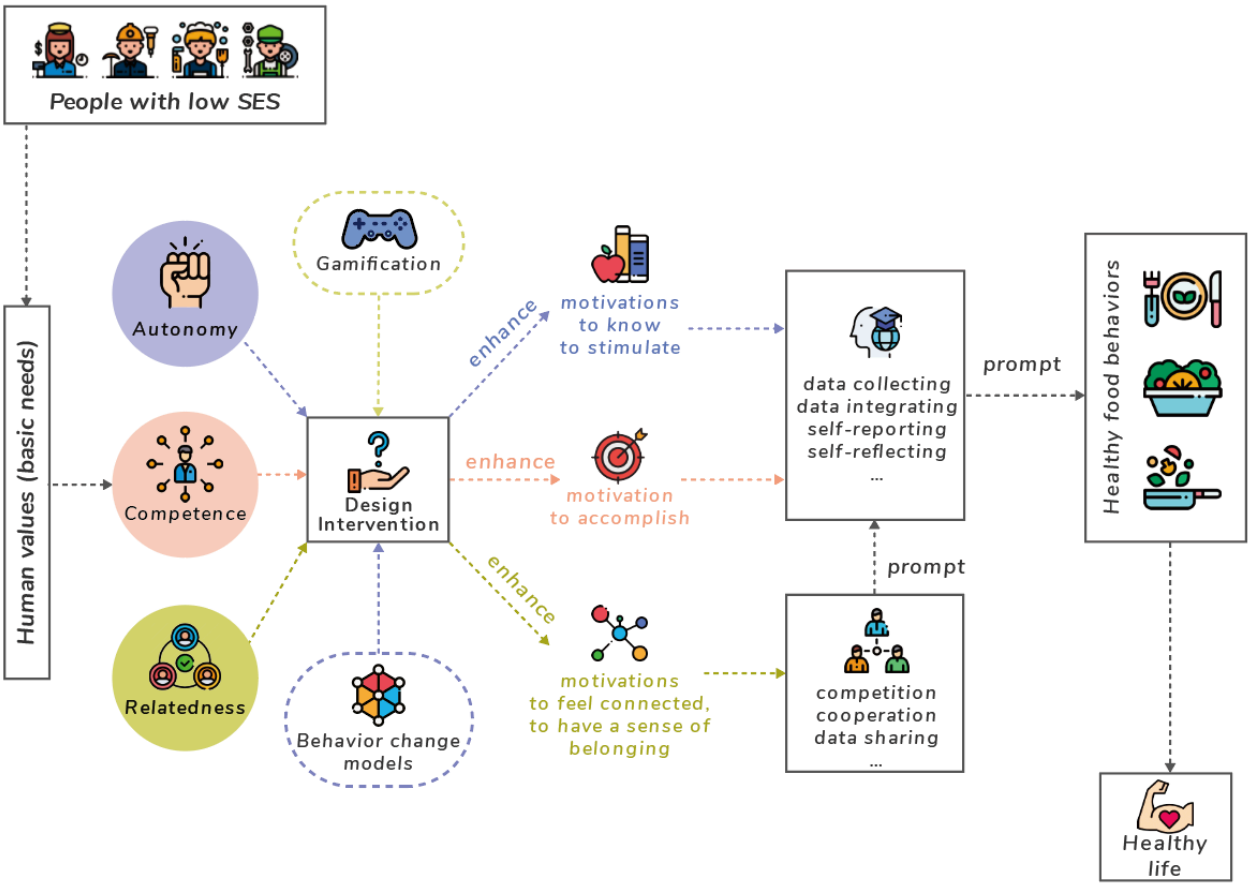


Figure 2. The project vision

will be explored:

1. What factors influence the food behavior of low SES people and how they related to the 3 basic needs?
2. Does adding fun, attractiveness, and excitement work effectively on motivating users and increasing their autonomy to collect and reflect on food data?
3. Can users' competence be enhanced by simplifying the process of self-reporting and making food informatics tools less effort to use?
4. Will users be prompt to gain knowledge if they can strengthen social relatedness with others through food informatics tools?

1.4. Project phases

The graduation project will go through 3 phases (Figure 3):

A research phase which will start from the desk research about the low SES group, food literacy, self-determination theory, and gamification strategies. Meanwhile, since the low SES target group is difficult to reach, the user research will be conducted by means of design intervention (booklet, scenario, etc.) to reduce the language barrier. The design requirements will be summarised at the end of this phase.

A design phase in which research insights will be translated in to divergent design ideas for prototyping test and iteration. Later the insights from test and iteration will be integrated to give a direction for the final concept and this phase will end up with the final design.

An evaluation phase in which the final prototype will be evaluated with users in real context. Recommendations of the design will be given for further continuation of the project.

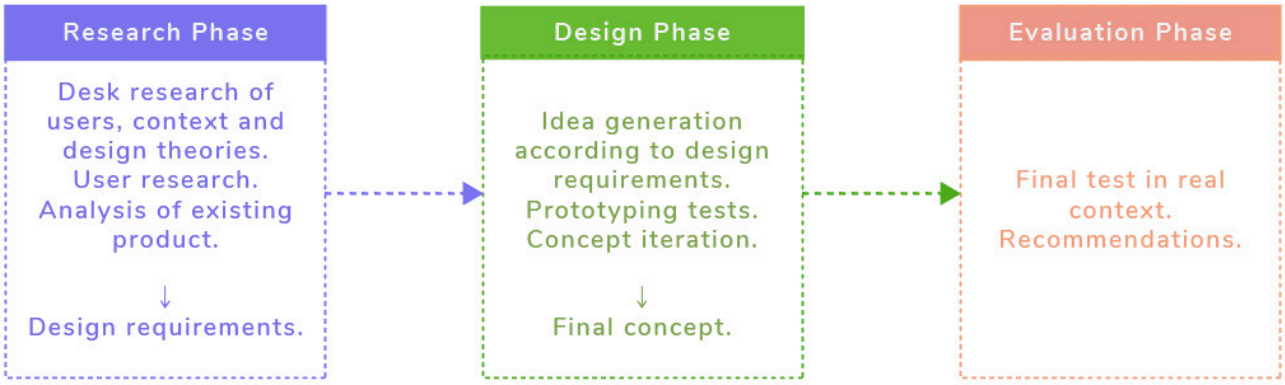


Figure 3. Project phases


2
Research
Phase

2.1. Introduction

In order to get deep insights into design requirements and possible directions, the first stage of the project mainly focuses on research and analysis.

The research includes a literature review and user test about the characteristics of the target group (low SES people), the definition of food literacy, and design theories like gamification and self-determination theory, followed benchmarking of existing healthcare products. The results are summarized to come up with design requirements that help with the ideation session next step.

2.2. Food literacy

Before starting to think about how to increase food literacy of people with low SES, it is necessary to look at what food literacy is. In the modern world, literacy is not only interpreted as the ability to read and write but have one more broad interpretation as knowledge and competence in a specific area.

2.2.1. Definition

Vidgen and Gallegos (2014) define that "*food literacy is the scaffolding that empowers individuals, households, communities or nations to protect diet quality through change and strengthen dietary resilience over time.*"

It consists of a series of interrelated skills, knowledge, and behaviors required to plan, manage, select, prepare, and eat food. It can be simply interpreted as the knowledge needed to build a healthy lifelong relationship with food.

2.2.2. Domains and components

Based on the studies of Charmaz (2006) and Vidgen and Gallegos (2014), components of food literacy are categorized into four core domains, which are

planning and management,
selection,
preparation,
and eating.

Planning and management

The plan and management of food are essential to be considered particularly in an environment in which unhealthy food options are more accessible to get than healthy options. Also, having a plan or being capable of making a plan can effectively avoid unexpected outcomes. In this domain, food literacy is the ability to:

- *Prioritize money and time for food.*
- *Plan food intake so that food can be regularly accessed through some source.*
- *Make possible food decisions which balance food needs with available resources.*

Selection

The components within this domain refer to the selection of grocery items (e.g., choosing vegetables or fried chicken) and food service items (e.g., choosing takeaway food options). The literacy includes the ability to:

- *Access food through multiple sources and know the advantages and disadvantages of those.*
- *Determine what is in a food product, where it came from, how to store and use.*
- *Judge the quality of food.*

The selection of food could also be influenced by convenience, self-preference such as taste, and the local food environment.

Preparation

To prepare foods is an essential life skill and it requires ability to:

- *Make a good tasting meal from whatever food is available.*
- *Apply basic principles of safe food hygiene and handling.*

The terms "good tasting" is largely individualized and the ability to prepare food that tastes good is important because the taste is a significant factor in food choice, especially for young people.

Eating

This domain includes both the act of eating and its consequences.

- *Understand that food has an impact on personal wellbeing.*
- *Demonstrate self-awareness of the need for personal balance food intake.*
- *Join in and eat in a social way.*

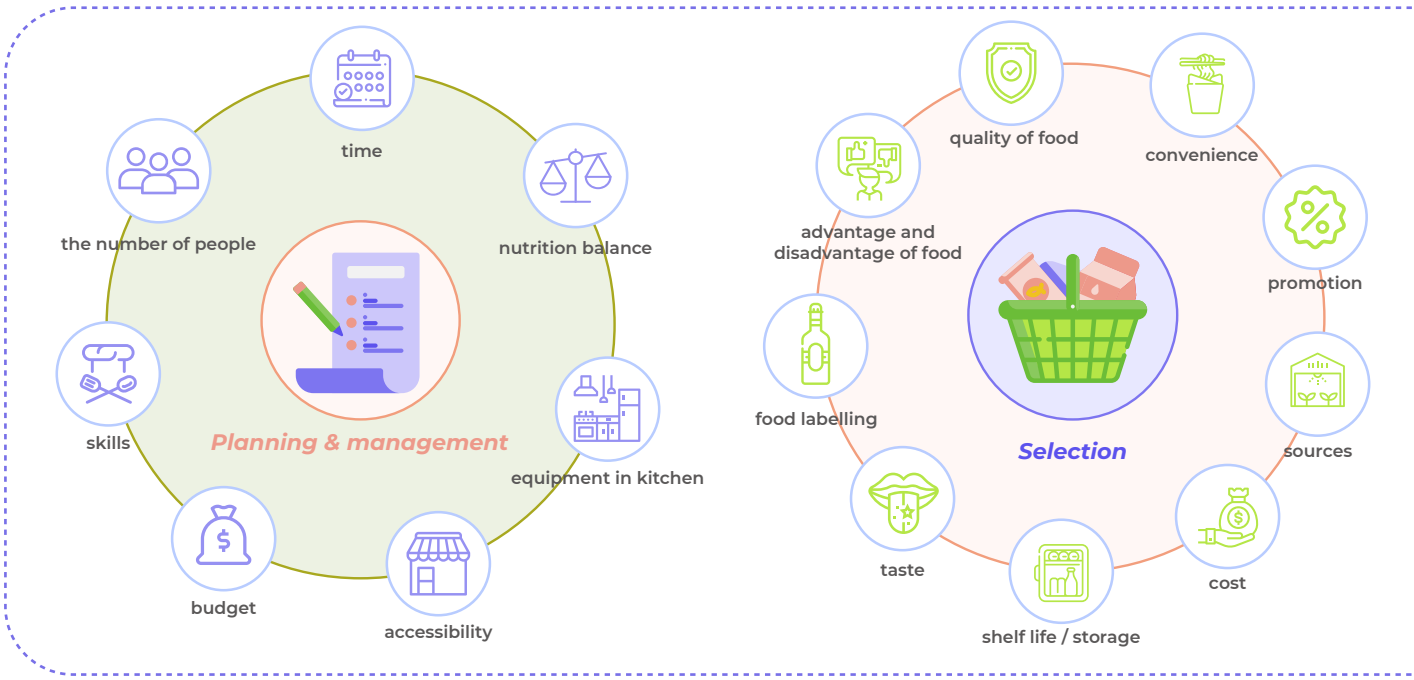
Nutrition can be considered to be both a component and a potential outcome of food literacy. For many people, nutrition was related to obesity prevention rather than health promoting.

The social function of food is also frequently described as an important part of the eating activity. Sharing a meal is considered as friendly while eating alone was usually viewed unfavorably. Moreover, food is also related to taking care of others in a family context.

2.2.3. Food literacy during the journey of food behavior

As it is shown in Figure 4, the four domains can also be seen as four stages during the journey of people's food behavior. For each domain/stage, there are some components that related to food literacy and behavior.

This project decides to mainly focus on the planning and selection stages because they are the earlier stages in people's food behavior journey, where most food decisions are made. And people are more likely to prepare healthy meals and eat healthily by using healthy food products they choose before. If we understand the reason behind their food decisions, we can use design



intervention to convey food knowledge and lead users to healthier food choices.

2.2.4. Significance for people with low SES to have food literacy

Food literacy can empower individuals to determine their food intake and understand the impact of their food choices on their health and the environment. Developing food literacy could evoke and enhance one's health consciousness, decrease the vulnerability to the obesogenic environment.

Especially in this project, food literacy will work as the bridge that leads people with low SES to healthy food behavior.

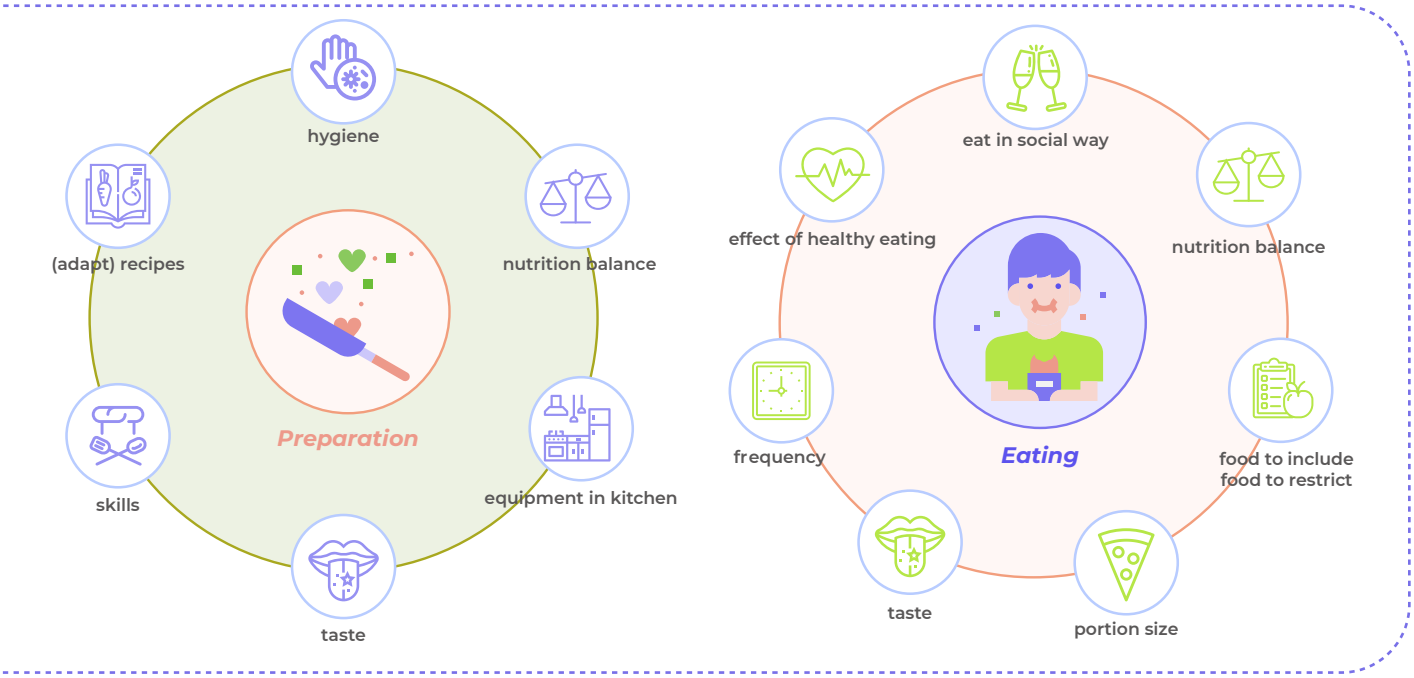


Figure 4. Components in the four food literacy domains

2.3. Users and context

2.3.1. Introduction

Socioeconomic status (SES) is the social standing or class of an individual or group. It is often measured as a combination of education, income, and occupation (American Psychological Association). Numerous studies have found an inverse relationship between food-related health problem (diabetes, obesity) and education, occupation, and income that is consistent across all adult age groups (Everson, Maty, Lynch & Kaplan, 2002). For instance, people with lower SES are more likely to consume diets high in fat (such as fried fast foods), low in micronutrient density, and to have lower intakes of fruit and vegetables, which increase the risk of diet-related disease and overall health inequalities (Turrell & Mathers, 2000). Nevertheless, the determinants of food choice can be individual and environmental (see the theoretical framework in Figure 5).

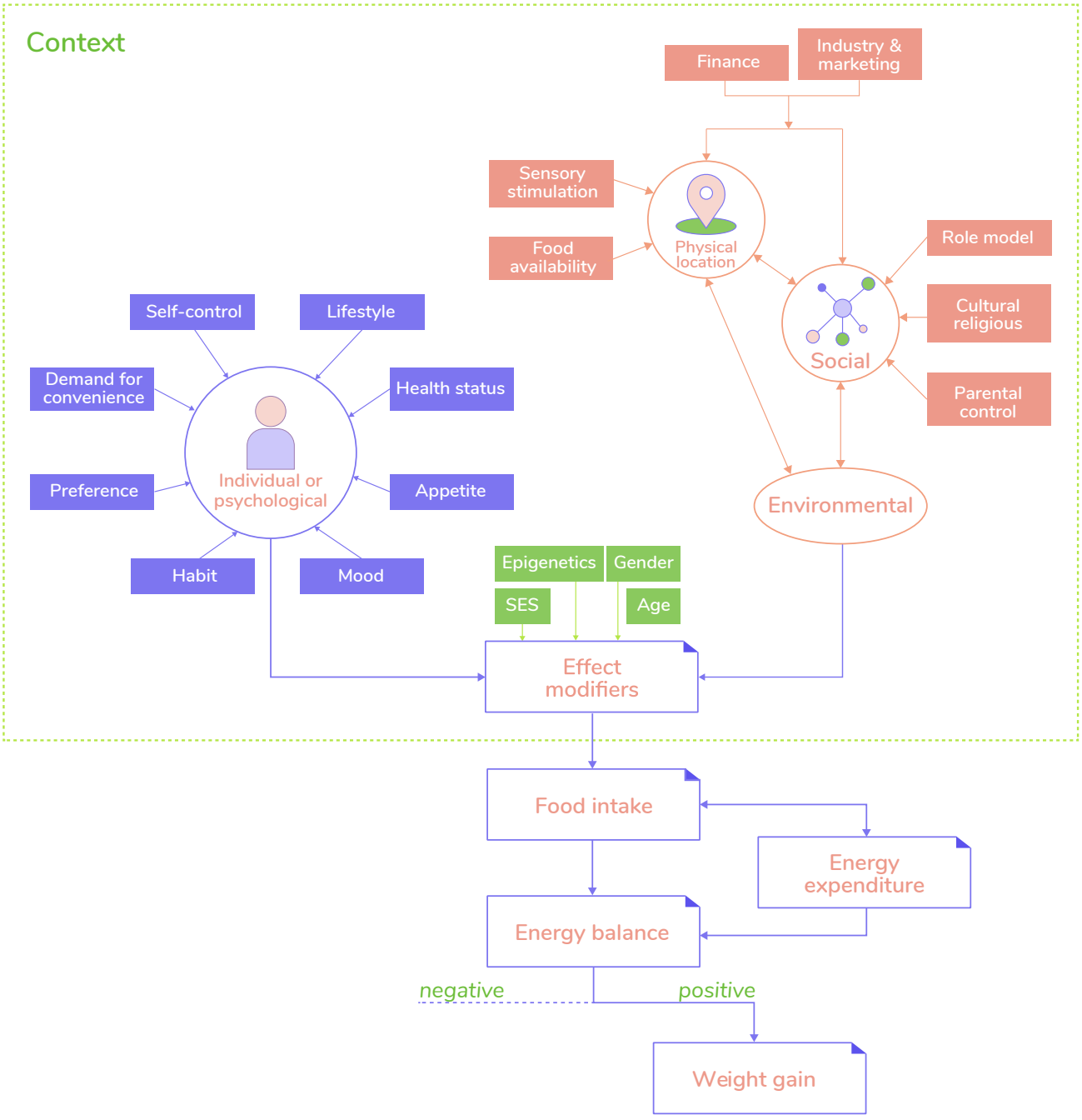


Figure 5. Theoretical framework of contextual factors

Most studies have examined food choices or behavior from an individual perspective to understand when, how much and what people eat. However, most of the food choices are made unconsciously in a context where the challenging external environment is continuously trying to seduce people to eat or consume food. Therefore, in order to get a better understanding of the reasons behind food behavior, it is necessary to find the characteristics of people with low SES and the contextual factors that influence their food behavior.

2.3.2. Factors influencing food selection

Thinking about making food choice, the first thing that came out in my head was purchasing food, which usually happens before preparing food and eating. Therefore, I observed people's behavior in the supermarket and did a small test to see what factors they based on more when making a food choice. I choose to conduct observation and the user test in Lidl because it is a supermarket who attracts many low SES people to go by its low price and regular discount activities

Setup

The test was conducted in Lidl, and it included an observation (Figure 6) and a short test to find if health-related notification would influence the choice of people with low SES. Like some supermarket (eg., Albert Hejin) already did, I made colorful labels to emphasize the health level of food; in this test, the health level of food was represented by how many calories it contained. Three types of chocolate eggs were divided into two groups to be compared and selected by consumers (Figure 7). Chocolate A and B had different price and energy; the cheap one had higher calories. A and C were the same in price but different in energy. The portion size and other aspects were all the same. The label with lower calories was green while the normal one was blue. The test was conducted in Lidl.

Figure 6. Observation in Lidl

Figure 7. Chocolates for the test

Research questions

. What typical behavior do people have when purchasing food products?
. What factors influence consumers' food

choice and how?

Participants

For user test: 10 random consumers in Lidl, 5 males and 5 females.

Observation

For the observation part, I stayed at Lidl in Delft for one and a half hours and observed people's behavior. During the interview session, I asked participants to circle the habits they have in the questionnaire, and also asked if they had other habits and the reason why they have these habits.

Result of observation

Q: What typical behavior do people have when purchasing food products?

- Many people choose the product quickly without wandering in the supermarket.
- People usually to buy food in bulk because it is cheaper and enables them to have fewer shopping times.
- The product in discount tends to be sold out fast.
- Some people will look at posters and brochures about special activities to find discount information.

Insights

- People may already have a plan or goal in their mind about what to buy before going shopping so they can make choices quickly.
- The food storage and weekly meal prep can be taken into consideration in the design stage since people usually buy a lot of food product at one time.
- Price matters a lot in food choice.
- Posters and flyers with discount information could be a good medium to convey information.

Test Procedure

1. Participants were asked to choose one between chocolate A and B and explain the reason.
2. Participants were asked to choose one between chocolate A and C and explain the reason.

After the test, a mini KitKat chocolate was sent as a reward for participation.

Result of test

Q: What factors influence consumers' food choice and how?

- In the first part, 9 people would like to buy a cheap one with higher calories because they wanted a cheaper one than a healthier one. Many of them did not care about the calories, some not even notice it.
- In the second part, participants who chose A said the energy did not matter, and someone wanted more calories because that was the reason they bought chocolate, to get energy. People with C concerned a bit more about health. See the full result in Appendix A.

Insights

- The price influence people's decision on selecting food while the calories intake does not matter.
- Many people lack the awareness of healthy eating. Some people have the willingness to eat healthier, but their behaviors are limited due to the lack of money.
- However, since people with low SES have less knowledge about food, the way to convey health information to them can be more direct. For example, put a slogan like "10 times healthier than usual" on the shelves.

2.3.3. Characteristics of users

From the test, I found that there were different types of users. Some people never care about health when buying food; in other word, they do not have the ***motivation*** to purchase healthy food products. Some people are willing to eat healthily but the healthy food in supermarkets are expensive and people do not know how to make a healthy meal by themselves, so they choose to buy cheap food which are less healthy. In this situation, people lack the ***ability*** to eat healthily. In a word, motivation and ability determine the food choice of people.

Since the goal of this project is to increase food literacy and being willing to learn food knowledge is part of healthy food behavior, it is important to know what factors influence people's motivation and ability to have a healthy food behavior.

Some characteristics of low SES people that related to food behavior were listed based on the research proposed by Pampel, Krueger & Denney (2010), which reviewed explanations of the relationship between low SES and unhealthy behaviors and the empirical support they have received. The health behaviors in their research included the avoidance of tobacco, participation in physical activity, and maintenance of proper weight and diet. Other insights from literature reviews were also combined. And according to the Fogg's Behavior Model (Figure 8), there are three elements must converge at the same moment for a behavior to occur: Motivation, Ability, and a trigger. Therefore I divided these characteristics based on their relation to motivation and ability.

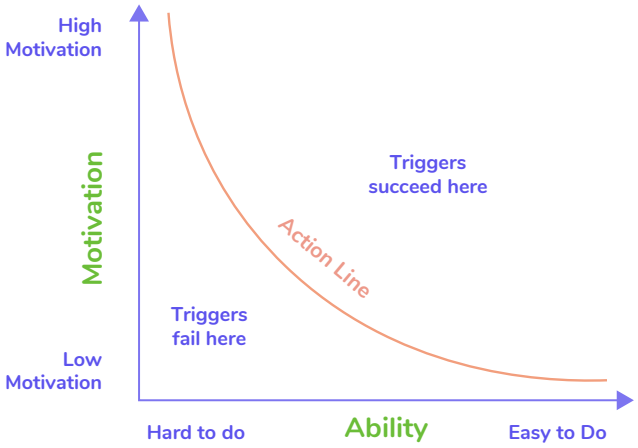


Figure 8. Fogg's behavior model

Characteristics related to motivation

- ***More Stress:*** Chronic stressors in the daily living trigger compulsive behaviors such as overeating, drinking. They may be indulging in enjoyable but unhealthy behaviors for pleasure and relaxation.
- ***Present-mindedness:*** More heavily discount the future. Smaller economic benefits are chosen, and future financial security and earning potential are sacrificed.
- ***Feel fatalistic*** about their ability to act in ways that extend their lives.
- ***Lower lifetime earnings and wealth:*** There are fewer reasons to invest in future longevity, so people focus more on the present in making decisions about health behaviors (Cutler & Lleras-Muney, 2006).
- ***Doubt about the (limited) benefits they can get*** in terms of longevity from healthy behavior
- ***Cultural bias:*** In less developed countries: weight may signify success and well-being.
- ***Peer influence:*** It is unusual for low SES people to build networks of health-oriented family members, relatives, friends, and neighbors to support healthy behavior.
- ***Responsibility for the family:*** Women are likely to be responsible not only for their diets but also for those of their families, especially

children (Inglis, Ball & Crawford, 2005).

• ***Vulnerability to commercial advertisings:*** Children in low SES families tend to watch more television. So they have greater exposure to food advertisements (Nicklas, Theresa A., et al., 2011).

Characteristics related to ability

• ***Lack of money:*** People with low SES have limited budgets to support healthy food behavior, and it is also unaffordable for them to purchase aids for healthy behavior.

• ***Lack of time and energy:*** People with low SES are hindered by more pressing matters in their daily life and schedule. All of these problems might require their immediate attention and may not leave enough room to focus on a lifestyle or habit change (Pechey & Monsivais, 2016).

• ***Lack of knowledge and access to learning:*** Many of low SES people are less educated and have limited knowledge of the harm of unhealthy behavior, which leads to less motivation to adopt healthy behaviors.

• ***Contradiction:*** People know what is good for their health, but they are not doing it. The ability to act on health knowledge rather than the knowledge itself affects health behavior.

For these characteristics, I used the approaches mentioned by Fogg to get suggestions for the later design stage.

Motivation

There are three drives highlighted by Fogg:

- ***Sensation:*** the physical level of motivation. People are motivated to seek pleasure and avoid pain. Therefore, the motivation can be enhanced if people feel learning food knowledge and eating healthily is enjoyable.
- ***Anticipation:*** the emotional level of motivation, specifically, hope and fear. For low SES people, in order to use hope as a motivator, it is important to make them realize the meaning of healthy eating and the consequence of unhealthy behavior.
- ***Belonging:*** the social level of motivation; people want to feel like they belong and do not want to feel rejected. For example, creating a social atmosphere where people support and encourage each other to eat healthily may increase people's motivation.

Ability

The word ability here refers to how simple it is for someone to do something at a particular moment in time. Fogg outlines six ways to make a task simpler and encourage new behavioral patterns to stick.

- ***Time:*** Time is precious and no wants to waste it. People are much more likely to complete a ten-minute task than a whopping one-hour one. Low SES people have many pressing matters to deal with. Therefore the interaction between users and food informatics tool need to be clearer, more manageable and less time-consuming.
- ***Money:*** People with low SES lack money and if the design can help them with saving money, their motivation might be increased.
- ***Physical effort:*** No one likes doing unnecessary work, especially for many low SES people who are busy with their work and family, making the experience more effortless is useful to stick.
- ***Thoughts:*** Since many low SES people are low educated and cannot process information well, the call to action should be simple and clear to understand.
- ***Social deviance:*** People want to be related to others. Adding social functionality can make users feel that they are not the only

one who use the design.

- ***Non-routine:*** Everyone has their daily routines. The routines help people to structure their lives, therefore anything sits outside of a daily routine is much less likely to get done. The design could base on the existing routines or works as an add-on function.

Trigger

There are three types of trigger:

- ***Spark:*** a trigger that comes with added motivation. It works best for those who have the ability but lack the motivation. People with low SES may have other motivations in their daily life that could be related to healthy food behavior.
- ***Facilitator:*** a trigger to give users instruction and help them reach the level of ability needed. It is suitable for people who have the motivation but lack the ability. In this project, the facilitator could be easy and quick cooking tips for people to get basic food knowledge.
- ***Signal:*** a trigger for people who already have the motivation and the ability to start the action, e.g., using alarm clock as reminder.

If we use motivation and ability (to make healthy food choice) as two dimensions, there are four types of people to be considered (Figure 9). Since people who have both motivation and ability are more likely to change their behavior without any intervention, this project will not focus on this user group. For the rest three types of users, to make it simple to analysis, I divided them into two groups:

Group A: People who (may have motivation but) lack the ability.

Group B: People who (may have the ability but) lack the motivation.

People in Group A lack time and money, and there are many limitations that make a healthy lifestyle hard to achieve. In some case, people have the competence to do self-reporting about their diets, but they are not engaged in doing it because they think it is

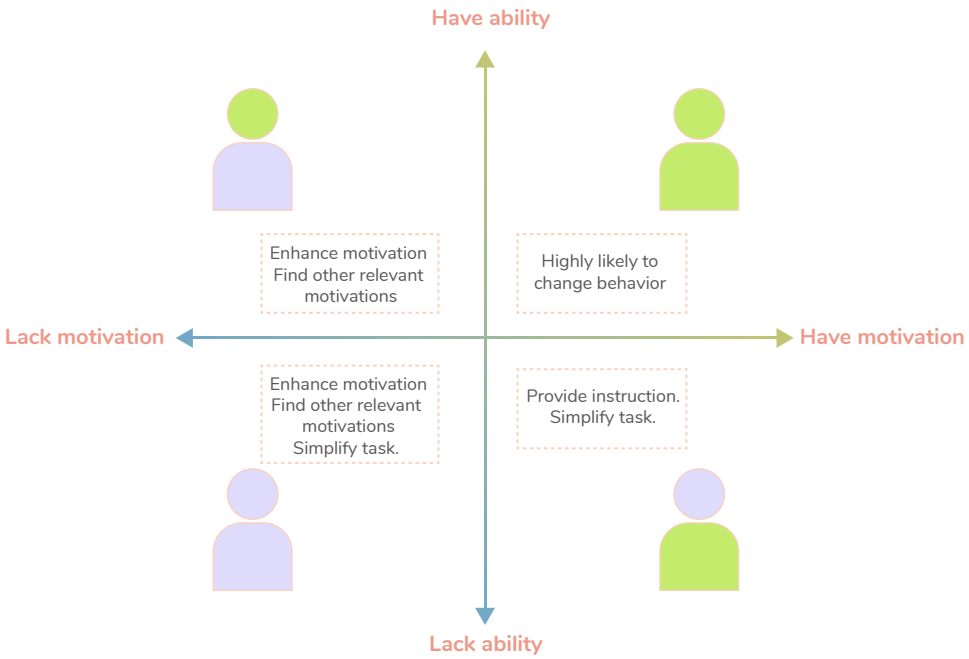


Figure 9. Four types of users according to Fogg's behavior model

not worth the effort. For this group of users, the design challenge is to reduce the effort and difficulty of consuming and reflecting on food literacy.

People in Group B do not know or care much about the meaning of healthy food behavior, and therefore they have no reason to learn food knowledge or form a healthy eating habit. So the design here should evoke the motivation or link the desired food behavior to other existing motivations.

2.3.4. Contextual factors related to food behavior

The research of Food Sampler project aims to make an overview of relations between food intake and context. Based on the results of the research (see the complete result in Appendix B), the contextual factors that influence people's food behavior are selected and summarized in Figure 10. The insights for design as well as relevant design theories are also listed and will be discussed in the next section.

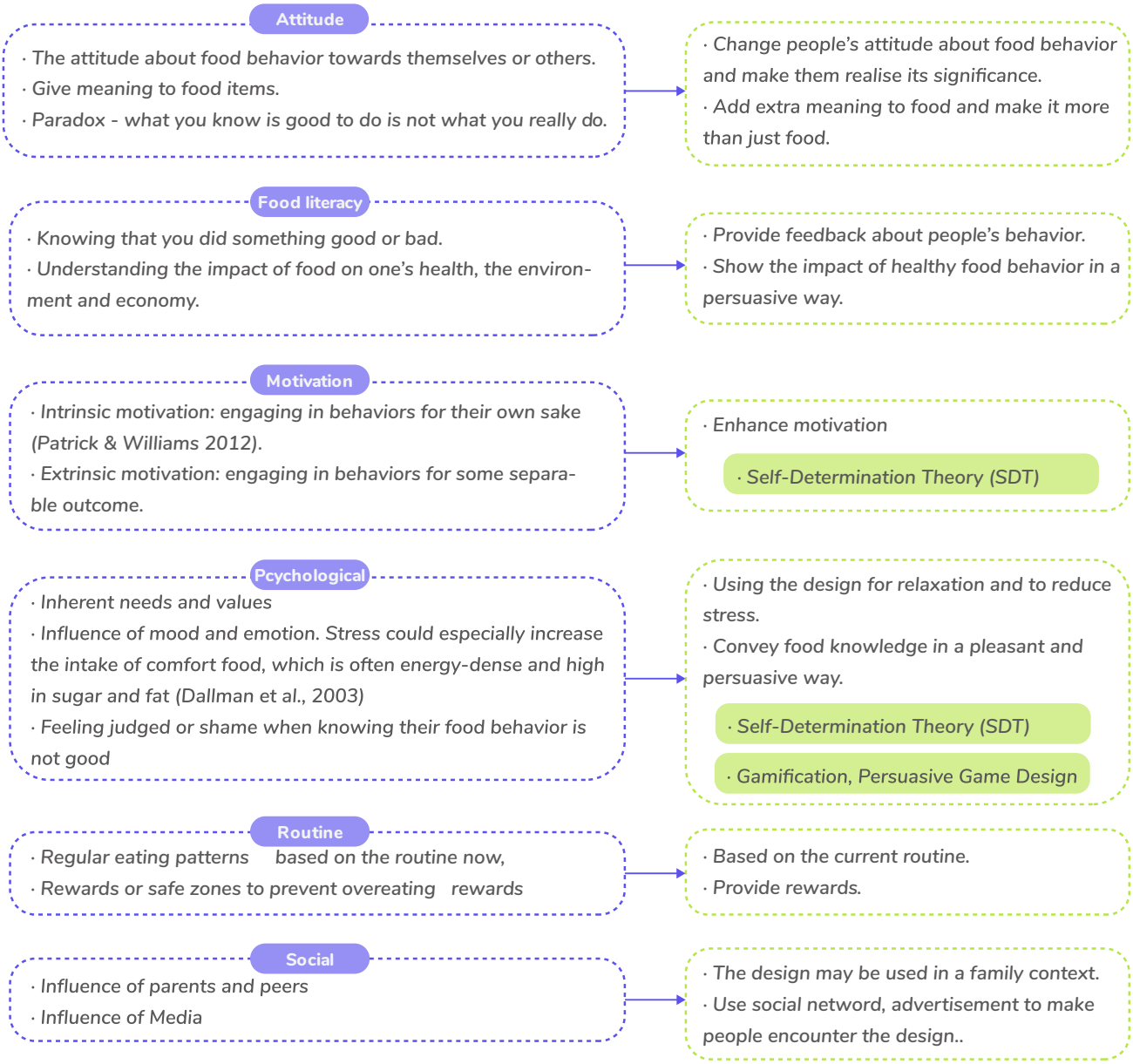


Figure 10. Contextual factors related to food behavior and insights for design

2.4. Design theory & method

2.4.1 Introduction

Based on the food and eating context and the characteristics of low SES people, theories related to motivation and persuasion are chosen to help with the analysis and design process. Self-determination theory states the inherent human needs that drive people to be curious about the environment and interested in learning and developing one's knowledge. Nevertheless, many contextual factors influence people's food behavior, and therefore gamification and integrated behavioral models are applied to deal with these factors and enhance motivations by engaging users with food data consuming and reflecting.

2.4.2. Self-Determination Theory (SDT)

Basic human needs

Self-Determination Theory (Figure 11) is a theory of motivation and personality that concerns people's inherent growth tendencies and three innate psychological needs: autonomy, competence, and relatedness (Ryan & Deci, 2000).

Autonomy *is the need to feel volitional, as the originator of one's actions in carrying out an activity.*
Competence *reflects the need to feel efficacious and capable of achieving desired outcomes.*
Relatedness *involves the need to feel close to and valued by important others, to have a sense of belonging with peers, family, and community.*

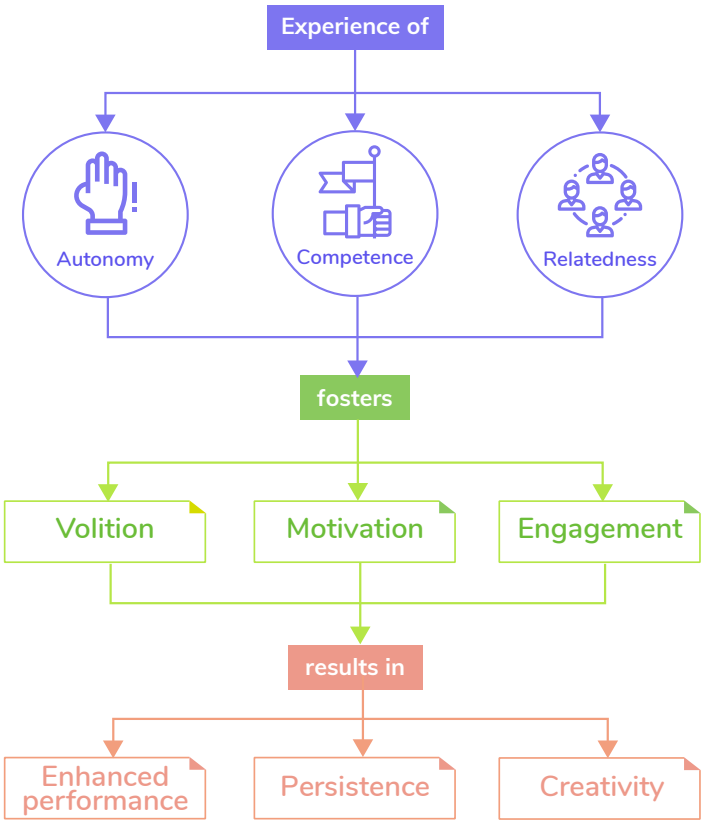


Figure 11. Mechanism of self-determination theory, based on Ryan & Deci, (2000)

Motivation

Motivation is an important aspect in self-determination theory. SDT mentions intrinsic motivation and extrinsic motivation:

> **Intrinsic motivation** *is characterized by engaging in behaviors for their own sake (Patrick & Williams 2012).*
> **Extrinsic motivation** *is characterized by engaging in behaviors for some separable outcome, whether this comes in the form of tangible rewards, social acceptance, proving something to oneself, or maintaining consistency.*

The theory posits a self-determination continuum (Figure 12) which ranges from amotivation to intrinsic motivation according to the level of self-determined.

As it is shown in the graph, interest, enjoyment, and satisfaction can evoke intrinsic motivation, which is highly autonomous and keep for a long time. Moreover, extrinsic motivation can be enhanced by external rewards and punishments, which has low autonomy but can work for a short time. Together these can become the basis of the design: be enjoyable and interesting to use, and meanwhile, provide proper rewards to attract users. Also, families and peers can be involved to meet the need for relatedness and create more interaction between users to make them feel engaged.

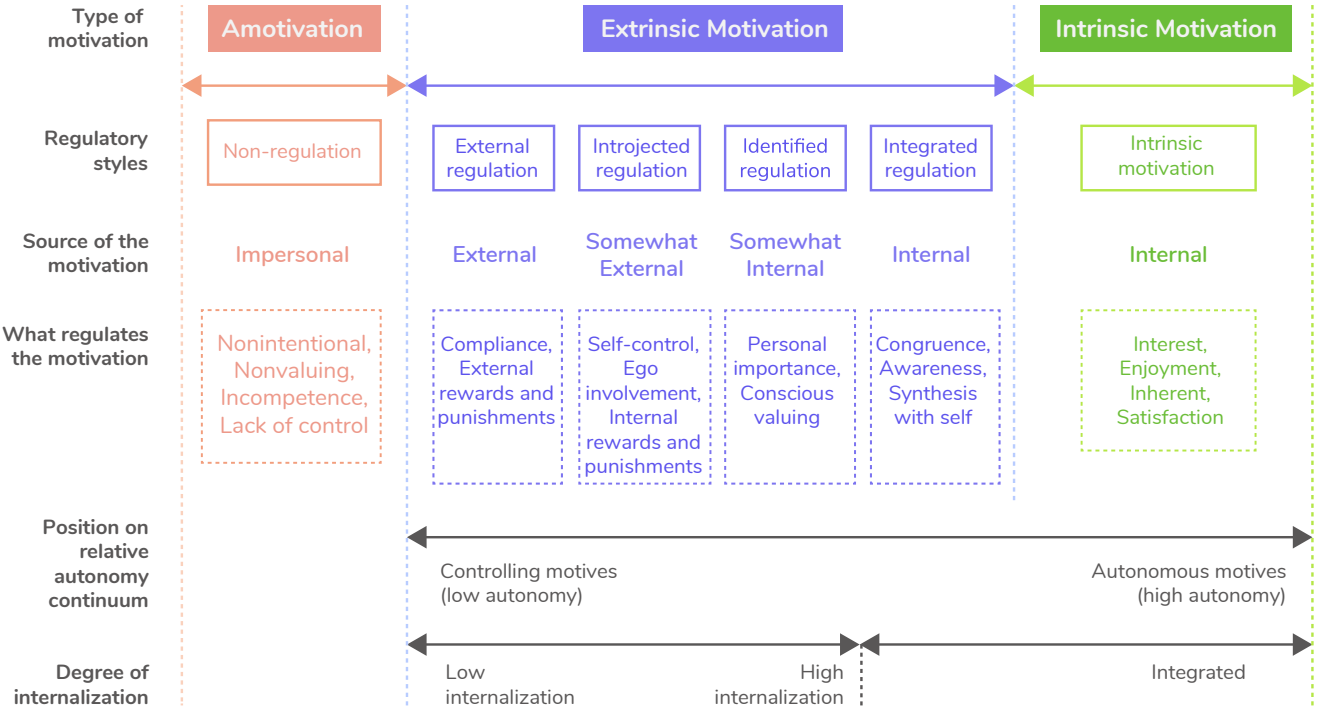


Figure 12. Schematic relation of the five types motivations according to SDT, based on Ryan & Deci, (2000)

2.4.3. Gamification

Introduction

Games are not only able to provide entertainment but also stimulate players to acquire skills that can benefit them outside the experienced world of gameplay (Visch et al., 2013). Playing digital action games may improve cognitive spatial skill (Feng, Spence & Pratt, 2007) and being indulged in fictional story world may enhance prosocial skill resulting in altruistic behavior or belief change (Johnson, 2012). The research result of people with low SES shows that the very lack of motivation resulted from many contextual factors is a big obstacle for them to learn food knowledge or change into a healthier behavior, and gamification can be a suitable way to achieve the goal of engaging people with low SES to use food informatics tool and increasing their literacy. Games are generally motivating because they fulfill the basic motivational needs for autonomy, social relatedness and competence (Przybylski, Rigby, & Ryan, 2010) and gamification focuses on motivating users through enjoyable or exciting game mechanics and transferring game effect to real-world effect.

Define gamification

Gamification is the concept of applying game mechanics and dynamics to non-game contexts to make people more motivated and engaged in solving problems (Kim, Hyerang, et al., 2015).

> **Game mechanics** *are functional elements in gamification, including a leaderboard, points, badges, levels, and challenges or quests (Zichermann & Cunningham, 2011).*
> **Game dynamics** *are related to the individual's reactions to satisfy fundamental needs and desires, including the desire for achievement, altruism, competition, rewards, and self-expression (Bunchball, 2010).*

The combination of game mechanics and dynamics creates a motivating, emotional, and entertaining interaction, driving the users' engagement and participation and stimulating them to move the action forward to achieve goals.

Game elements

The game world is created by selecting, combining and enhancing different game elements. An overview of game elements can be seen in Table 1. This selection is based on existing literature on gamification (Korhonen, Montola, & Arrasvuori, 2009 & Garris et al., 2002).

One game element can be represented in various forms, for instance, leaderboards, points, and badges are usually used to create the experience of competition, and the experience of fantasy can be expressed with avatars and fantastic narrative themes.

Combining with motivations mentioned in SDT, typical factors that make an activity intrinsically motivating in game design are elements as challenge, curiosity and fantasy. Extrinsic motivations typically used in game design are rewards, although they can be considered less effective than intrinsic motivations (Garris, Ahlers, & Driskell, 2002).

In design process, these game elements will be selected and combined according to the context and requirement to find the most effective way of engaging users.

Game element	Description
Captivation	Experience of forgetting one's surroundings
Challenge	Experience of having to develop and exercise skills in a challenging situation
Competition	Experience of victory-oriented competition against oneself, opponent or system
Completion	Experience of completion, finishing and closure, in relation to an earlier task or tension
Control	Experience power, mastery, control or virtuosity
Discovery	Experience of discovering a new solution, place or property
Eroticism	Experience of sexual pleasure or arousal
Exploration	Experience of exploring or investigating a world, affordance, puzzle or situation
Expression	Experience of creating something or expressing oneself in a creative fashion
Fantasy	Experience of make-believe involving fantastical narratives, worlds or characters
Fellowship	Experience of friendship, fellowship, communality or intimacy
Mystery	Experience of evoked curiosity
Nurture	Experience of nurturing, grooming or caretaking
Relaxation	Experience of unwinding, relaxation or stress relief. Calmness during play
Rules/Goals	Experience of feedback on progress towards goals
Sadism	Experience of destruction and exerting power over others
Sensation	Meaningful sensory experience
Simulation	Experience of perceiving a representation of everyday life
Subversion	Experience of breaking social roles, rules and norms
Suffering	Experience of frustration, anger, boredom and disappointment typical to playing
Sympathy	Experience of sharing emotional feelings
Thrill	Experience of thrill derived from an actual or perceived danger or risk

Table 1. Game elements (based on Korhonen, 2009 & Garris, 2002)

Gamified healthcare apps

Because this project considered to use a gameful way to engage users, an analysis of 8 gamified healthcare apps (see Appendix C) of different domains was carried to see what game elements they used (Figure 13). The analysis was done by finding information on each game through the Internet and asking people to use them on the mobile phone.

An example case of Zombies Run can be found in Figure 14. It is an immersive running game. Players act as the character "Runner 5" through a series of missions, during which they run and listen to various audio narrations to uncover the story.

The result showed that game elements like ***completion, challenge, rules/goals, competition, and simulation*** were most frequently found. Some products also use elements like ***exploration, nurture, and fantasy*** to increase enjoyment during gameplay. Therefore, when looking at engaging food informatics tools to increase the literacy of people with low SES, these game elements can be taken into consideration first.

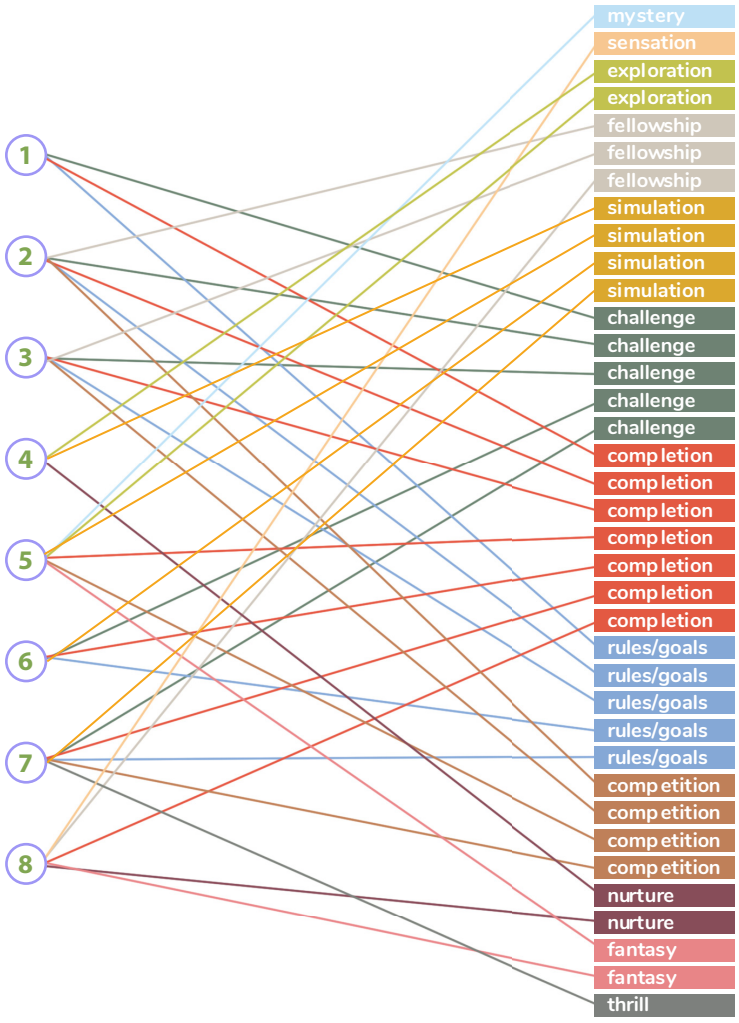


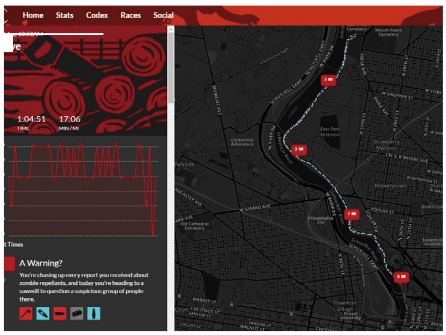
Figure 13. The overview of game elements used

Sensation

While running, the players listening to audio narrations and music from their own playlists.

Thrill

Being chased by the zombies make players thrilled.



Challenge

Players need to run faster than zombies and the missions have different levels.

Competition

Runner need to compete with zombies.

Completion

During missions players need to collect items to help the town survive.

Rules / goals

Players need to uncover mysteries and finish missions by running.

Simulation

The game simulates the experience in horror movies.

Figure 14. The example case of Zombies Run

2.4.4. Persuasive Game Design Method

The core of persuasive game design (PGD) is "to transport the users' experience from a real world experience towards a more motivational game world experience in order to facilitate the realization of aimed-for transfer effects in the real world", (Visch et al., 2018).

Persuasive game focus more on persuasion, aiming to persuade player to change behavior, views or influence their behavior. The gameful behavior in the game world is designed to facilitate or persuade the realization of real-world goals. See the model of PGD in Figure 15.

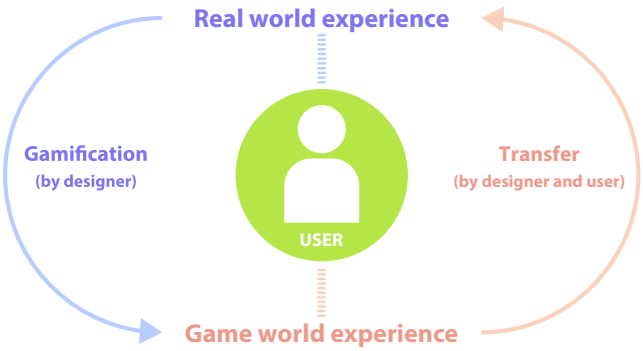


Figure 15. - Persuasive game design model (based on Visch et al., 2013)

The cookbook method (Visch et al., 2018) is proposed as a structural method for designing persuasive games. The typical PGD meal is composed of four dishes. The dishes represent major steps which are commonly used to design a persuasive game. These dishes include:

Dish 1: *Defining the transfer effect*
Dish 2: *Investigating the user's world*
Dish 3: *Game Design*
Dish 4: *Evaluation of effects*

Ingredients: *the typical components of a dish, such as eggs for a breakfast dish.*
Utensils: *the various techniques and tools that designers can use when preparing the ingredients for a dish.*

In the project, research insights are summarized into dish 1 and dish 2 by using this method, which gives a clear overview of the current situation and desired effect. Dish 3 and 4 are filled iteratively in the design phase.

Dish 1 - Ingredients

Effect type:

Attitudinal change: increase the willingness of consuming and reflecting on food-related data

Performance: increased food literacy, be able to make healthy food choice.

Change type:

Encourage a new behaviour / a behaviour based on existing routine of being engaged in data providing and consuming.

Point of Impact

During or after gameplay

Domain

Food behaviour, healthcare

Dish 1 - Utensils

· Investigate scientific literature
· Carry out best practices research

Dish 2 - Ingredients

Real world context:

Users' current experience: Less healthy food behaviour. Struggle with self-reporting activity due to constant judgement and immediate effort of reporting yet unclear direct benefit (positive feedback)

Context: Impact of social environment, sensory stimulation, food availability, etc.

Existing motivational affordances:

Needs: Autonomy, competence and relatedness

Motivation: intrinsic (feel enjoyable during gameplay) and extrinsic (separable outcome like rewards).

Attitude towards transfer effect:

Users' characteristics:

- Lack of money.
- Hindered by more pressing matters in their daily life.
- Present-mindedness—>Less motivation to adopt healthy behaviours.
- (Low) Self-control and low food intelligence.
- Mood, emotion like stress influences behaviours.
- Dislike the feelings of judgement or shame.

Dish 2 - Utensils

· Investigate scientific literature
· Carry out best practices research
· Conduct research by means of intervention
· Create personas

2.5. Entering the design phase

In order to have a clear conclusion of research stage before starting to design, two personas and scenarios were created to discuss different user types, design requirements, and design directions. Before these, to get more inspiration, there was an analysis of existing dietary products and a user test about how to convey food information to users.

2.5.1. Analysis of existing dietary apps

The goal of this study was to find the typical functional features of the existing popular dietary smartphone apps using assessment criteria based on the study of Chen, Cade & Allman-Farinelli (2015). Eleven apps from the free and paid sections of Google Play and iTunes App Store were selected, and a benchmark analysis was conducted to see what features were contained. All of these apps mainly focus on weight management, include the function to record diet and food intake (self-monitoring). The overview of this assessment can be found in Appendix D.

The result (Figure 16) showed that ***reminders*** were used frequently to trigger users to record food intake every day, and most of the apps provided a ***recommendation*** of nutrients intake as well as ***recipes*** for eating healthy. ***Social support and visualized behavior change process*** could meet the need of relatedness and give users a feeling of achievement. These products could be effective for people who already had the motivation to lose weight or change eating habit, but there was still a lack of persuasiveness to push low-SES users to maintain the use of these self-reporting tool.

2.5.2. User Test- Possible Media to convey information

It is important to consider how to bring the design to users (or bring users to the design), therefore this test was conducted to see people's reaction about intervention related to food literacy.

Test setup

This test aimed to see people's reaction to the food information provided by others. Since

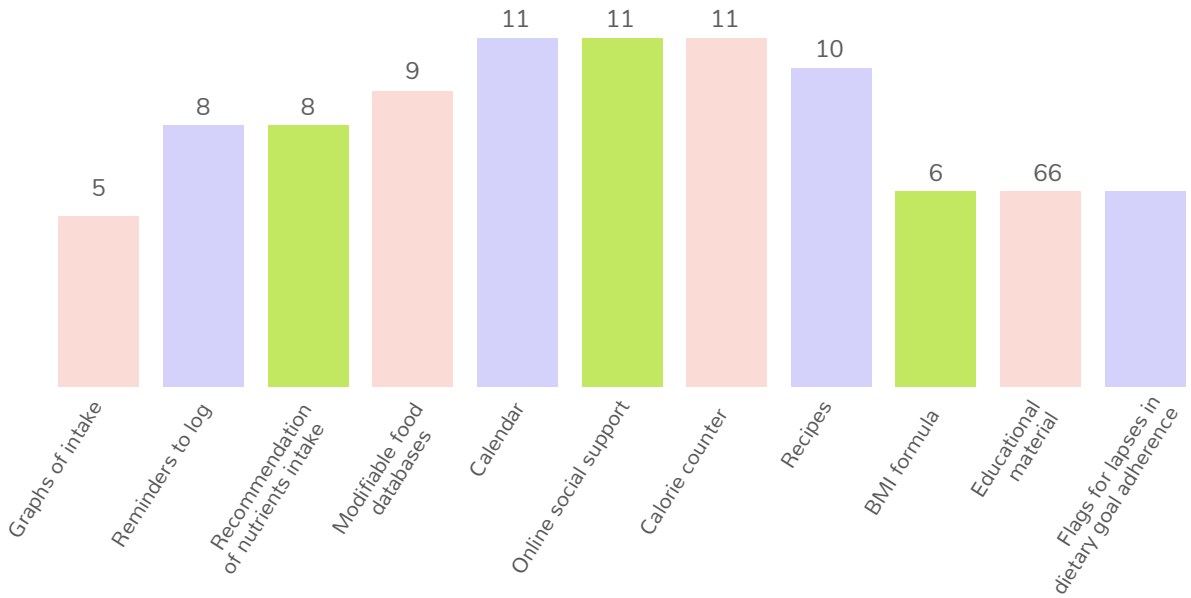


Figure 16. The overview of functional features that popular dietary apps have

people used to receive flyers and brochures in daily life, I decided to use flyers (Figure 17) as the first medium to convey food knowledge. Moreover, according to theories about extrinsic motivation, people tended to be more motivated when having rewards, so I used chocolate wrapped with paper as the second medium (see original file in Appendix E). The information on flyers and chocolates were the same, which was about the origin, the making process of chocolate and the benefits of eating it. The texts were in Dutch to make sure people can read them. Fifteen flyers and fifteen chocolates were prepared for the test.

Figure 17. Flyers and chocolates used in the test

Research question

Is using reward helpful to convey food knowledge?

Participants

37 random customers in Lidl.

Test procedure

During the test, I stood at the entrance of Lidl, sending flyers and chocolates (Figure 18). A friend of mine helped me to record videos and observe the following actions of people when they left the supermarket.

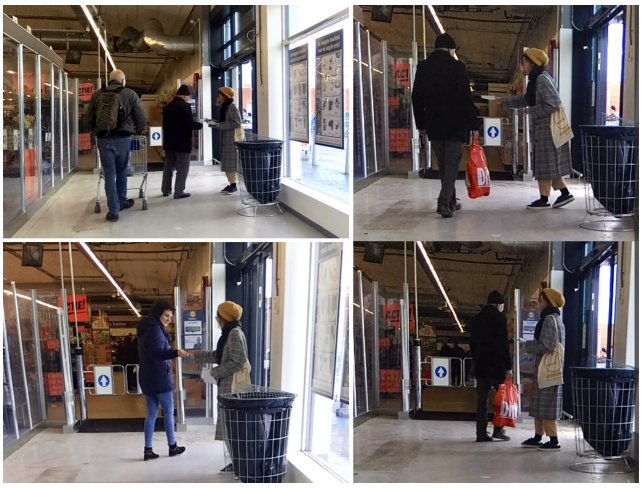


Figure 18. Handing out flyers and chocolate at the entrance of Lidl

Result and Insights

Q: Is using reward helpful to convey food knowledge?

About half people refused the flyers, but no one refused chocolates. Most people read information on flyers and chocolates.

Therefore, using rewards or adding extra value when convey information would make people more willing to accept, and the possibility for them to learn and increase literacy would be enhanced. Besides, thinking about the prototyping test in the design phase, this approach could also be used to recruit participants for user research.

2.5.3. Personas and scenarios

Personas

Two personas (Figure 19) were created based on research insights. They represent the tow users groups in the motivation-ability dimension mentioned in 2.3.3.:
people who (may have motivation but) lack the ability to learn food knowledge or have healthy food behavior, and people who (may have the ability but) lack the motivation to do so.

Each persona has different characteristics according to the research of people with low SES, and therefore the design focuses will be different. These personas will be used to provide inspiration in the design phase.

Persona A: Ela has the motivation to make healthy food for her children but she cannot do what she wants due to limited time and cooking skills.

Name: Ela
Age: 34
Occupation: Cashier & waitress in fast food shop
Family: Father, mother, husband, son, daughter

Bio:
Ela has a busy life. She has two young children, she *wants to take good care of them and let they eat more healthy food*, but the *lack of time* due to work commitments rather than family commitments *caused a barrier for her to prepare healthy foods for her families.* When she goes shopping at the grocery store or low-price ranged supermarkets such as Lidl and Aldi, she always chooses food products packed in bulk and makes sure the trolley is full, so she does not need to shop often.
Cooking is unpleasant for her, especially when she spends so much effort but the meal she makes is not delicious. Therefore, Ela sometimes brings fast food or takeaway meals home when she is unwilling to cook. She is *trying to improve her cooking skill* and hopefully one day she can make good meals that make everyone in her family happy.

GOALS

· To take good care of her children.
· To have more free time.
· To improve cooking skill.

FRUSTRATIONS

· Uncertainties in food selection and preparation.
· Unable to meet everyone's taste.

Persona B: Fouad has the ability but he doesn't see the meaning of healthy eating.

Name: Fouad
Age: 18
Occupation: Student
Family: Father, mother, brother, sister

Bio:
Fouad is a high school student who doesn't like school very much. He sometimes feels it is difficult to concentrate during the classes and he always checks on his mobile phone to check the updates the social medium.
Fouad also *likes playing games*, especially card games and competitive games. He plays a lot instead of doing homework, which makes his parents very angry with him and the constant conflict between them makes Fouad tired and stressful. He wishes he could be independent as early as possible.
He often goes out and eats with friends, and they eat a lot of junk food, but Fouad thinks he is still healthy and energetic. *He doesn't see the meaning of eating a lot of healthy food which is expensive and bad tasting for him.*
He ignores the slogans of healthy diets and doesn't really care about the ingredients in meals as long as they tastes good.

GOALS

· Win the championship in the game he's playing.
· Move out and have his own place, do whatever he wants and eat whatever he likes.

FRUSTRATIONS

· Keep receiving advertising message about healthy recipes, which is useless to him at all.

Figure 19. Personas

Two initial design directions

The two types of users lead to two design directions:

① .***A product (with game elements) to provide dietary advices.*** This direction aims to lower the difficulty of learning food knowledge and having healthy food behavior by providing food related tips and approaches according to users' need. Game elements will be used to make people be more engaged in using.

② .***A game with food elements.*** This direction focuses on how to convey food literacy through gameplay and make people realise the meaning of healthy food behavior by playing an enjoyable game.

Scenarios

Based on the personas and design directions, two scenarios were made to explore the possible interactions with design interventions and the effect achieved in desired situations. In order to have a more comprehensive analysis, each scenario has two extra samples with different characteristics. There is a variety of motivation and limitation among these personas, which leads to different forms of self-reporting and feedbacks. Each scenario was analyzed in the following aspects:

Motivation and obstacles: the reasons behind people's current behaviors.
Entrance points: how will users get access to design intervention.
Interaction with the design: how will people use the design.
Forms of self-reporting and feedback: what kind of information the design wants users to upload and what feedback will users get.
The reason of food choice: factors that influence people's food choice after using the design.
Benefits: what kind of benefits can people get from using the design.
Moreover, for each stage of the user journey, the design goals, possible design strategies and methods were listed.

The first scenario (Figure 20) is mainly based on the persona of Ela, the woman who has a busy job but wants to take good care of her children by preparing healthy meals for them. There are two extra personas, one is a woman struggling with emotional eating and wants to control sugar intake, the other is a man who has diabetes and needs to change diet. All of them have motivation but lack the ability to change food and eating behavior.
In these situations, the design mainly focuses on providing help and instruction to simplify the using process. The design works as a traditional food informatics tool but with game elements to increase engagement.

The second scenario (Figure 21) is about people who can have healthy food behavior but don't want to. For example, the girl who dislikes eating vegetables will not choose salad but wants more snacks even though she knows vegetables are good for her health. And the man who just wants to get more energy from eating always choose food products with higher calories. The teenager eats a lot of junk food because he does not believe the consequence of unhealthy food behavior. It is hard to impart food knowledge directly to these users, so the design here provides a game world to attract people and convey food knowledge during the gameplay.

People who lack the ability

Design goals.

Design interventions.

Motivations & Obstacles

Entrance point

Get access to the design.
Feel curious or be attracted.

Interaction with the d

Be capable of using the pro
Be interested and engaged
using the design.

Responsibility for herself.
Wants to stop emotional eating

Stressful life.
Low self-control.

Through social media.

Self-monitoring
Coping with stress
Learning

Relat

Responsibility for himself.
Wants to control diabetes through proper diet.

Lack of knowledge about diabetes.
Low educated. Lack of the ability of processing information.

From the hospital or doctor.

Learning
Making diet plans
Self-monitoring

Responsibility for families, especially for taking good care of her children.

Lack of time. Hard to keep the balance between work and family.
Limited cooking skill.

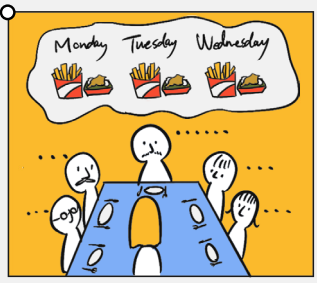
In the supermarket or grocery shops.

Learning
Prepare meals
Collecting recipes

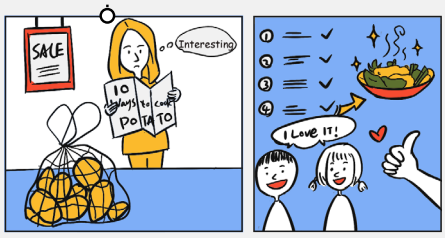
Put Advertising on the Internet.
Use flyer or brochure related to food products.

Provide instruction.
Low entry threshold to
users can easily unders
use the product.
Provide general knowle
Set graded tasks.

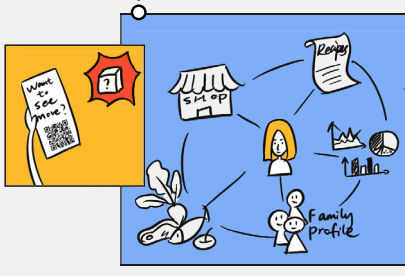
Ela is busy with work and housework and she always has trouble in preparing food for her big family.



She often cooks the same dishes three times a week or buys fast food. Of course, this will not satisfy anyone.



She receives a booklet called 10 ways to cook potato when buying a big bag of potato in the supermarket.
She tries some of them, following the guide.
Surprisely, everyone like the meals!



Ela scans the QR code on the flyer and re
contains information about food nutrition
She creates a family profile and enters th
see relevant recommendation. The produ
just like games. Ela feels encouraged whe
meals she made and gains the first badge
herself not only in the app but also in real

Scenario A
A product (with game elements) to provide dietary advices.

esign
duct.
in

Self-reporting and feedback
Be willing to report.
Form a habit gradually.

Reason of food choice (desired situation)
Be able to apply food knowedge into daily activities.

Benefits
Increased food literacy.

Food and mood log.
ion between mood and food intake.
Instruction to increase self-control.
Recommendation of food intake.
Reward and Encouragement.

Mood
Meals
Location or situation

Suitable amount of sugar and fat.
Less comfortable food.

Better physical and mental condition.
Sense of achievement.
Increased self-control.
Support from peers.

Food log.
Log of blood sugar level.
Influence of food intake.
Recommendation of food intake.

Meals
Blood sugar level

Low sugar and fat.
Rich in nutrition.

Better physical condition.
Ability to recognize what food is good for health and what to reject.
Support from families.

Recommendations of recipes.
according to everyone's preference.
Food log.
Process of improvement.

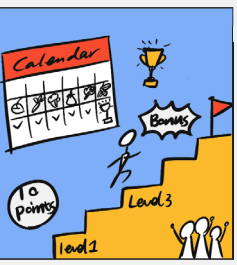
Meals
Personal preference
Recipes
Comment and feedback of meals

Families' preference.
Instruction from the recipes.
Easy to prepare and cook.
Convenient to store.

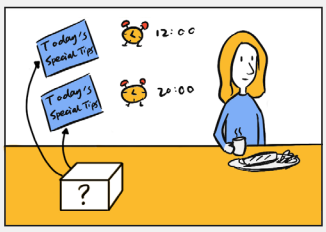
Sense of achievement.
More free time.
Improved diet quality of the family.
Improved cooking skills and time management skill.

make sure
stand how to
edge.

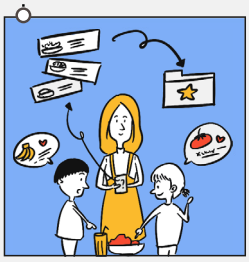
Prompt specific goal setting.
Time management .
Provide feedback on performance.
Provide contingent rewards.
Provide social support.



ceives the product. It , recipes to local shops. eir eating preference to ct has a points system en she uploads the e. She wants to upgrade world.

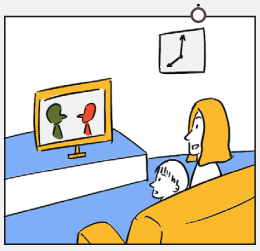


Using the product becomes part of her daily routines. During lunch and after dinner she always read one cooking tip or food knowledge point sent by it, which only takes 2 minutes.



She records the meals and adds the successful one to her favorite. She finds that children eat more fruits and vegeta-bles than before.

After using the product for a while, Ela is able to make plans before shopping and has more skills about food storage and how to make the most of her groceries.



Now Ela can efficiently finish food-related housework and get more free time to watch TV and relax.

Figure 20. Scenario A

People who lack the motivation

Design goals.

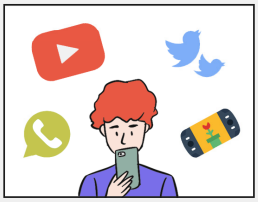
Design interventions.

Motivations & Obstacles	Entrance point Get access to the design. Feel curious or be attracted.	Interaction with the desi Enjoy the ga Be competitive and curio Learn food knowledge unconsciou
Likes watching cartoon on TV (positive Influence: have more access to information). No motivation of changing food behavior. Dislikes vegetables. Loves snacks. Influenced by commercial advertising.	Friend's recommendation.	Playing the game alone with pare
Wants to get more energy from food. No motivation of changing food behavior. Uses beer to help cure tiredness after whole day working.	Social media. Influence from peers.	Playing the game alone with frien
Addicted in social media (positive Influence: have more access to information). Likes playing games with friends. No motivation of changing food behavior. Doesn't see the meaning of healthy diet.	Advertisement on TV or in shops. Influence from parents.	Playing the game alone with frien

Spread information and advertisement through social media.

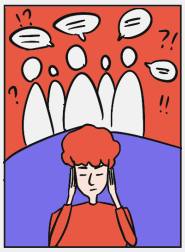
Provide rewards.
Involve cooperation or competition.
Set graded tasks and challenges.
Provide feedback on performance.
Combine online and offline activities.
(other strategies of gamification)

Fouad is weary of studying.



He cannot help but using his mobile phone to watch video on YouTube or check the latest trends on Twitter during the classes.

He plays a lot, but he doesn't feel relaxed. His parents get angry and there are more and more conflict. Fouad hates being judged by others.



His friend recommends a game for him to have some fun.

Fouad downloads the It's a collectible card g with a food theme.

Scenario B
Design direction: A game combined with food elements and food activities.

	Reason of food choice (after gameplay)	Self-reporting and feedback		Benefits
	Be more conscious about food and eating than before.	Be willing to report. Form a habit gradually.		Increased food literacy. The ability to apply food knowledge.
or nts.	To get rewards. To earn points. To win the game. Personal preference change.	Pictures of Meals Pictures of cooking process	*Points/Reward/achievement/ rising ranking in the game. Food log.*	Enjoyment Common topics with friends Rewards from parents
or ds.	To get rewards. To earn points. To win the game. To eat healthier	Food products he bought Pictures of Meals	*Points/Reward/achievement/ rising ranking in the game. Food log.*	Relaxation. Sense of achievement Enjoyment
or ds.	**To get rewards. To earn points. To win the game. To eat healthier.**	Food products he bought Pictures of Meals	*Points/Reward/achievement/ rising ranking in the game. Food log.*	Sense of achievement. Enjoyment. Excitement.

Provide cues.
Prompt practice and reflection.
Provide information about healthy food behavior.

game.
ame

Foud like this game. He collects cards to assemble powerful combos sand creates mighty decks.

There are point exchange rules in the game, so Foud chooses milk instead of cola in order to earn 50 points.

The bonus mission of this week is to upload a photo of you eating salad. Foud doesn't like salad, but he tries to eat because he wants the bonus.

Now he can even use the experience gained from game to help his mom with cooking.

Figure 21. Scenario B

The scenarios were discussed with the supervisory team of this project and peer students. From the feedback, I found that although the target users are divided into two groups for analysis, there were some connections between them in the scenarios. The last scene in scenario B shows the possibility that users can bring knowledge learned from the game to others. In that situation, users with low motivation and users with low ability could be connected and influence each other, especially in a family context. For instance, when children want to get rewards in the game by eating healthy food in the real world, their preference will influence the food decision of their parents, and they may also provide help to parents in choosing and preparing food. In turn, parents who have health consciousness can use the design to let children form a healthy eating habit. Together they can all get benefits from using the design and achieve their personal goals.

2.5.4. Design vision

The design goal formulated at the beginning of this graduation project is:
To evoke active engagement in getting and processing food-related data and increase food literacy of people with low SES.

During the research, it became clear that there are two main reasons why people did not have healthy food behavior and struggled with food informatics tools:

. People lack the motivation to do these because they could not see the benefits they can get from healthy food behavior and the bad consequence of unhealthy eating habit. Besides, the experience of using food informatics tools to report eating is unpleasant and time-consuming.
. People's behavior is limited due to the lack of ability, e.g., they could not afford the expensive healthy food in the supermarket, do not have enough time to prepare nice food due to busy work, or lack of basic cooking skills.

So the design will focus on simplifying the using and learning process (as shown in scenario A) and deliver food knowledge in an interesting and enjoyable way (as shown in scenario B). Also, to make it more specific, I chose the supermarket as the context where users encounter the design intervention because the supermarket is a place where people make food choices. And the design goal was refined:

Design Goal

To convey food-related knowledge in a gameful, indirect, and unforced way.

I wish the users to feel enjoyable and relaxed when interacting with the design, consuming and reporting food-related data without the unpleasant feeling of being judged, and at the same time, find meaning (which can be the increased food literacy, the sense of achievement or responsibility, etc.) through playing.

In this way, the design will be able to prompt and facilitate people with low SES to make healthy food choices in the supermarket and finally lead to healthy food behavior.

Design requirements

The design requirements gives the boundary conditions within which the design has to operate (Figure 22).

Naturally encounter users

The design needs to think about the entrance points where users can encounter the design and should attract people to start to use.

Easy to get started

The ways or rules to use the design should be easy to understand. The instruction will be simple and clear, without complex terms and explanation.

Keep users coming back to use

The design needs to prompt users to keep using the product, for example, provide cues as reminders or set seductive goals.

Provide food-related information

The main goal of the project is to increase food literacy, which asks the design to present food information to users in a proper way. This information should also help users to make healthy food choices and meet their need, e.g., information about how to cook healthy and delicious meals with low-cost.

Gather dietary data from users

The design should prompt users to report dietary data, which may not only be the meals they consumed but can also be where and when they eat or the emotion they have.

Provide feedback and recommendation

Based on the data reported and the interaction between users and the product,

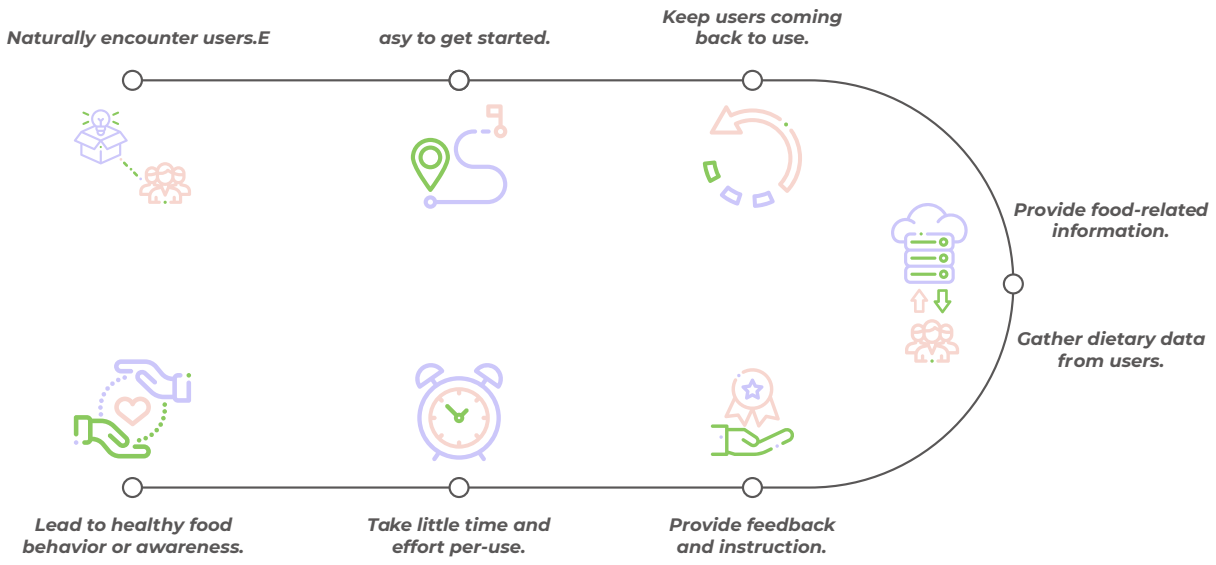


Figure 22. Design requirements

the design needs to give clear feedback and personalized recommendation to make people feel their actions are meaningful and beneficial, which is essential for them to keep using the design.

Take little time and effort per-use

Using the design should not become a burden or a troublesome task. It ought to be low effort and enable flexible using time.

Lead to healthy food behavior or health consciousness

The final goal of the design is to form healthy food behavior or consciousness; it should prompt self-reflection on food selection and healthy eating and lead to behavior change through a persuasive way.

Based on the design goal and requirements, here are the criteria that will be used to evaluate design concepts in the next phase:

① .***Enjoyment:*** the using experience is enjoyable or not.

② .***Likelihood of long-term use:*** users will/won't continue to use the design in the future.

③ .***Helpfulness / Benefits:*** the design is helpful with achieving personal health goals or not; people feel that they can get benefits from using the design or not.

④ .***Ease of understanding:*** the design is easy/difficult to use.

⑤ .***Effort of use:*** the design costs little/much effort.

⑥ .***Food literacy and health consciousness:*** the design increases users' food literacy and evoke health consciousness or not.


3
Design
Phase

3.1. Introduction

During the design phase, insights and requirements gained from the research phase were selected and used to generate different ideas. According to the cookbook method (Visch et al., 2018) for Persuasive Game Design, I chose the ingredients (typical components) and utensils (approaches and techniques) that could be used in this phase:

Ingredients

- The main gameplay loop
- Game elements
- Game metaphor
- Goal within the game
- Transfer effect
- UI & UX design

Utensils

- Carry out creative design session, e.g., brainstorm session
- Create interactive prototypes
- Carry out evaluative sessions

The design phase started with a brainstorm session with fellow students (N=6). An evaluative session was carried out after that to discuss the three ideas selected from the brainstorm session. Two ideas were worked further and developed into concepts. The two concepts were tested with users to get feedback, which was used in developing the final concept. The whole process will be described in detail in the following sections.

3.2. Brainstorm session

Goal

The brainstorm session aimed to generate different kinds of ideas for games that could encourage people to buy healthy food and accept knowledge during the gameplay.

Setup

In order to make this session more efficient, PLEX cards, which were created to communicate the 22 categories/ game elements (Appendix F) of a Playful Experiences framework to designers who wish to design for playfulness (Lucero & Arrasvuori, 2010), were used to kickstart the brainstorm. Ten cards were chosen according to the insights and design goal of the research phase (Figure 23).

Figure 23. Ten selected PLEX cards

Challenge: Testing abilities in a demanding task.

Competition: Contest with oneself or an opponent.

Completion: Finishing a major task, closure.

Simulation: An imitation of everyday life.

These four cards correspond to the most commonly used game elements in gamified healthcare apps (see 2.4.3.).

Control: Dominating, commanding, regulating.

Taking control in the game world may increase the sense of ownership, and people will be more engaged in the game.

Fellowship: Friendship, communality or intimacy.

Based on the SDT theory and user characteristics, people want to feel close to

and valued by important others.

Relaxation: Relief from bodily or mental work. Low SES people usually have a busy and stressful life, therefore the game should be relaxing.

Discovery: Finding something new or unknown.
Exploration: Investigating an object or situation.
Nurture: Taking care of oneself or others.
These three cards are more related to long-term playing, which is what the project want to achieve. Nurture is related to the characteristic of users that they feel responsible to take care for their families.

Participant

Six graduation students, two of them had experience in gamification design.

Procedure

In the beginning, I introduced the topic of this project and the main outcomes from the research stage, including the scenarios, design goal requirements. After a short introduction of the ten PLEX cards and how to use them, six participants were divided into pairs. Each pair picks randomly picked three cards and start generating ideas of games based on the three cards. The last card was placed in the middle of the desk, and every pair could choose to use it. After finishing the idea generation, participants shuffled the cards and randomly picked three of them again. There were three rounds in total. At the end of the session, each pair presented the ideas and discussed together.

Results

The random combination of game elements opened the mind and led to various design directions. After the discussion, three ideas were selected for further development because they had logical narratives, and the way they were translating food knowledge (e.g., nutrition facts) into attributes in games were considered playful and effective. An overview of the ideas and their expected pros and cons can be found in Appendix G.

3.3. Three ideas and evaluative session

The three selected ideas were developed and quick prototypes were made for the evaluative session to make sure the storylines of the ideas are clear to understand, and the transfer from game experience to real-world experience is natural and logical.

Setup

Quick interactive prototypes were built for each concept and printed pictures of food products were used to simulate the shopping process.

Participants

Six graduation students in IO faculty. To avoid bias, the test was held with students who did not know about this project before.

Research questions

. To what extent can people understand the storyline of each concept?
. How do people feel about the connection between healthy eating(or food knowledge) and the gameplay

Procedure

Participants were asked to role-play as customers who encounter the design in the supermarket for the first time. They went through the whole story with instruction and used the prototypes at certain points. After the test, a short interview was conducted to ask their opinions on the concepts.

3.3.1. Idea 1: Super Monster

Description

The Super Monster is a game that allows users to create and collect monsters using the food they buy in the supermarket. When they collect ten monsters, they can get a physical reward from the supermarket, which would be the initial motivation for them to start playing the game. In this game, users create a monster when shopping in the supermarket; the appearance and attributes of the monster are based on what food they choose (Figure 24). The more healthy the food products are, the stronger the monster will be. The monster can have battles with other players' monsters in the arena to win a higher ranking. To get stronger monsters, people need to choose healthy food products and keep a good nutrition balance. The game will take place on the screen of scanners and mobile phones. See the flowchart of all interfaces in Appendix H.

The main gameplay loop

» Choose and purchase food products in the supermarket.
» Get visual feedback of what kind of monster they would get.
» Get a monster based on the food choice. Battle with other players.
» Get suggestion and tips on how to get a stronger monster (eg., to choose food with certain nutrition).
» Get reward(coupon, food, discount) in the real world after collecting a certain amount of monsters.

Game elements

Discovery: The game encourages players to create and collect new monsters every time and discover the effects of different food products.

Competition: Players can compete with other players and be on the top of the leaderboard.

Challenge: Players may need to change the current eating habit in order to get stronger monsters. The game contains progression to various levels.

Game metaphor/ storyline

The story is about an enchanter who is trying to create the most powerful monsters. Player's food selecting actions are a metaphor for the in-game material hunting actions of the enchanter. Choosing food that has certain nutrition is explained narratively as to create a monster with strong attributes in the game.

Goals within the game (which lead to transfer effects)

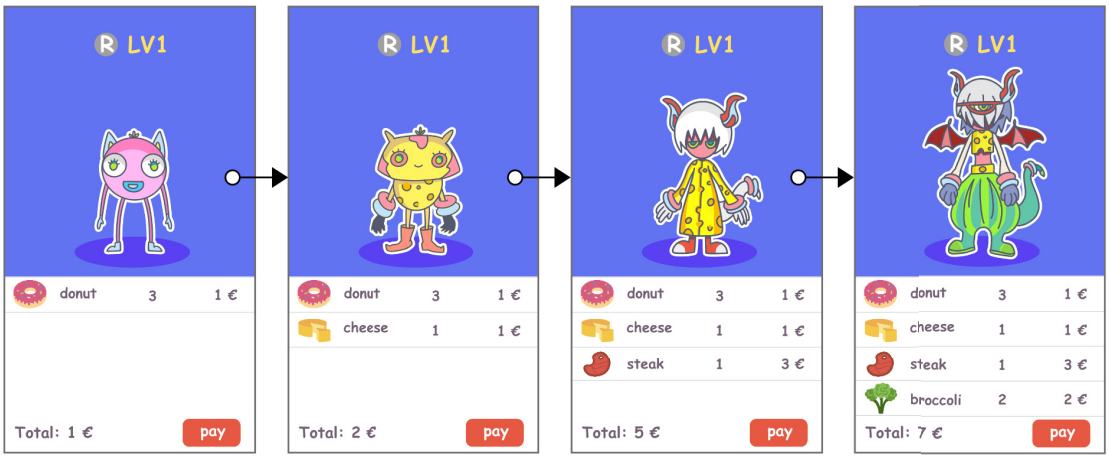
Get the strongest monster and win the champion.

Transfer effects

- Choose nutrition balanced food that beneficial for their health
- Have the consciousness of healthy diet and know what is good to eat.

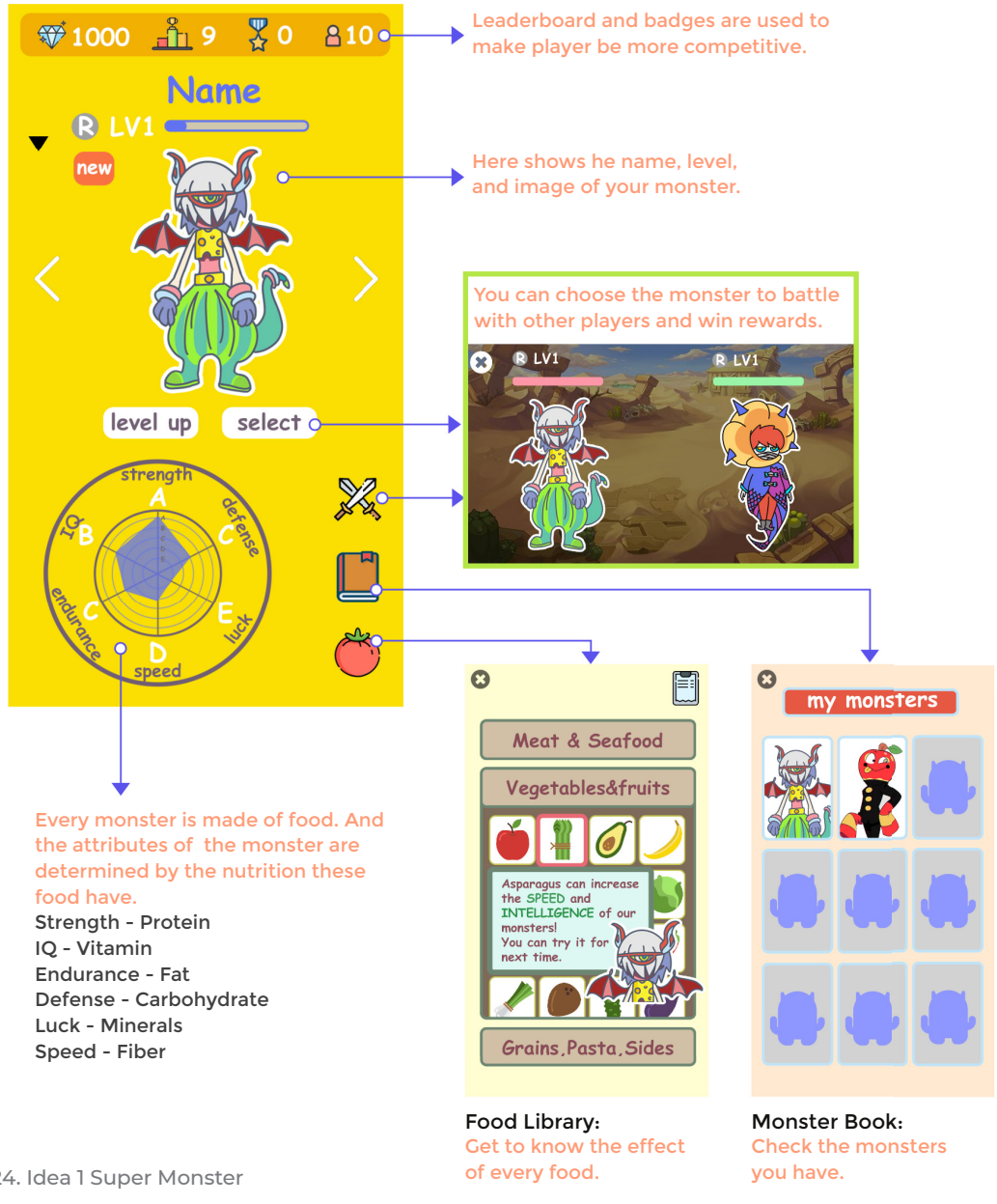
Feedback from the evaluative session

- The narratives/storyline is clear and the theme is interesting. Transfer vitamin intake into the attributes of monster is creative and original.
- The connection between the gameplay and desired healthy food choice in the real world is clear but could be enhanced by directly telling the player that the nutrition of the food they bought will influence the monster's attributes, e.g., involve the nutrients in the name of attributes. Two participants realized the relation between attributes of monster and nutrition before I explained to them. While three participants mentioned that they might



This experience will happen in the supermarket when people choose food products.
Based on the food people choose, the monster will be created on the screen of the scanner.

Home page of the game



Food Library:
Get to know the effect of every food.

Monster Book:
Check the monsters you have.

Figure 24. Idea 1 Super Monster

find the regular pattern gradually, but they did not see the relation between vitamin intake in the real world and intelligence of monsters in gameplay.

- The fusion of monster and food seemed not obvious and most of the participants did not realize that the images of the monster were changing according to their food choices. Also, there might be too many types of monsters if every food combination could create a new monster. The number of monsters should be limited.
- There can be only one variable, how healthy the food products are. The healthier the food people chose, the fancier the monster became, which may attract people to buy more healthy food because they wanted to get fancy monsters instead of a normal one.
- The fight mode increase the social function but makes the game complex to play. Participants did not know the standard of strong and weak, although there was an attribute graph. The rules during the fight should be defined and may also link to food knowledge.
- There could be a Monster Book to show the images of all the monsters and the food they require so people know which one they would like to collect and what food they need to buy in order to get the monster.

3.3.2. Idea 2 Glutton Pet

Description

In this idea, users can choose to have a digital pet to take care of. The food they bought in the real world will become virtual ingredients in the game every time after shopping. To raise the pet, players need to use these ingredients to make meals and feed their pet three times per day. The healthier the meal is, the more experience points the pet can get to level up and grow up. During the nurturing progress, users can unlock achievements and gain rewards in the real world. The game will take place on mobile phones (Figure 25, see the flowchart of all interfaces in Appendix H).

The main gameplay loop

» Purchase food products in the supermarket.
» Get virtual food in the game.
» Make a meal to feed the pet.
» Get visual feedback from the pet.
» Upgrade the pet.
» Get suggestion and tips on from the pet (eg., I want more vegetables instead of eating pizza every day).
» Exchange for reward(coupon, food, discount) in the real world by using virtual game currency.

Game elements

Nurture: Players need to take care of the pet and let it grow up.
Relaxation: The game does not take much time and effort to play, and the cute pet can make players relax.
Control: Players can decide what to buy and what to feed the pet.

Game metaphor/ storyline

Taking care of a digital pet in the game is a simulation of keeping a pet in the real world. The difference is what the pet eat in the

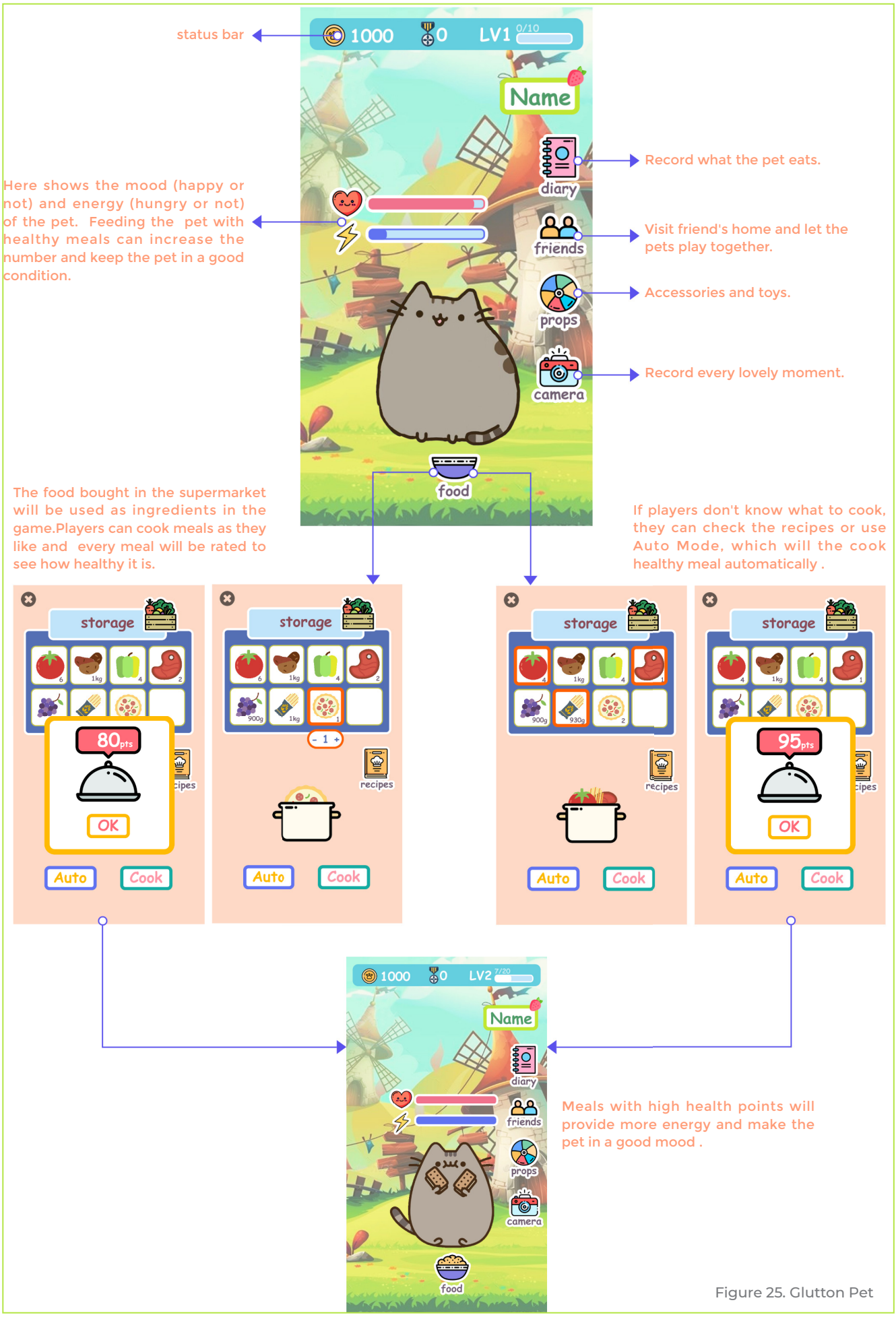


Figure 25. Glutton Pet

game depends on the food choice the players made in the real world. The pet is like a mirror that reflects the eating habit of the player.

Goals within the game (which lead to transfer effects)

Keep the pet healthy by feeding it with healthy food.

Transfer effects

- Be willing to buy healthy food and be able to use available ingredients for cooking healthy meals.
- Have the consciousness of healthy diet and know what is good to eat.

Feedback from the evaluative session

- The whole story is coherent and logical because the food people bought became the ingredients in the game.
- The connection between gameplay and healthy eating is not very clear because the player could not link the points they got after cooking to the healthy level of the meal. All of them thought that was the energy point the pet can get from the meal. There should be some explanation about the points.
- Participants were more engaged in this concept because they could make more decisions when preparing food for the pet. Also, pet could evoke empathy so people would like to take good care of it and keep it healthy.
- Some participant chose food based on how hungry the pet was so they fed their pet with high-calorie food when they saw the energy point was low.
- Half of the participants chose food based on what they want to eat in the real life. Others would like to choose random food to feed the pet.
- Two participants said they were unlikely to change their food choice for the pet's health, but they would buy healthy food if the pet gave obvious negative feedback (eg., became sick) after eating unhealthy food for many times.
- Participants said this concept could increase their food knowledge and help them learn how make healthy meals although their food behavior might not change.
- Keeping a pet took more time than the other two concepts, so people may forget to check the app or unwilling to take care of the pet when they were busy.

3.3.3. Idea 3 The Pioneers

Description

In this idea, users can build houses to create their city on a desert island. To get building materials, they need to buy certain food products from the supermarket. All the customers in the supermarket can play the game together and see each other's building. The game will take place on the checkout screen in the supermarket and on mobile phones (Figure 26, see flowchart and all interfaces in Appendix H).

The main gameplay loop

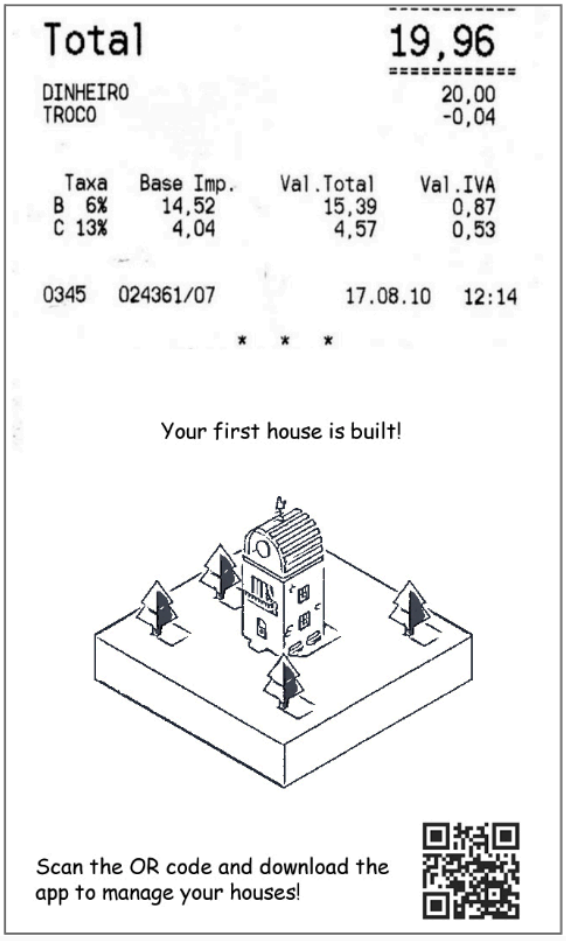
» Choose and purchase food products in the supermarket.
» Get building materials in the game.
» Build a new house in the city.
» Receive visual feedback on the developing process of the city.

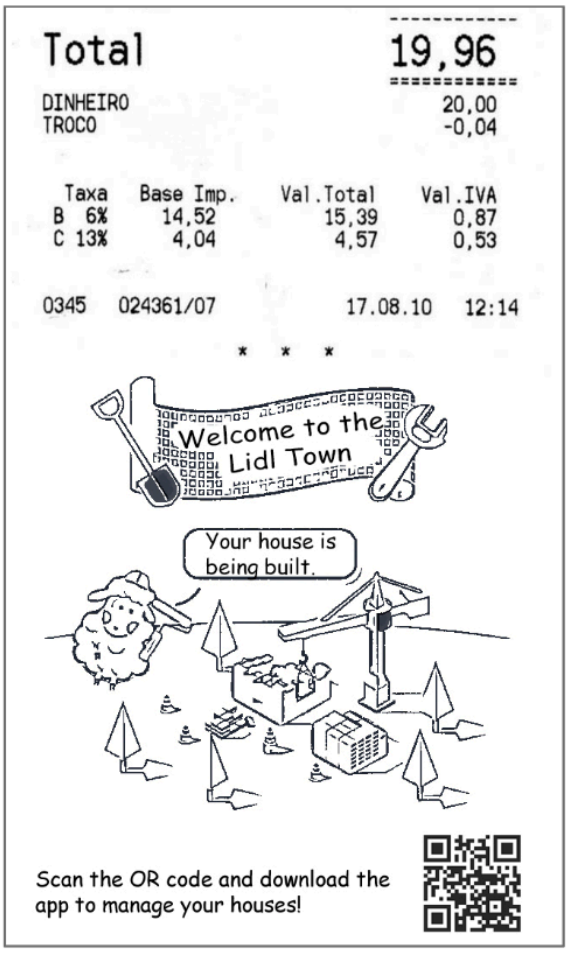
Game elements

Completion: To build one house, players need to get enough materials, and they can build many kinds of houses.

Fellowship: Players can see each other's

The game starts on the checkout screen of the supermarket. After scanning the code of food, the building materials in the game will increase.
There will be tips saying that buying healthy food can make the construction speed up.





The game progress will be printed on the receipt. If the users want to know more, they can scan the code and download the app. But they can always play this game in the supermarket without the app.
After shopping several times, the house will be built.

Figure 26. Idea 3 Pioneers

houses and cooperation with others (e.g., exchange materials)

Exploration: Players can explore in the supermarket to find suitable food that helps with their city-building and also learn knowledge about the food.

Game metaphor/ storyline

The story is of pioneers who are trying to build their city on a desert island. Player's food selecting actions are a metaphor for the in-game material finding actions of the adventurers. Choosing food in a certain category is explained as to collect certain material (e.g., vegetables represent wood). Players together will make the city more and more thriving.

Goals within the game (which lead to transfer effects)

Build more kinds of houses and create a prosperous city.

Transfer effects

- Choose nutrition balanced food that beneficial for their health.
- Have the consciousness of healthy diet and know what is good to eat.

Feedback from the evaluative session

- The relation between gameplay and healthy eating is not very clear.
- The translation from food to building materials is contrived and far-fetched. It would be more reasonable to use size or types of building to visualize the healthy level of food, e.g., people could get a small cabin when buying unhealthy food and would get a villa when buying nutrition-balanced food.
- The idea of using the receipt to show the game progress is considered as a good trigger to let people encounter the design. And the checkout screen and receipt were both good media to connect the real world experience and game experience in the supermarket context.
- Players wanted to know how many materials the food could bring to their house, so maybe put on numbers on the package of food products.
- Participants became more interested in the design after they got the first building.
- Seeing their own house within others' buildings made players feel peer pressure, and they became more competitive.
- This idea is similar to the monster one but less interesting.

3.3.4.Conclusion

Based on the feedback in the evaluative session and the design requirements and wishes mentioned before, the positive and negative attributes are summarized for each idea.

Idea 1: Super Monster

Positive

- The storyline is clear and easy to understand.
- The connection between healthy food choice and gameplay is relatively strong.
- This idea is considered creative and original, collecting monsters in the supermarket is enjoyable and attractive.
- It conveys food knowledge indirectly by translating nutritional facts to the attributes of game character.

Negative

- The rules are found a bit complicated because there is no explanation in the game.
- There are some doubts about the way of generating monsters.

Idea 2: Glutton Pet

Positive

- The storyline is clear and easy to understand.
- The idea that the food people bought in the supermarket will become the ingredients in the game makes a connection between the game world and the real world.
- Keeping a pet in the game can evoke empathy, care, and responsibility, which may influence people's food choice in real life.

Negative

- The connection between healthy food choice and gameplay need to be enhanced, for example, by showing the impact of feeding more obviously in the game.
- Taking care of a pet costs more time and effort, and may decrease the enjoyment.
- The emotional bond between the player and pet is not strong enough. People may not easily change their food choice for a virtual pet.

Idea 3: The Pioneers

Positive

Using receipt and checkout screen as media to convey game information is a good attempt, which links the game world to the real world without an extra device.

Negative

- The storyline is a bit confused, and the connection between healthy food choice and gameplay is weak since the metaphor of changing food into building materials is found contrived.
- The rules seem unclear.
- It has similar game elements as the Super Monster idea but less appealing than that one.

Conclusion

The first two ideas both have a clear and logical narrative, and they are related to making food choice in the real world. They have different directions and focus points, which are both considered to be in line with the design goal. Therefore these two ideas will be developed into more complete concepts in the next stage. The third idea is the least favorite due to the unclear storyline and improper metaphor, so I decide not to continue with it, but the media (receipt, checkout screen in the supermarket) of it will be combined in later concepts.

3.4. Two concepts

Based on the insights, the ideas Super Monster and Glutton Pet was worked further into concepts Super Monster and Glutton Dragon.

3.4.1. Concept 1 Super Monster

Description

In the concept, customers can get a random digital monster when they buy more than three kinds of food in the supermarket. The type of monster is based on the food the customer bought (e.g., buy three fruit and get Fruit Monster, buy three sweet food and get Sweet Monster). When people collect ten monsters, they can get a plush monster toy from the supermarket, which would be the initial motivation for them to start playing the game. If people want a get one particular monster, they need to buy the food products from certain categories. The game will lead players to choose healthy food products that have good nutrition balance so they can learn how to make healthy food choice by playing the game. The game will take place on the screen of scanners and mobile phones (see the storyboard in Figure 27).

This concept focuses on encouraging players to get every monster and fill their monster book by trying new food combinations and choosing healthy food products, which makes the game more ***challenging and rational***.

The main game loop

» Choose and purchase food products in the supermarket.
» Get a monster based on the food choice.
» Check the monster book and library to see how to get other monsters.
» Follow the tips and buy certain food products.
» Get a new monster.
» Get reward(plush toy, food, discount) in the real world after collecting a certain amount of monsters.

Game elements

Discovery: The game encourages players to create and collect new monsters every time and discover the effects of different food products.
Completion: The game attracts players to collect all kinds of monster and complete their monster book.
Challenge: Players may need to try different food combinations to get the monster they want. They also need to build a strong adventure team by using high-level monsters.

Game metaphor/storyline

The player in the game plays the role of a monster collector who is trying to collect all the food monsters. The food they choose are the materials used to create the monsters, and different food combinations will lead to different results.

Goals within the game (which lead to transfer effects)

Collect all monsters and get a plush monster toy.

Transfer effects

- Choose nutrition balanced food that beneficial for their health.
- Have the consciousness of healthy diet. Know the nutritional value of different food and what food is good to eat together.

Figure 27. The storyboard of concept Super Monster

Based on the previous idea, some features were adjusted to fit the design goal better. New feature Adventure was added to emphasize the food knowledge as well as increasing entertainment, and the Battle feature was removed due to its complexity.

The structure of the concept is shown in Figure 28. See the flowchart with all interfaces in Appendix I.

Adjusted features

- The rules and goals in this concept become more clear, which is to collect all kinds of monsters by purchasing different food combinations in the supermarket. The monsters will be generated based on certain food combinations, so the number of monsters is limited and it is possible for players to collect all them gradually.

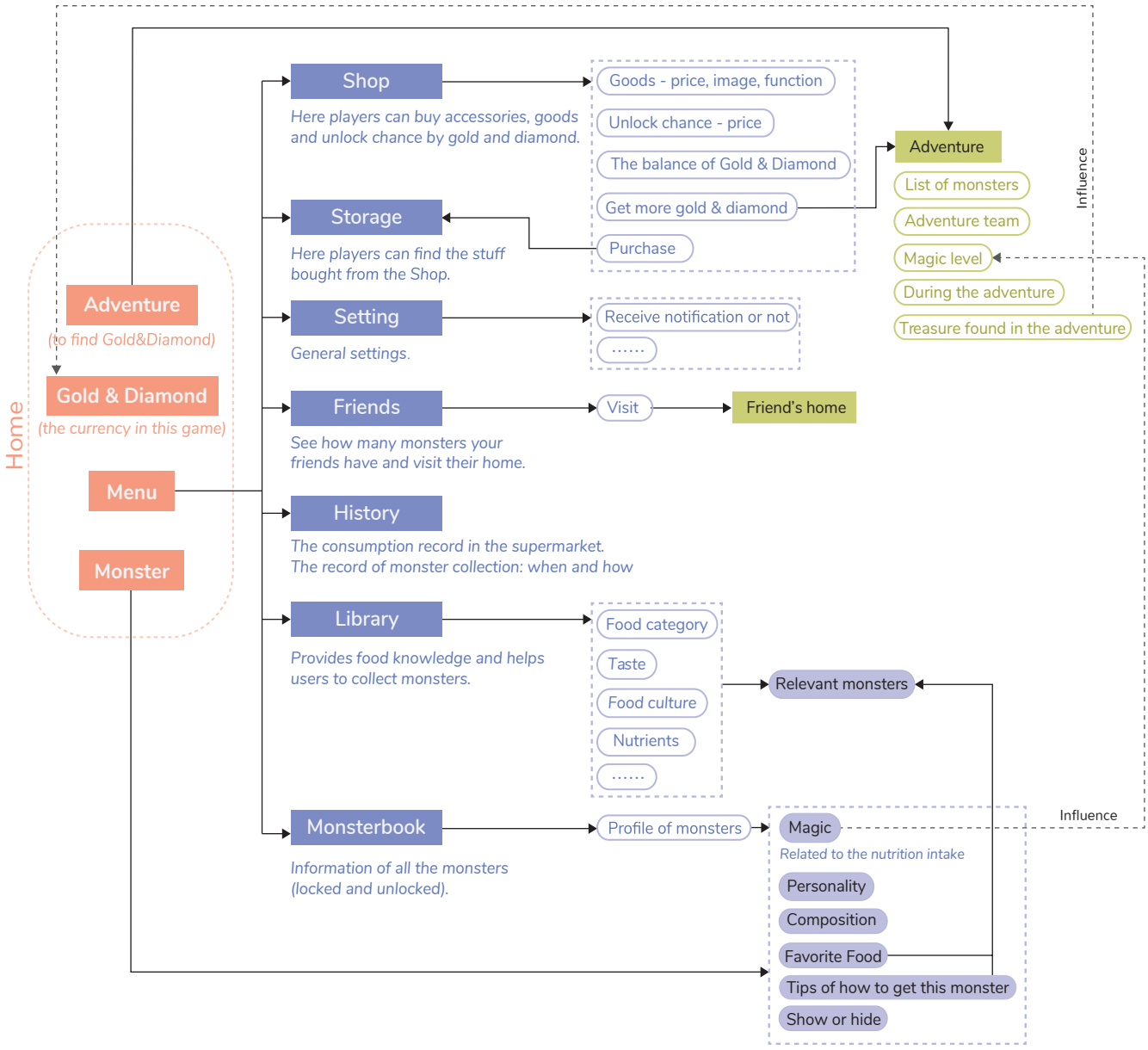


Figure 28. The structure of concept Super Monster

- **Monster Book:** all the monsters (locked and unlocked) will be shown in the Monster Book (Figure 29), the instruction of how to get the monsters will also be provided to players so they can make a shopping plan and try to get the monster they want.
- The nutrition facts of food are translated into magic skills of the monsters, which are also shown in the Monster Book.

Monsters have different magic skills and the type of magic depends on the nutrition of food items that create them. For example, Reddy has Wind Magic because it's made by fruits, which are rich in Vitamins.
The relation between magic skills and nutrition intakes is:
Wind - Vitamins, Fire - Fats, Water - Minerals, Thunder - Protein, Earth - Carbohydrates
This feature builds the connection between gameplay and the food selection behavior in the real world and indirectly makes the player be aware of the nutrition value of food.

Every monster can be created in different ways, which depend on the food the player buys. So every monster is unique for the player.

The chance of getting the monster will be increased when people buy the monster's favorite food.

From the tips, players can learn that they need to buy certain food products in order to collect as more as monsters. It's challenging but also enjoyable, since they get a sense of achievement when collecting new monsters. They will be more willing to have a balanced diet because by doing this they can unlock new monsters(unforced).

Figure 29. The Monster Book

Added features

- **Adventure:** players can form their adventure team by selecting 5 monsters they have and get treasures from the adventure (Figure 30). To form a strong team, players need to buy nutrition balanced food products and collect monsters with multiple magic skills. The higher level the team has, the more treasures the player can get. The adventure process is automatic and can be done when users are offline.

Removed features

- The battle system was removed based on the feedback because it made the game complex to play.

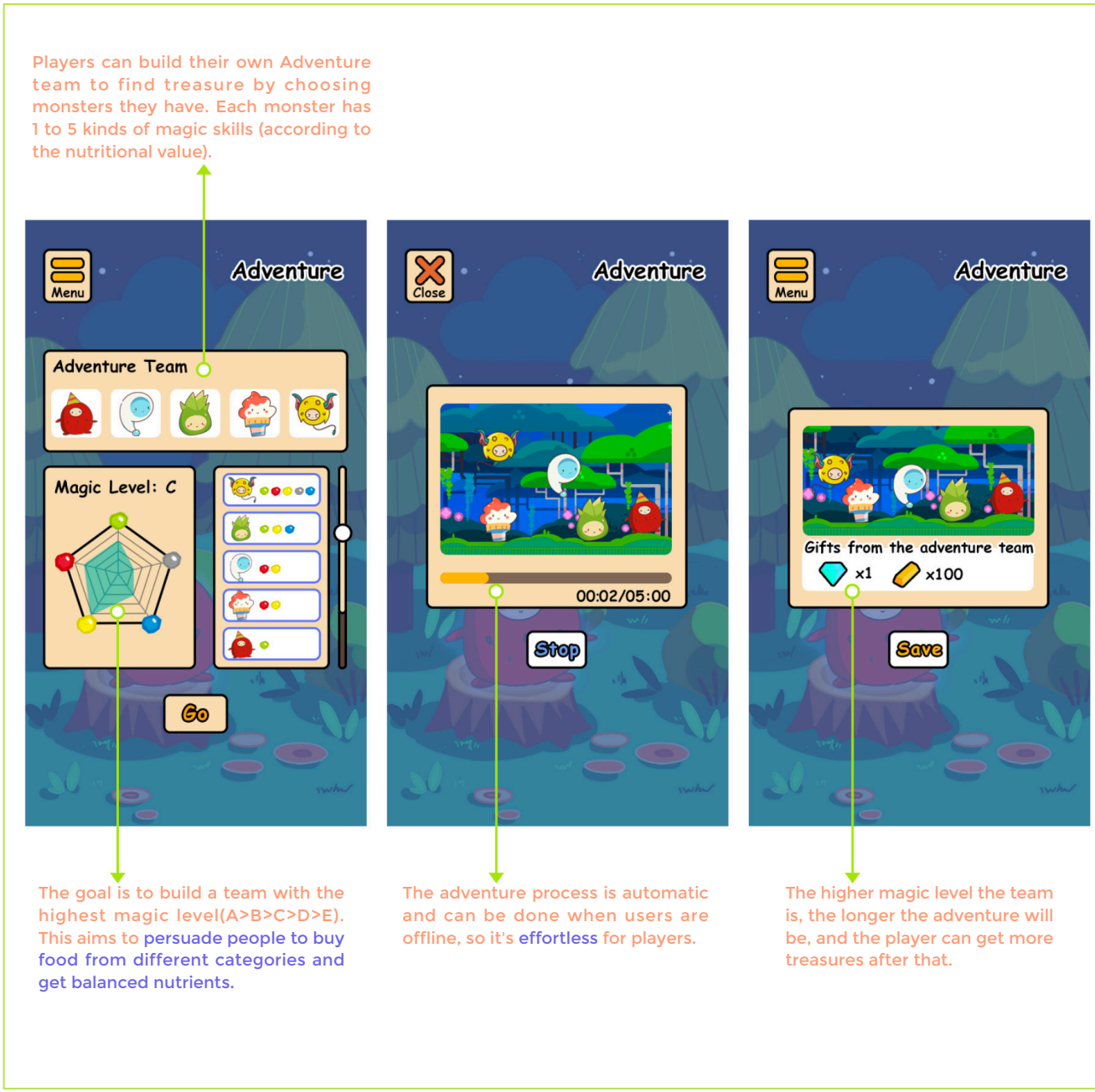


Figure 30. The Adventure function

3.4.2. Concept 2 Glutton Dragon

Description

In this concept, users can get real food by keeping a dragon. The food they bought in the real world will become virtual ingredients in the game every time after shopping. To raise the dragon, players need to use these ingredients to make meals and feed their dragon three times per day. People can earn crystals(game currency that used to exchange for real food) by providing healthy food to the dragon and make it happy. The game will take place on mobile phones. The storyboard in Figure 31 shows how people encounter and interact with the design.

This concept is more ***emotional***; it aims to create a bond between players and the virtual dragon and ***evoke their self-reflection*** through taking care of the dragon.

The main gameplay loop

» Purchase food products in the supermarket.
» Get virtual food in the game.
» Make a meal to feed the dragon.
» Get crystals and visual feedback from the dragon.
» Get suggestion and tips on from the dragon (eg., I want more vegetables instead of eating pizza every day).
» Exchange for reward(coupon, food, discount) in the real world by spending crystals.

Game elements

Nurture: Players need to take care of the dragon and keep it healthy.
Relaxation: The game does not take much time and effort to play, and the cute dragon can make players relax.
Simulation: Players can use the same ingredients to cook for their dragons, just like cooking for themselves in the real world.

Game metaphor/ storyline

Becoming a dragon master and taking care of a dragon in the game is a simulation of keeping a pet in the real world. The difference is what the dragon eat in the game depends on the food choice the players made in the real world. The dragon is like a mirror that reflects the eating habit of the player.

Goals within the game (which lead to transfer effects)

Keep the dragon healthy by feeding it with healthy food.

Transfer effects

- Be willing to buy healthy food and be able to use available ingredients for cooking healthy meals.
- Have the consciousness of healthy diet and know what is good to eat.

Figure 31. The storyboard of concept Glutton Dragon

Figure 32 shows the structure of the concept.
See the flowchart with all interfaces in
Appendix I.

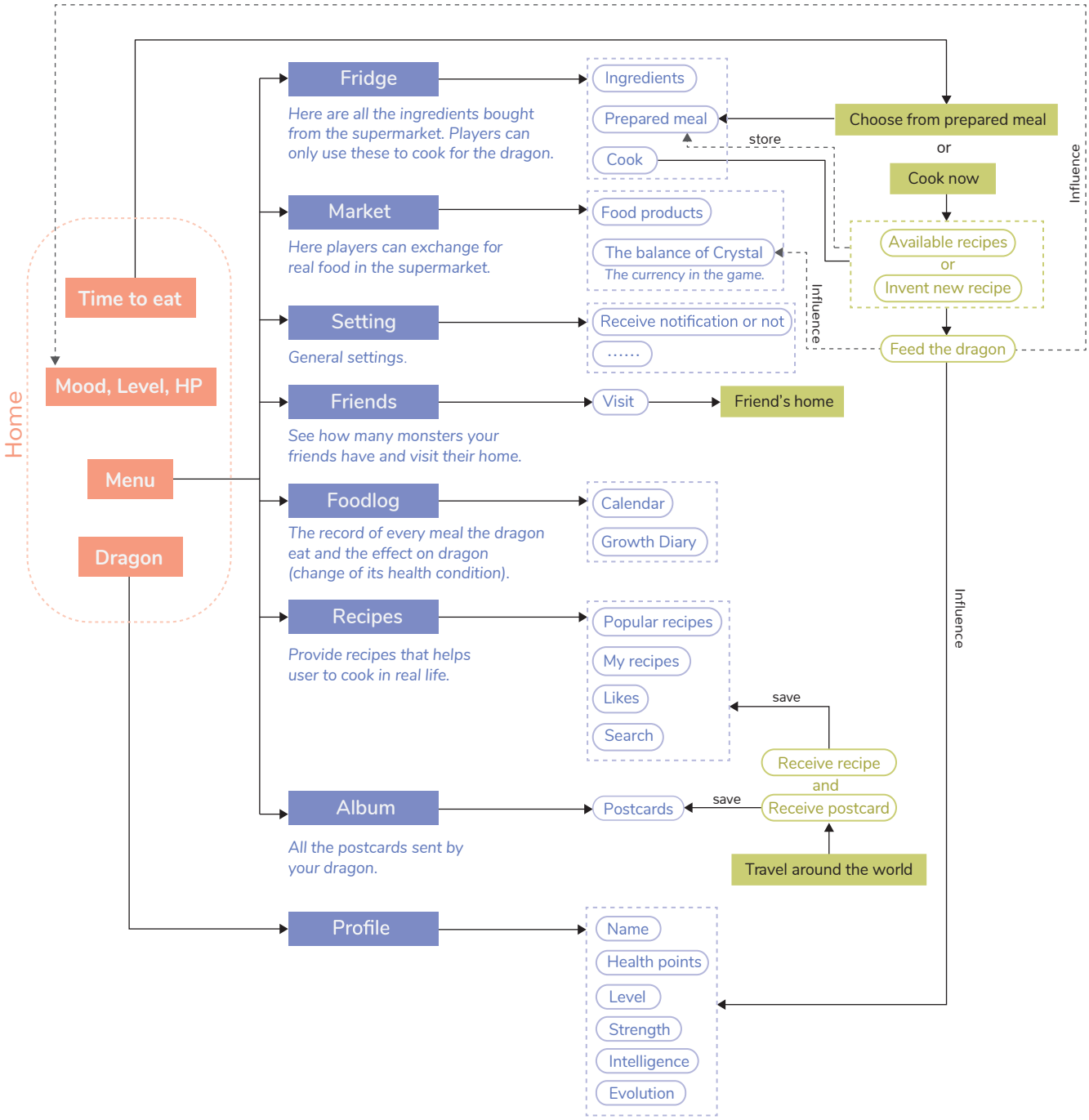


Figure 32. The structure of concept Glutton Dragon

Adjusted features

- Dragon instead of a normal pet is chosen as the game character because, on the one hand, it creates a fantasy theme in the game and may increase the enjoyment of playing; on the other hand, a fantasy creature is suitable for anybody regardless of the racial difference or socioeconomic status.
- The main task in this game is to keep the dragon healthy by feeding it with good meals. The concept uses health points instead of energy points to show the physical condition directly.
- Players can choose to follow the recipes to cook or invent new recipes by themselves. After feeding the dragon, players can get crystals as rewards (Figure 33).

Added features

- To let players notice **the influence of eating**, especially the bad consequence of unhealthy eating, the appearance of the dragon will change according to its health statue (Figure 33).

Food products that players buy in the supermarket will become ingredients in the game. Based on the ingredients, recipes are provided.
Players can check the health point of the recipe and see detailed steps if they want to cook it in the real world.

They can also invent new recipes based on their preference, choosing the ingredients they want to use.

Instant feedback (dragon's mood and health point) will be provided to let people know the effect of the meal, and they can get crystals as a reward every time they feed the dragon.

The dragon can become sick or fat if the player keeps feeding it with unhealthy food. This can evoke empathy and make people feel that they need to take responsibility for their dragon and keep them healthy.

Figure 33. Cooking and feeding in Glutton Dragon

- **Market:** when getting enough crystals in the game, the player can exchange for real food in the market and get it in the supermarket. This feature aims to enhance people's motivation to play this game.

- **Recipes:** the player can search for recipes in the game and cook the meal in the real world. It conveys food literacy through recipes and helps people to cook healthy meals easily.

- **Fridge:** the food bought in the supermarket will be shown in the fridge as virtual ingredients. It connect the gameplay to the food selection behavior.

- **Postcard:** the dragon will travel around the world to find yummy food and send a postcard with a recipe to the player. This function is aimed to enrich the game experience and enhance the relationship between the player and the dragon.

These two concepts want to engage people in different ways. Super Monster is more rational and aims to make people enjoy the challenge of purchasing and eating healthy food in order to collect monsters. Glutton Dragon is more emotional and focuses on nurturing, caring, and self-reflecting. In order to check the effect of the two games and find which concepts fit users' preference more, a user test was conducted.

Market

Recipes

Fridge

Postcard

Figure 34. Added new features in concept Glutton Dragon

3.5. User test

Setup:

The storyboards were made for each concept, providing an overview of how people encounter with the game in the supermarket and what they could do after downloading the game. Tablet computer (Figure 35) was used as the checkout screen to simulate the real situation in the supermarket (see all the interface in Appendix J).

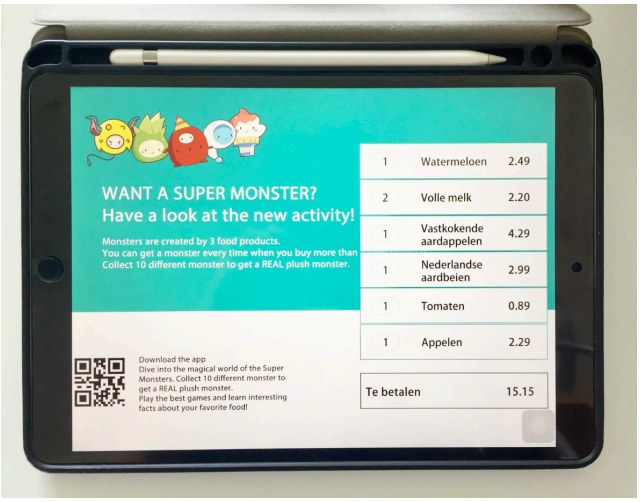


Figure 35. Device for user test

Interactive prototypes (Figure 36) were created to test the main features of the games and the user experience. With the help of the storyboard, participants can go through the whole process and try the interactive prototypes at certain moments.

Figure 36. Interactive prototypes for user test

In order to get in touch with as much as low SES participants, the test was carried out in the low-cost residential areas in neighborhood Voorhof and Hof van of Delft, also including shops frequented by low-income people, such as supermarket Lidl, Turkish super and Chinese fast food restaurant. The zip code of the participants was also recorded as a reference. A Dutch fellow student was invited to join the test and helped to communicate with participants who were not able to speak English.

To attract people for the test, I started the conversation with an introduction that there would be a new promotion in the supermarket and you could get a discount or even free food and household goods by playing a game. Then I asked if they were interested in doing a ten minutes test about the two games we had now, and there would be a chocolate bar as the reward for participating.

The questionnaire (also in Appendix J) was designed to collect general information (age, gender, zip code, family composition) from participants and their feedback about the two concepts. The test criteria were based on the design requirements and were evaluated ~~using a 7-point bipolar scale (Figure 37).~~

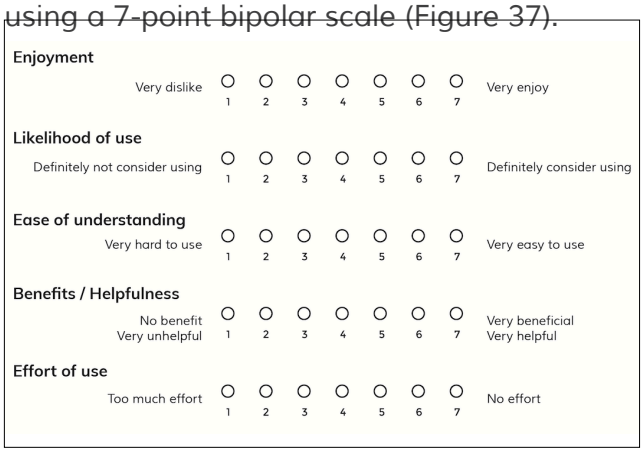


Figure 37. Bipolar scale for user experience

Research questions:

. To what extent do the concepts meet the

design requirement?

- What feeling or association do people have from the concepts? Can they feel what the concepts want them to feel? (e.g., be eager to get more monsters; feel responsible for keeping the dragon healthy)
- Which concept do users prefer and why?

Participants:

14 random participants, 7 males and 7 female, mainly aged from 20 to 39.

Procedure:

- Participants were asked to image they were going to purchase food in a supermarket. The storyboard of one concept was shown as an instruction to let people go through the whole user journey.
- When participants read about checkout in the supermarket, the tablet computer was presented to show the interface of the checkout screen.
- After that, participants were asked to use the interactive prototype of one concept on the phone, following the instruction and go through every function.
- During the test, we encouraged participants to think out loud, and after trying the prototype, they were asked to fill in the questionnaire and rate for the first concept.
- Repeat the above steps for the other concept. The order of showing the two concepts was changed for half of the participants to avoid the influence of order.
- In the end, the participants needed to choose which concept they prefer and the reason behind their choice.

Results

The results (Figure 38) of user test showed that 10 of the 14 participants preferred the concept Glutton Dragon than the Super Monster because the former was easier to understand, the story and main task were clear and more related to their lives. Some participants mentioned that taking care of the dragon was like taking care of themselves, which was exactly what the concept aimed to achieve. Although they thought it might take a bit of effort, they also saw the benefits they could get through playing. While the later seemed more complex to play at the

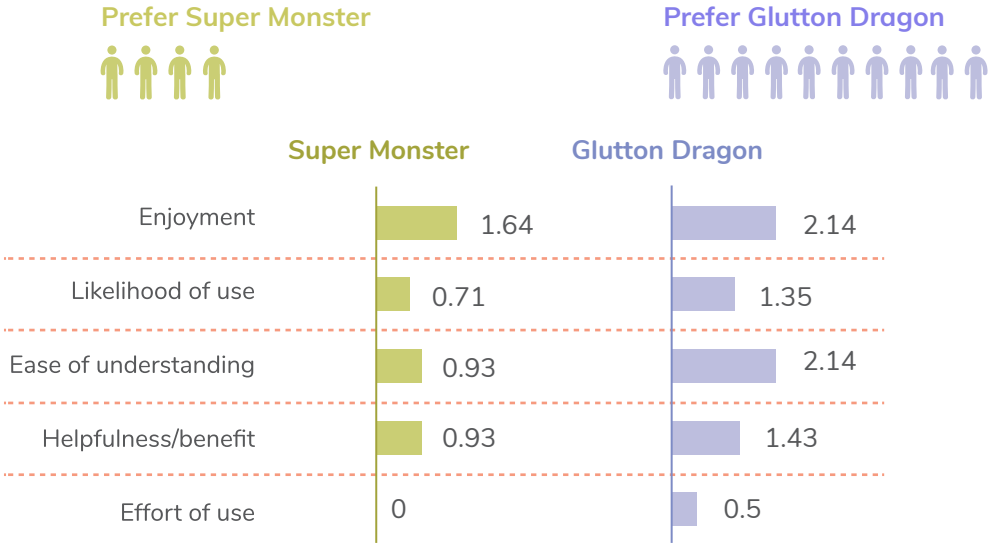


Figure 38. Result of user test

beginning since it had too many game components, and it required players more thinking and learning.

On the other side, the supporters of Super Monster hold the views that collecting monster would be delightful and challenging to play. They particularly loved the random generating of monsters because they would be surprised when getting the new monster.

The main results and insights for the final concept were summarized as follows, the raw data can be found in Appendix K.

Result - Super Monster

Visual style

- Some male participants think the monster looks too cute for boys.
- People will be more curious if they can't see the images of all the monsters.
- Monsters made of healthy food products are not more attractive to people who pay more attention on the appearance of monsters, which means people may only want some particular monsters regardless of healthy level and when they got them they would stop playing.
- Most people like the visual style of this concept.
- Kids would like the monster because they are cute, chubby and colourful.

Experience

- There are too many components in this game, which makes it difficult to understand at the beginning. #Ease of understanding#
- The rules of Monster is complex and people need to think a lot when playing. #Effort of use#
- Participants can feel the challenge element in this concept; some people enjoy it because it makes the collecting process interesting, while some dislike it because they don't want to spend time on learning (how to get new monsters) or they just want more relaxation. #Enjoyment#
- The random generating part gives people surprise. #Enjoyment#
- People like that they can always get something(a monster) after shopping. #Benefits#
- One participant asked would there also be monsters in the supermarket and she might want to buy the food at that moment if she saw the monster. #Connection between game and reality#

Insights - Super Monster

Visual style

- There should be more diverse in the image of game characters to meet the users' preference as more as possible. Be cute but not too cute.
- Only show the silhouette of locked monsters maybe.
- The visual elements should not become the main motivation for people to collect monsters.

Experience

- Reduce the components in the game, make the main gameplay loop (main storyline) more obvious and easy to play. Do not over-design. #Ease of understanding#
- Reduce learning load. #Effort of use#
- Receiving surprise and always

getting something new are helpful to keep the users interested. #Enjoyment#

. Make the game more related to the real world experience; add more triggers in the supermarket; put monsters next to the food products. #Connection between game and reality#

Result - Glutton Dragon

Visual style

. The dragon (in the app) looks like a dragon who doesn't eat vegetables. Maybe there are different dragons, some like meat and some like vegetables.

. The dragon is cute and makes people want to take care of it.

Experience

. This concept is considered easy to understand and there is only one task. #Ease of understanding#

. Most participants prefer this concept because it integrates more of cooking and nourishing ideas, which is helpful. #Helpfulness#

. People like this game because there are more interaction between me and the pet. #Enjoyment#

. People like getting direct benefits/ reward. #Benefits#

. Almost every participant likes the idea of showing the real food you bought in the game because it makes them feel the game is related to their lives. #Connection between game and reality#

. Some people do feel that taking care of their dragons is like taking care of themselves. #Self-reflection#

. The game is more helpful but it takes more effort. #Helpfulness# #Effort of use#

. Some people said they might not change their behevior but they believed that the game could increase their health consciousness. #Helpfulness#

. Some people said they would not going to buy food in particular for the dragon because it's just a game. #Helpfulness#

. This concept lacks surprise. People may become impatient or feel boring about doing the same task everyday. #Enjoyment#

Insights - Glutton Dragon

. Dragons may have difference eating preference, which can be based on the preference of users. #Enjoyment#

. Reduce the effort. Make the cooking process easier or even automatic. #Effort of use#

. There could be alternative ways to get ingredients that the dragon wants instead of buying real food.#Effort of use#

. Add new features to keep things fresh. #Enjoyment#

Conclusion

According to the test result, both of the two concepts fit the design requirements to a certain degree. The concept Glutton Dragon was evaluated more favorably than concept Super Monster in all 5 aspects, especially for its ease of understanding and helpfulness.

Super Monster was considered enjoyable to play because of the collecting feature, which also provided a pleasant surprise to users since they couldn't know what new monsters they would get. Many users thought it's a bit difficult to understand this concept due to the challenge of collecting and too much game elements, which led to more using effort and a lower likelihood of use. The helpfulness and benefits of playing this game were not very obvious to users.

Glutton Dragon got more positive comments about its ease of understanding because the game loop was more simple and clear. Using food they bought from the supermarket as ingredients in the game was considered highly interesting because it increased the sense of participation of users, and they felt the game was more related to their lives. Besides, users could realize that the dragon mirrored themselves and they should take good care of their dragon, which was what the design aimed to achieve.

In general, users prefer Glutton Dragon more. Therefore, the project will make iterations based on the concept of Glutton Dragon, at the same time trying to combine the well-received features in Super Monster to enhance its enjoyment.

These insights lead to the final design, described in the next chapter.

3.6. Final concept

The final concept, the Glutton Dragon will firstly be presented based on the persuasive game design model (Figure 39). The detailed explanation of the design will be in the following sections.

3.6.1 Persuasive game design model

Real world experience

The resulted of the research phase shows that there are mainly two situations where people with low SES choose not to learn food knowledge and have healthy food behavior.

For many of them, the pressing matters in daily lives already take too much time and energy to deal with, so they tend to choose the easy, cheap and fast way to eat even they want to prepare good meals. They feel it's ***difficult, inconvenient and not worth the effort*** to have healthy food behavior.

For people who seldom care about if their food behavior is healthy or not, the food choice is based more on getting energy instead of getting balanced nutrition. They feel learning food knowledge is ***unavailing and unpleasant***.

Game world experience

The Glutton Dragon aims to convey food literacy in an ***enjoyable*** way instead of judging people's food behavior or force them to learn what is good to eat. It tries to evoke users' ***responsibility*** for taking care of the dragon in the game (as well as taking care of themselves in the real world), and then provide feedback on people's food choices and cooking behavior through the dragon. Rewards are provided to attract people to start the game; during the gameplay, people can get a ***sense of achievement*** from finishing various tasks and raising their unique dragons, and ***relax*** in the fantasy world.

Gamification

To make people be engaged in the design and create desired game world experience, game elements and mechanics are applied according to the research and iterative tests.

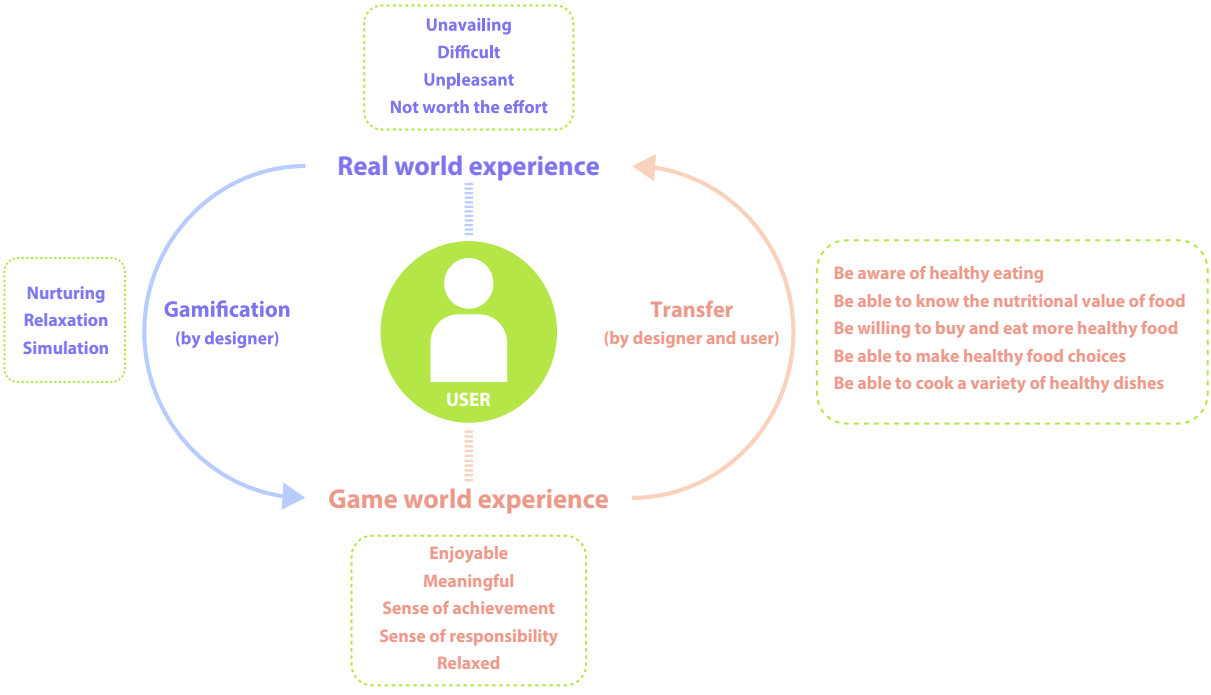


Figure 39. PGD model applied on Glutton Dragon

The main game elements in Glutton Dragon are:

nurturing: experience of nurturing, grooming or caretaking;

simulation: experience of perceiving a representation of everyday life;

relaxation: experience of unwinding, relaxation or stress relief, calmness during play.

Transfer goal

Transfer goals will be achieved by evoking the consciousness of healthy diet of users and making them willing to learn how to eat healthily when they try to feed their dragon with healthy meals. The further goal will be reached if people can apply what they learned from the game into their real lives and form a better eating habit.

3.6.2. Game concept

As shown in Figure 40, the game cooperates with the supermarket and the whole experience starts from shopping the supermarket. In order to strengthen the link between the game and reality, the information and components from the game will be shown in the supermarket as more as possible. For example, promotional materials like posters and cuddle toys (Figure 41) can be used to create an immersive shopping experience, make people encounter game naturally, and motivate them to download

Figure 41. Promotions for Glutton Dragon in the supermarket

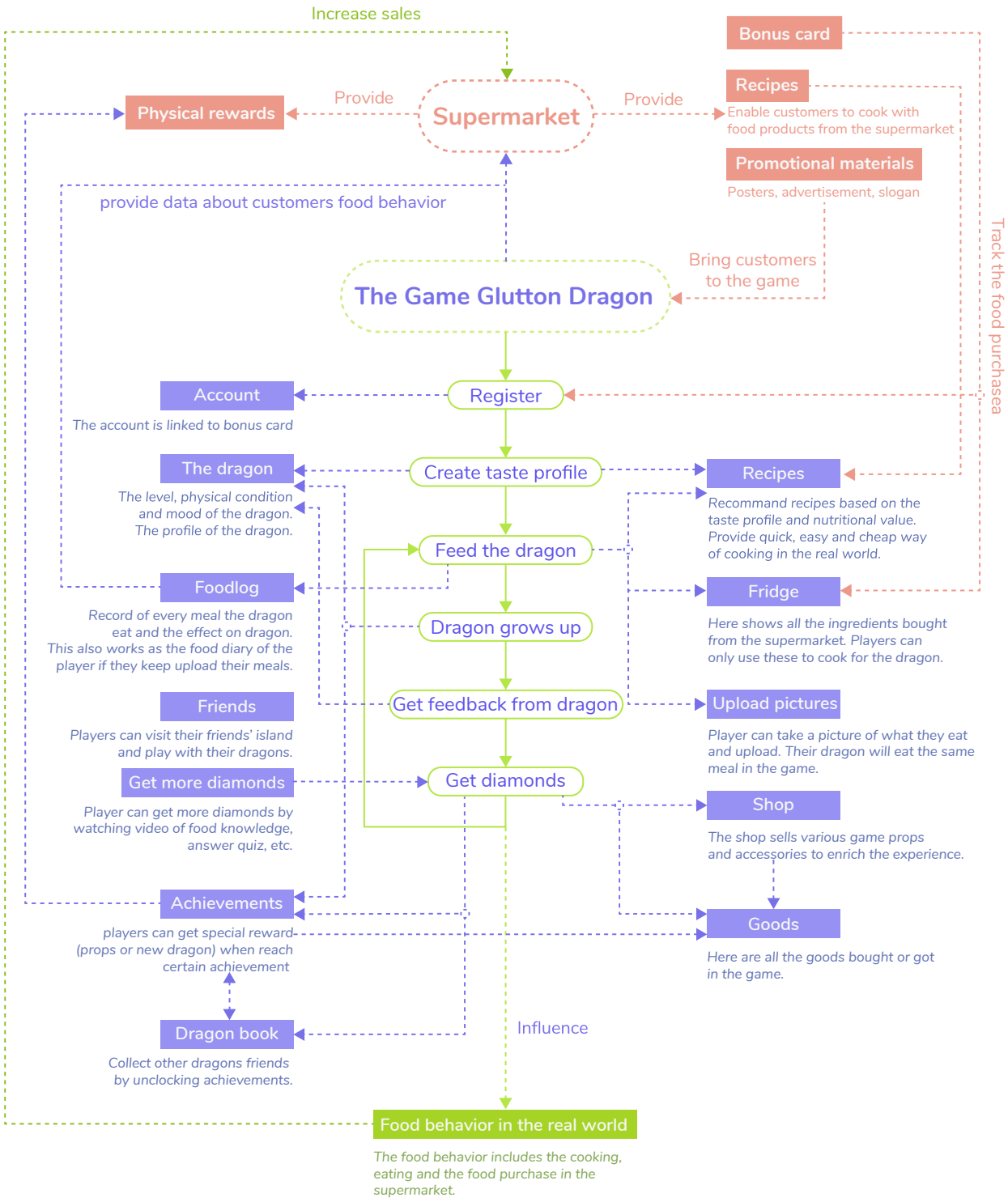


Figure 40. The systematic structure of the concept

and start the game.

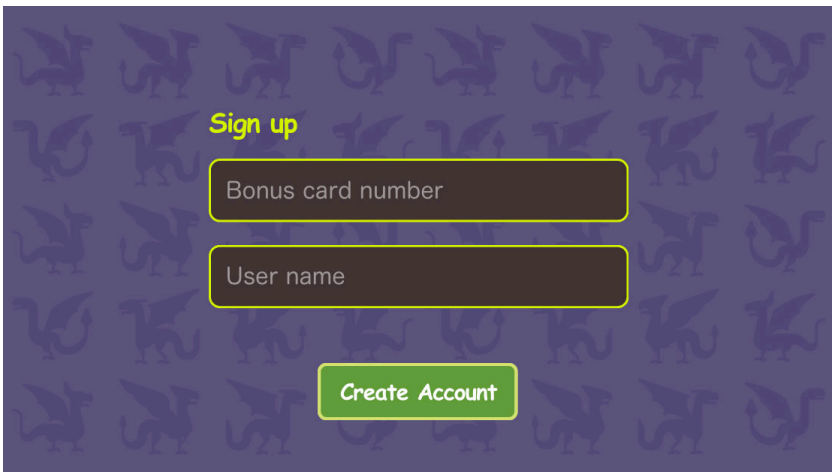
The game account will links to the supermarket bonus card in order to track the food purchase. The supermarket can also provide their recipes to the game and nudges customers into buying ingredients for cooking. Registration rewards and promotion materials will be used to encourage people to download the game and then people can experience all the functions in the game.

The detailed features in this concept will be explained as follows, the flowchart of all user interface can be found in Appendix L.

Preparation Stage

Create account

The game account is linked to the bonus card, so the system knows what people buy in the supermarket.

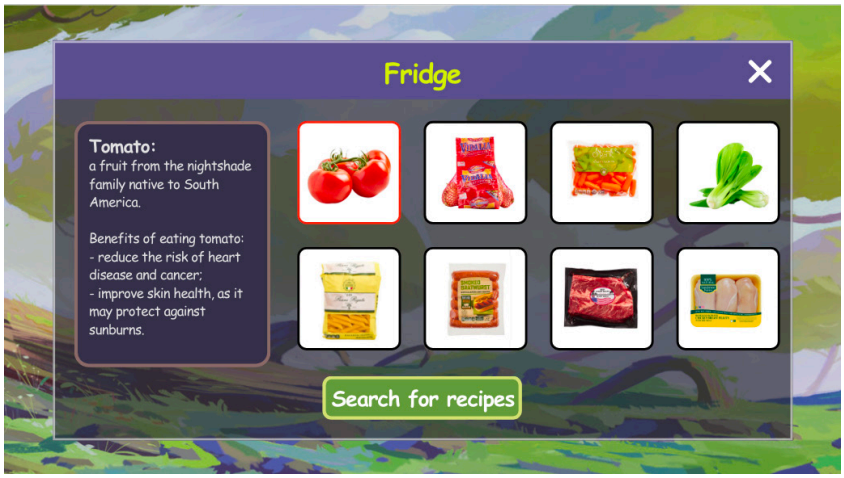


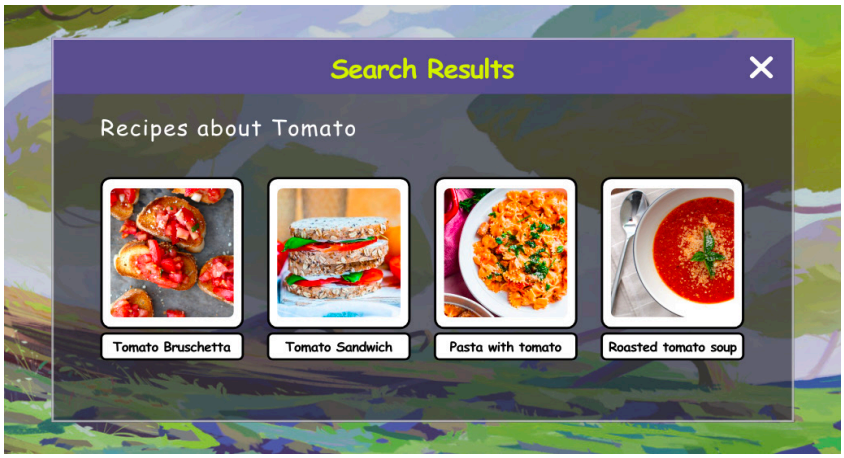
Choose the dragon

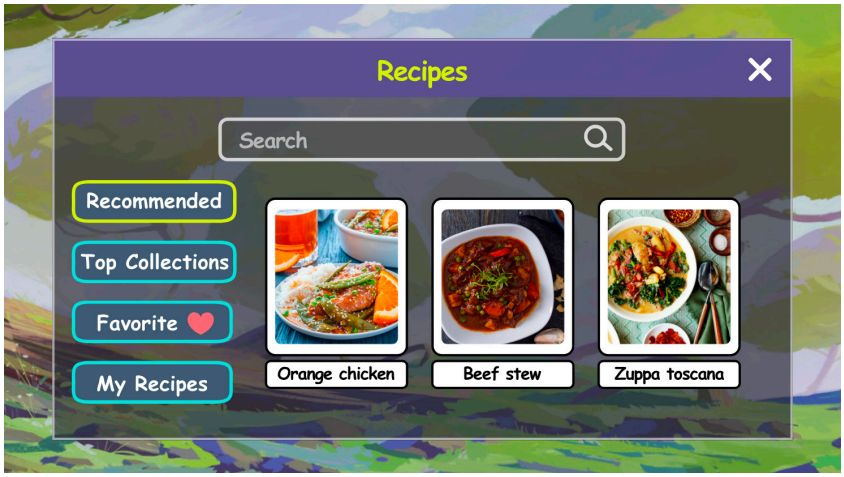
To *personalize the game experience* and *strengthen the emotional bond* between players and their dragons, players are able to choose the breed of the dragon, decide its name and place of birth at the beginning. They will get a baby dragon at first, and as the game goes on, the dragon will grow up.

Create taste profile

The last step in the preparation stage is to answer 4 simple questions in order to find the eating preference of the users, which will become the preference of their dragons. This step aims to *make users feel that their dragons are representing themselves and give the nurturing process more meaning and enjoyment.*







Main features and main gameplay loop

The main gameplay loop is:
Cooking and feeding the dragon -->get feedback andfrom the dragon -->spend diamonds to buy goods and enrich the gameplay.

Home page

The status bar on the top shows the mood and level of the dragon (health points are required to upgrade), and how many diamonds the player has. The layout of the menu was changed from the previous concept to make the main functions(on the left side) easy to reach.

Fridge

The food products bought from the supermarket will become ingredients in the game to make meals for the dragon. They will be shown in the Fridge with a short introduction of its nutritional value and benefits. Users can select the food and search for relevant recipes (e.g., choose tomato in the Fridge and search, the recipes about tomato will be listed). In this way, the game involves input from user's real life and create a connection between the game world and the real world.
Players may feel that the goal of this game is to raise their dragon and have fun, but actually, they are receiving food knowledge indirectly.

Recipes

Food literacy is integrated main in the recipes. The game recommends recipes based on the taste profile and health value. Besides, according to characteristics of people with low SES, recipes of cheap, quick and easy meals will also be provided more. Pictures of real dishes are used to increase credibility.

Home - Touch the dragon

There are 3 choices after touching the dragon.

Camera: take a screenshot of the dragon and record special moment.

Profile: see the basic information about the dragon, including its eating preference, which is useful for feeding it.

Feed: provide meal to the dragon.

Profile

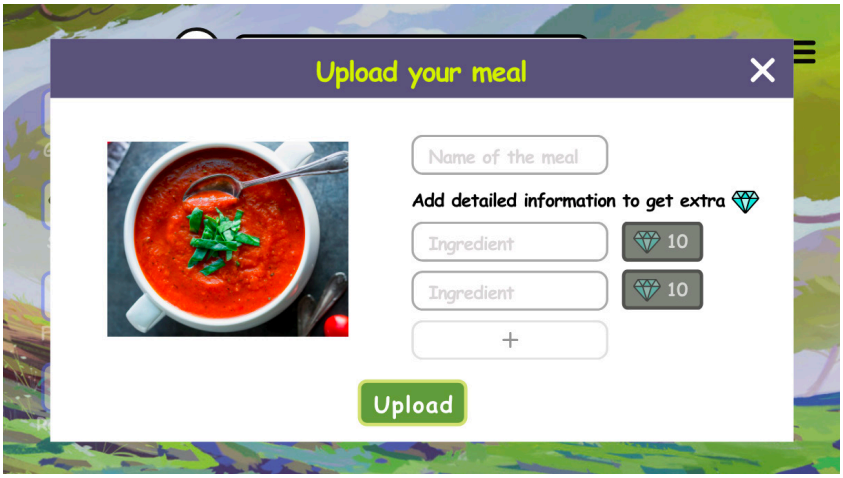
Here shows the information about the dragon. Each dragon is unique because its characteristics are decided by the player.

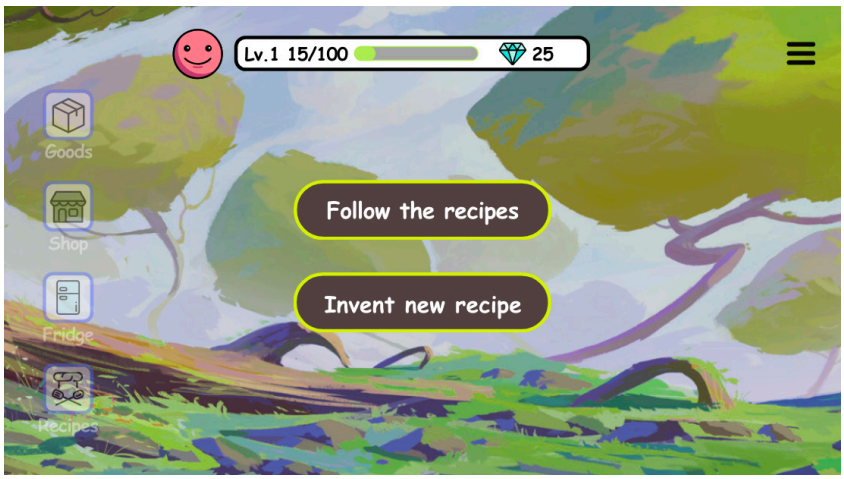
Feed

The dragon needs health points to level up, and the only way to get health points is feeding the dragon. There are two ways to feed the dragon. One is Cooking with virtual ingredients in the game, the other is to Upload a photo of your meal. The latter is added to reduce the effort of play according to the test feedback.

Instant food recognition technology can be applied to quickly and accurately identify food items, and after that the system will decide how many health points the meal can provide.

At the same time, the game still encourage users to report their diet by filling in detailed information about the meal (e.g., ingredients, portion size, when and where did they eat) to get more diamonds.





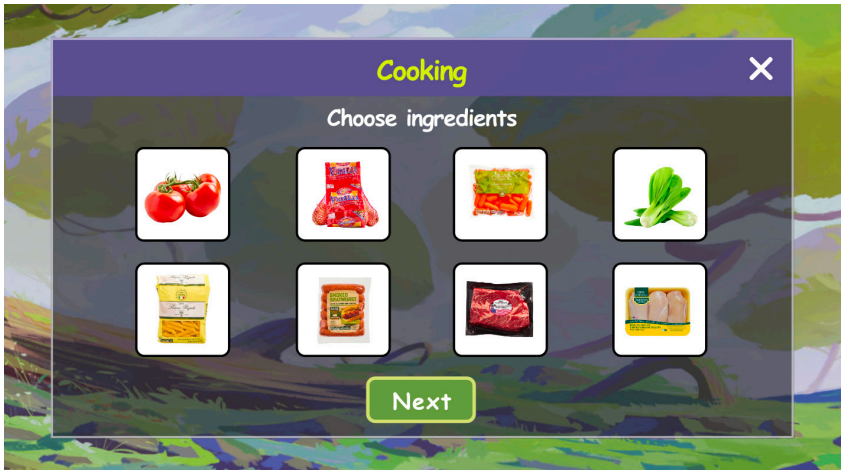
Cook in the game

For cooking in the game, there are also two ways: Follow the recipes or Invent new recipe.

Follow the recipes

These recipes are based on the ingredients in the Fridge, sorted by healthy level, effort to cook and popularity.

Every recipe is explained in detail, therefore *apart from learning what to make for the dragon, users can also use the recipes to cook in the real world and enjoy healthy and delicious food*.



Invent new recipe

When users choose to invent new recipe, they can then select the virtual ingredients they need and edit the cooking steps if they want more rewards.

Social function such as Like one's recipe was added to encourage users to upload and share their recipes to others.

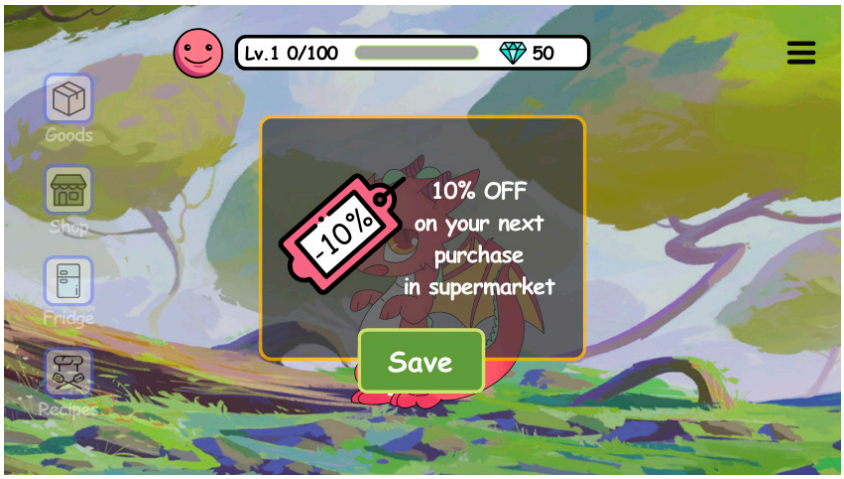
Feedback from the dragon

As a thank-you gift from the dragon, diamonds will be given to the player after they feed the dragon. Players will get the same amount of diamonds no matter the meal is healthy or not because the goal of the game is to convey food knowledge and *encourage people to report their diet instead of judging their food behavior or force them to upload only healthy meals*.

The health level of meals only influences the physical condition of the dragon. If the meal provided is healthy and yummy (fit the preference in the taste profile), the dragon will become very happy and grow up faster. In the meantime, it may give some comments on the meal and share cooking tips with the player, which is also an *indirect way to convey food literacy*.

Players can get direct visualized feedback about the effect of eating. For instance, if the player keep feeding the dragon with unhealthy food, the dragon can get sick or change to weird color. In this way, the consequence of unhealthy diet is visualized through the dragon. On the one hand, it *can evoke a sense of responsibility* that as the master, the player need to take good care of the lovely dragon; on the other hand, it can *let users realise what could happen if they keep having unhealthy diet*.

The dragons will also tell players how to deal with the illness so they can buy medicine in the game shop or make healthy meals to cure their dragon.



Shop

Shop is where players can use the diamonds to buy stuffs in the game, for instance, if they need certain ingredients to cook for dragon but don't want to buy real food, they can buy virtual ingredients in the Shop.

Accessories such as hat, necklace and a variety of plants are provided to let users decorate their dragons and islands. They can also change the landscape of the island.

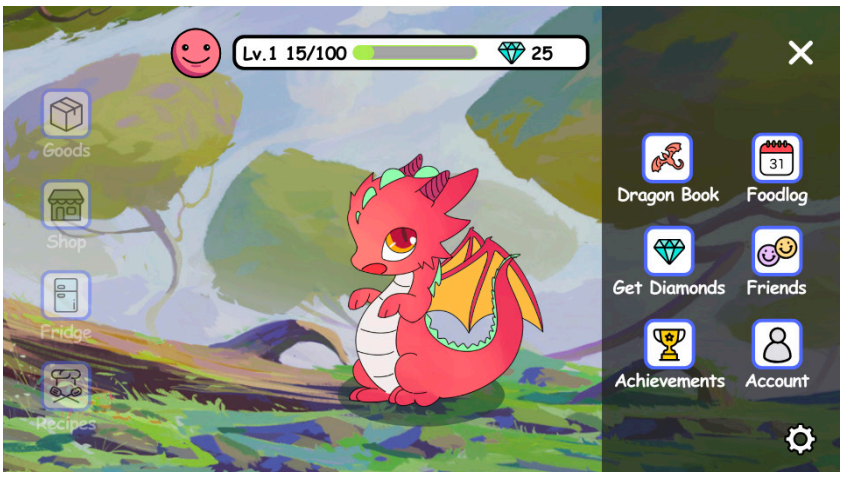
Unlike the previous concept, the resources (diamonds) in the game is no longer related to products in the real world, which means people cannot use diamonds to exchange for real products in the supermarket. This is because I want to *evoke the intrinsic motivation by the game itself instead of relying too much on extrinsic rewards*. Through the interactions in the game, people can already be engaged and feel enjoyed to play, and therefore there is no need to use extra rewards.

Goods

Props, special rewards got in the game, and accessoried bought in the Shop will be stored here.

Other functions

Under the menu on the right side of the home screen, there are other functions designed to enrich the game experience.

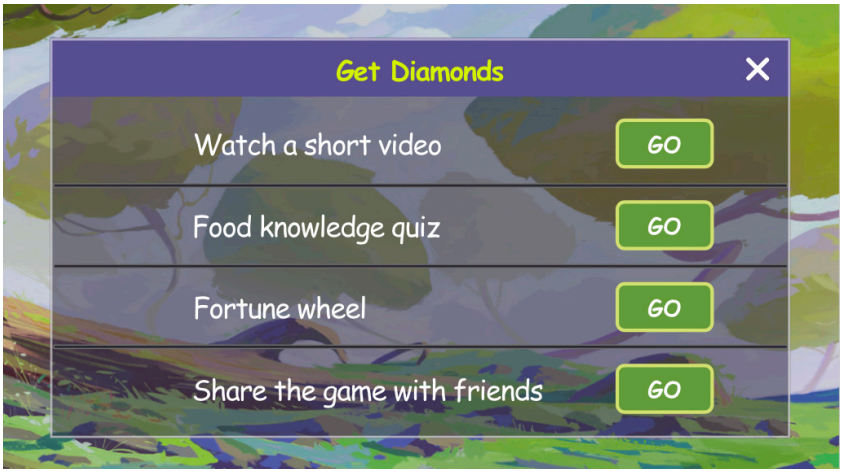


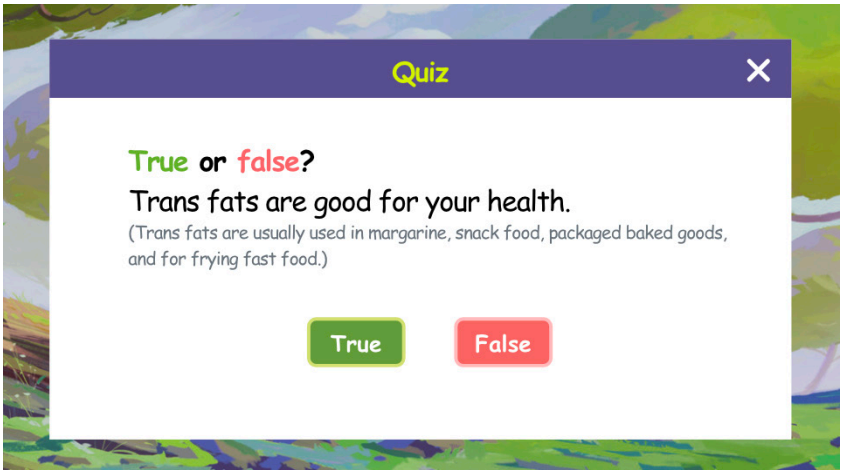
Get Diamonds

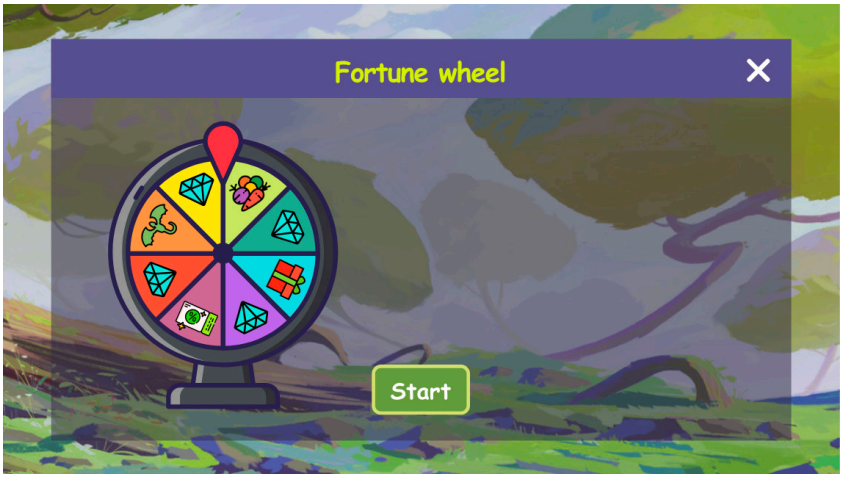
In this game, the main approach to get diamonds is to raise and feed the dragon. The game also provide other ways to earn extra diamonds.

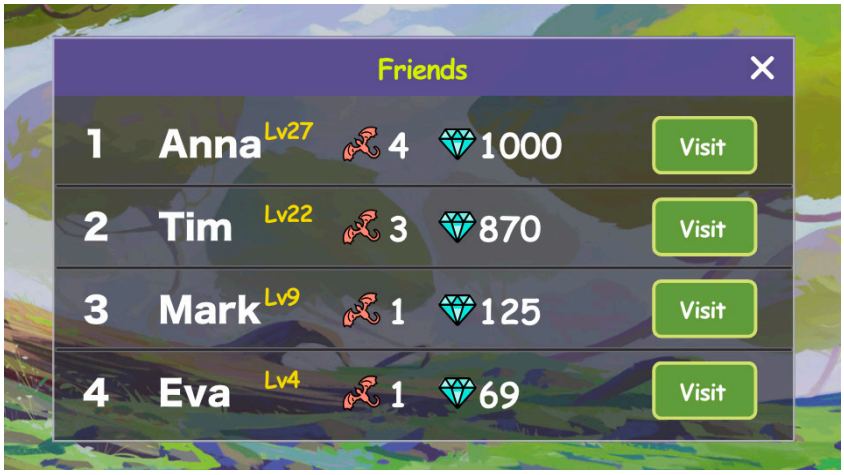
Players can watch a short video about food or do a quiz of food knowledge (they can still get some diamonds even the answer is wrong). Apart from the recipes, these functions are also related to food literacy. If players want to earn diamonds for the game, they may become more active in doing the quiz and learning food knowledge, and then the transfer effect can be achieved.

Fortune wheel is added to evoke the feeling of surprise and increases the enjoyment of playing because people can always get something from the Fortune wheel, but they never know what they will get.









Achievements

The function of unlocking achievements is added to *make people play the game for a longer time*. There will be a special reward for every achievement. For example, players can collect different types of dragons by unlocking certain achievements, which may link to different cultural background (e.g., get a Dutch Dragon after cooking 10 Dutch food). The collecting feature comes from the concept Super Monster, which aims to *add more entertainment and surprise to the game*. The dragons collected from Achievements can be shown on the home screen as friends of the first dragon and players don't need to feed them.

Players can also get physical reward provided by the supermarket such as cuddle toy as they keep playing the game and taking care of their dragon.

Foodlog

The Foodlog records all the meals eaten by the dragon and count the health points as well as nutrition intake.

Users can check the Foodlog to see which meals have more positive effect on the dragon, or even use it to *track their diet and get feedback on their eating habits* if they always upload and report their meals in the game.

Friends

People want to *be related to others*, therefore, the social function allows them to visit their friends' island and have communication with each other, online and offline. Their dragons can also play and eat together.

Evaluation Phase

In this phase, evaluative sessions with experts were conducted to investigate if the final game concept fulfills the design goal: convey food-related knowledge in a gameful, indirect, and unforced way.

4.1. Validation with experts

Since the final prototype is not fully developed to let users really play with, which means whether users will play the game for a long time is not able to be tested, the supervisors of the project suggested to have expert tests instead of user test to get feedback on the applicability, usefulness, and value of the concept.

The evaluation sessions were carried out with one dietitian and four designers who were experienced in food-related game design and culture sensitive design.

Research questions

- To what extent do the participants feel the design meet the goal of conveying food literacy in an enjoyable, indirect, and unforced way?
- How well do the game mechanics and elements work in the concept?
- How valuable would the design be for low SES people to learn food knowledge and be healthy?
- What functions could be developed further?

Procedure

I did a one-on-one session with all of the five experts. First, there was an introduction of the project background and how the design goal was drawn from the research. A concept video (Figure 42) was made to tell the user story from encountering the design in the supermarket to playing the game and to

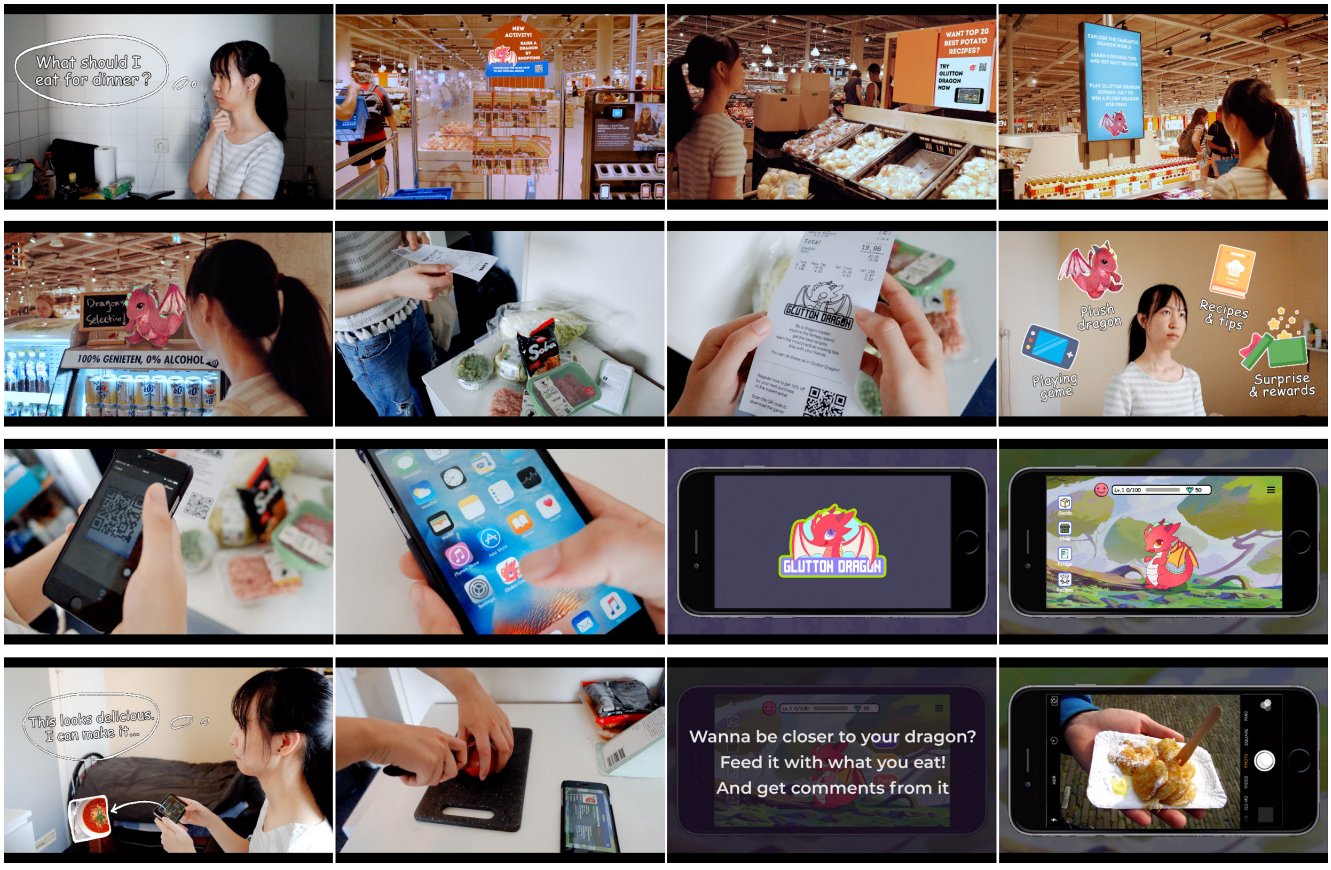


Figure 42. Screenshots of the concept video

show how the transfer effect is achieved. After these, the interactive prototype created in Adobe XD (Figure 43) was shown to the participants with a detailed explanation of every feature. The participants can give instant comments during the session, and in the end, there was an interview session to ask for feedback and suggestion according to

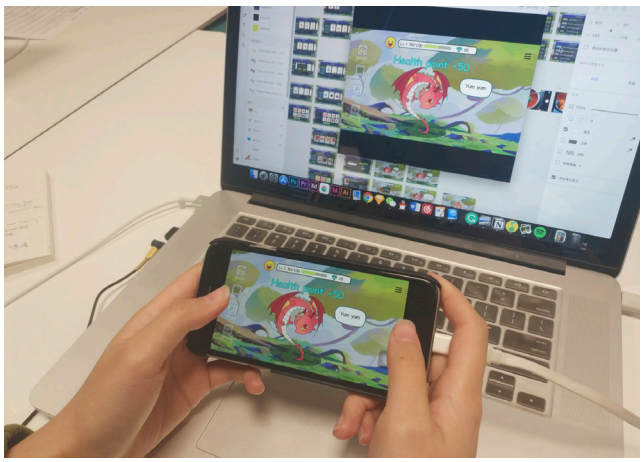


Figure 43. Prototype of the final concept

4.2 Result

To what extent does the design meet the goal of conveying food literacy in an enjoyable, indirect, and unforced way?

Enjoyable

The concept was considered attractive and enjoyable to play for its rich functions, the connection between real life and gameplay, the emotional relationship between players and their dragon as well as the visual style. One game designer suggested that in order to make people play the game for a longer time, the growing process of the dragon could be divided into several stages, combined with new mini-games to keep adding entertainment over time. Enabling people to educate the dragon might also lead to an interesting game experience, and it could also integrate with food literacy. By doing these, people can interact more with their dragon instead of only feeding them, and the emotional bond between them would be strengthened.

The cute game character and bright visual style gave people a positive feeling, but it might be more appealing for children than adults. Therefore there could be changes to make the game more fit for adult, which is not necessarily only in graphic design.

Relevant quotes

- *"Sometimes these game-like things are more complicated to me but this shows to me very clear, and it's appealing, and rich also, a lot of different things in it, so doesn't seem boring."*
- *"The idea of collecting more dragons as friends for your dragon is good for adding entertainment."*
- *"Have you think about how many growing stages it will have in the game. If you aim to let people play this game for 4 months, there should be something more. "*
- *"Add one more game layer to give people a reason to keep coming back."*
- *"So the basic thing you can do with the Tamagotchi principle related to food would feed it, cure it, or, and that might be very interesting, educate it."*

the design goal and requirements.

Indirect

The concept was perceived as fitting the design goal of conveying knowledge indirectly. The comments received showed that it used both direct and indirect ways to convey food literacy. For example, the quiz and feedback from the dragon directly showed users what is right or wrong, and how healthy or unhealthy food could influence their physical condition. However, the game as a whole indirectly influenced players to be more aware of the consequence of unhealthy food behavior and the meaning of healthy eating.

People enjoyed the game because they could see their dragon growing up healthily and they could build the game world by earning diamonds. Out of the game, on the one hand, they might reflect themselves from the dragons and change their attitude towards cooking and healthy diet unconsciously; on the other hand, the food knowledge or tips received in the game could be useful in the real world.

Besides, since the concept was likely to attract children by its cute and fantasy features, it showed possibilities to let children who enjoyed the game influence people around them. For instance, in a family context children could ask their parents to make a healthy meal because their dragon would like it, or teach their parents what they learned from the game, which was also an indirect way of conveying knowledge.

Relevant quotes

- *"I think they are influenced through this game. You have this quiz questions which are direct, but indirectly you influence people to think about food health."*
- *"I like the concept that it puts recipes that you can cook with your groceries. It's also important to check if they pick up the knowledge. Use pop-up questions, just to remind them of the knowledge and it also measures the impact of the game"*
- *"Definitely fit the goal. It's better on the one hand, if the knowledge is more specified in the interaction, on the other hand, if it is more embedded in the daily-life habits of the target group..... you can make a good user scenario, for instance parents and children, or in a school background, children among other children....."*
- *".....and the emotion is also a really good part. Maybe the dragon can look sad then people can feel that's their dragon and mirrors their own behavior."*
- *"The game provides direct feedback, which is the best part of the game now I think. It's fun and you directly see what it does to your dragon so it's really important. To let people know what healthy or unhealthy food does for them. "*

Unforced

The feedback from the experts showed that the concept has a good balance between leading people to healthy food behavior and making them feel free to make food decision without worrying about being judged. Apart from its impact on facilitating users to make healthy food choices, because the game was designed to cooperate with local supermarkets, it also nudged people into shopping in the supermarket and buy ingredients mentioned on the recipes instead of using advertisements to force them.

According to the suggestion of one game designer, it should be noted that when people got negative feedback (e.g., fewer rewards or the dragon became sick) after feeding their dragons with unhealthy food, they might feel unpleasant and then "lie to the game" by only uploading healthy meals in order to get only positive feedback. Therefore the design should be careful to make people be aware of the healthy part without evoking uncomfortable feeling and try to encourage the report of unhealthy diet as well.

Relevant quotes

- *"I think it's a good balance. It's clear that there is a message in it for yourself but there is also enough happiness in it, that makes it also inviting to play. Even you are not interested in the healthy part, you may want to play with it."*
- *"It feels really nudging, it feels really facilitating of making healthy and unhealthy choices. "*
- *"It also includes people with high SES, it's not only for very low SES people. You don't want to stigmatize them."*
- *"The way it connects to the supermarket nudges people to the supermarket not being forced by the advertisement but by the game. I really love it. "*
- *"When people notice that the game is like a mirror and their dragon is reflecting themselves, there will be some pain when they upload unhealthy food and we need to take these pain out otherwise people will stop playing because they play it for fun. Be careful with this, make people realize the meaning of healthy eating but don't make them feel bad. "*

How well do the game mechanics and elements work in the concept?

Using nurturing as the main game element was accepted as a good choice and it built a basic game loop for people to put something (meals and recipes) in and earn something back (the growth of dragon, diamonds); meanwhile, there were still rooms for adding new features. Other elements like collecting (unclocking achievements) and Fortune wheel were also considered as useful to motivate people.

The main problem mentioned in the evaluative session was there were more than enough functions in the game now, making it a little bit complex to focus on the main function and to meet the final goal, which was increasing food literacy of low SES people. The dragon should be put more to the front ground and the interaction related to the dragon and food knowledge could be developed further, e.g., teaching the dragon to make it have healthier eating habits.

One game designer wondered if the dragon was the right metaphor to represent the player. He could see that the dragon had a very rich cultural orientation and it immediately transport people to a world of fantasy, however, people could easily imagine him/herself as a wizard but might not think he/she could be a dragon. He suggested to define the role of the player in the game, make it obvious and more personalized.

The visualized feedback of the dragon's physical condition could include both short-term feedback and long-term feedback, and make the reaction of the dragon closer to people's real experience. For instance, during the eating of unhealthy meals, the dragon can be very happy; but after one hour it might feel stomachache or other things and turn into a strange color.

Relevant quotes

- *"In general, I like it, the game loop is good, well sorted out, features and user interface are well organized. And growing something is always a strong game element. "*
- *".....you can earn diamonds by doing stuff. That's very generic and leave all kinds of things open to put in there. You can even battle, to make it more mature, and this might be a very strong opportunity to motivate people."*
- *".....your idea is by doing this, in the process I give knowledge, and these give you feedback about your wellbeing. This is the basic line. You also put in some extra stuff, which makes it complex."*
- *"So try to prioritize all the functions you have now cause I think you have more than enough and in the end."*
- *"Now you have the personalized profile, and you have the taste preference. You can only see the profile, it might be interesting to see if you can edit it or change it by educating your dragon with food knowledge. "*
- *"Why don't you choose to have the representation/avatar in there to be you, as a player? That's a very clear representation. You can still have the dragon but with yourself in the game. "*
- *"The other thing is, if you wanna focus on benefits, there are short-term and long-term benefits, I think it's good for people to know the difference between them. Try to illustrate these kinds of things with the dragon."*

How valuable would the design be for low SES people to learn food knowledge and be healthy?

The concept focused on food selection and preparation, integrating with nutritional value, recipes, and cooking tips. The dietitian indicated that the knowledge part now could to some extent, help the target users to gain part of the food knowledge, but there were still many other things they need to do to increase food literacy. Except for learning from recipes, people needed to sit down at the table, eat with their families and learn how to really prepare food in a healthy and safe (it's also about hygiene) way, and what to do with food waste. Moreover, healthy food behavior also linked to other lifestyle behaviors, such as exercising, smoking, and alcohol abuse. Therefore it would be nice to approach different context and integrate with more disciplines.

The nutritional value of ingredients in the Fridge was thought a little bit complex to the target, and it only mentioned the objective health experience (e.g., lower blood pressure). It would be better to make some new factors that are not so much like fats or carbohydrate, but more to the experient sensation of food, perhaps taste, and also involve subjective health experience (e.g., sleep well). For instance, these ingredients can provide energy or those can decrease the anger feeling.

The features that can be developed further will be discussed in the Recommendations later.

Relevant quotes

- *"Because you can even play it if you don't know what to cook for tomorrow, you just going to play it and become inspired and in the meantime, you learn a bit about the food intake, what it does."*
- *"Maybe the only question is that we look at feeling healthy, it also about moving enough, so it's not only about food, but maybe that's too much. I was just thinking. Maybe this is for supermarket and you only focus on food and then it's enough."*
- *"I can image that I've been exercising a lot and I have been eating a lot after that, but I can still feel healthy, and my dragon gets sick. Health does not only depend on what you eat.....I think the key part is the multidisciplinary approach. "*
- *"For skills there is a bigger range because that's what you learn throughout your life, from your father, mother, family, eating together. Skills are also about how to eat, eat not too fast, not with TV, telephone. There are more food literacy skills, not only recipes, but it's ok to narrow it down. "*
- *"What I like very much is the inputting what you buy, so you have a real-life input from the food. But the food knowledge of individual ingredient is still quite complex for the target group. So what I would do is to redesign this nutrition label into perhaps two or three factors, and these can be factors related to the dragons."*

4.3. Conclusion and discussion

In general, the final concept Glutton Dragon meets the goal of conveying food literacy in an enjoyable, indirect, and unforced way. The game elements are considered suitable and well integrated with food knowledge.

However, the enjoyment can be enhanced by adding mini-games to let people play more with their dragons, and the feedback about unhealthy input can be refined to make sure people feel free and pleasant to upload what they really eat. The game mechanics and elements used in the concept are considered effective, but the functions need to be prioritized to emphasize the main game loop. The knowledge presented in the game, especially the nutritional value of food may still be complex for people with low SES, which should be simplified in order to announce the literacy. Moreover, a multidisciplinary approach is suggested for further development since healthy food behavior always relates to other lifestyle behaviors.

The final concept is also discussed and evaluated based on the design requirements proposed in chapter 2.5.4.

Naturally encounter users

The concept proposes to cooperate with supermarkets, in this way the game can be promoted as a special activity and attract customers in the supermarket. It also uses rewards and benefits to motivate people to start playing.

Easy to get started

The basic game loop (feeding dragon and getting rewards) is simple to understand; instructions are provided from the registration stage. User interfaces are well organized, the main functions are easy to reach and players can explore other functions gradually. However, the way of presenting nutritional value needs to be more simplified, avoiding the use of terminology that are unfamiliar to low SES people.

Keep users coming back to use

Since the concept is not completely developed to enable users to play for real, there is still a question about if it is enough for people to keep coming back and play for a long time. The concept now can be used as the start version, new functions can be added for more entertainment if needed.

Provide food-related information

The game integrates nutritional value and recipes to help people with cooking, use food quiz to deliver food knowledge and check if people pick up the knowledge and provides feedback on how healthy or unhealthy meals influence the dragons (and players as well) to make them realize the importance of healthy eating. According to the expert test, new factors can be made to present the food value in a way that easy to understand for low SES people, and the consequence on the dragon can be shown for both short-term and long-term.

Gather dietary data from users

This game links to the bonus card to track food purchase and encourages users to upload their meals by simply taking a picture of what they eat. Although the latest innovations in deep learning and image classification technology can quickly and accurately identify food items, based on the expert's feedback, it would be nice to have a database where meals are already profiled to let users choose.

Provide feedback and recommendation

The taste profile created in the beginning allows the system to give recommendations not only based on health, price or cooking effort but also take users' preference into account. The users can get visualized and textual feedback from the dragon after feeding it, which shows the impact of meals. For further development, it needs to pay more attention to the feedback on unhealthy diets and make sure users are willing to upload the real meals instead of cheating (only upload healthy meals to get good feedback).

Take little time and effort per-use

The main game loop is considered simple and clear, people can choose to cook in the game, which takes a little bit more time, or they can just take a picture of the meal and upload to feed their dragon easily. Apart from the enjoyment of seeing the dragon grow up and the surprise of collecting new dragons, benefits and rewards are used to motivate people so they feel it's worthy of spending time and having fun in the game. However, for now, the game may be a little bit too easy and lack of challenge or excitement to play for a longer time, therefore some mini-games can be added and people can choose if they want to play more.

Lead to healthy food behavior or health consciousness

The final concept conveys food knowledge in an enjoyable, indirect, and unforced way, so people can get knowledge through playing. And the dragon in the game, on the one hand, plays a role as a lovely pet, and people will feel that it is their responsibility to keep their dragon healthy; on the other hand, it is also a mirror that reflects the food behavior of the players, the reactions and feedback it provides shows the consequence of different eating habits. Although knowledge alone doesn't solve the whole problem of changing dietary behavior, it can change the attitude towards healthy eating and make people know what is good or bad for themselves, which is considered valuable.

5 Concluding Remarks

This final chapter includes a short conclusion about the whole project and the value of the design concept. Limitations to the research and project and recommendations for further development are mentioned as well.

5.1. Conclusion

The goal of this project is to increase food literacy of people with low SES. Based on the analyses of the user research and literature review, the reason behind the current situation that many low SES people don't have healthy food behavior and struggle with food informatics tools was revealed. On the one hand, low SES people don't see the significance or necessity of healthy eating because the bad consequence led by unhealthy dietary behavior is not apparent to them. On the other hand, the effort of getting food data and reporting diet is quite high for people who live a busy life. Therefore, it requires the design to find a proper way to motivate people and support them to consume as well as reporting food-related data. Fogg's Behavior Model and Self Determination Theory provided possible design directions, and a specific design goal was refined after the analyses of user needs: to convey food-related knowledge in an enjoyable, indirect, and unforced way.

Because of time constraints, the design focuses were narrowed down to the food selection in the supermarket and the food preparation after. Cooperating with the supermarket creates the opportunity to introduce the concept to the customers, and the supermarket can also benefit from this by promoting their food products through the design intervention.

The design aims to enhance motivation and evoke awareness by giving feedback on people food behavior. To achieve that, the persuasive game design method was applied because gameful behavior in the game world (which always considered entertaining) can facilitate or persuade the realization of non-entertaining real-world goals. During the design stage, different game elements and metaphors were tried out in evaluative sessions and users test. The results proved that nurturing did make people feel related to the game character, and it then evokes self-reflection of their food behavior. Other elements like fantasy and collecting add fun, attractiveness, and excitement to the game, and together they increase the intrinsic motivation for people to play the game and learning unconsciously by playing.

In the game Glutton Dragon, the theme is raising a dragon. Users can see the effect of food when they feed their dragons. They won't feel they are being judged or they are forced to learn; instead, they naturally learn what food is healthy to the dragon (and to themselves) and how to cook healthy meals from playing the game. The concept has a real-life input by turning food bought in the supermarket to virtual ingredients in the game, which strengthens the connection between the game world and the real world.

And in order to reduce the effort of use, the design proposes to use food image recognition technologies so users don't need to input too much information about their diet. While at the same time, it still encourages people to report more detailed information as well as the eating context (e.g., time, location) by offering extra game rewards.

In conclusion, this game concept proposes

a new way to convey food literacy and influence the behavior of people with low SES. Actually, it also fit users with higher socioeconomic status. This concept can be the first step to engage people in a gameful world where food knowledge is integrated and persuade people to pay more attention to healthy dietary behavior.

There are still steps need to be taken to complete the concept from both a technical perspective and design perspective. Further development and adjustment will enrich the user experience, and the transfer goal can be achieved better.

5.2. Limitations

This section discusses the limitations of the project from research stage to evaluation stage and the possible implications.

Limited access to the user group

One of the obstacles in the project is that it's very difficult to get in touch with low SES user group, especially for non-Dutch speaking people like me. Therefore the research about user characteristics was mainly from literature reviews. Although there were some user surveys conducted by means of small interventions in the supermarket, the sample sizes were not big, and there was not much verbal communication with the participants due to the language barrier. The user journey and personas can be more explicit and convincing if more people from the target group join in the research activity and provide detailed information about their current lifestyle, wishes, and requirements related to food behavior.

Also, because all the participants for the user research and user test were found in discount supermarkets and neighborhoods with lower SES, it's unable to determine their socioeconomic status accurately, which may cause deviation in the result.

Limitations of the design iteration and validation

Due to limitations in time and resources, it is not feasible to carry out a real gameplay testing for the design iteration and the evaluation of the final concept.

Instead, evaluative sessions with peer students and concept tests with users were conducted during the design stage to check the effect of certain game features and people's likelihood of use. Expert tests were also conducted for the final validation of the concept. Although interactive prototypes and introduction video can simulate the interactions happen in the game and the experience of users, the sense of participation is not enough and what will happen after playing the game for a period of time is unpredictable. The result of the final evaluation shows that the concept meets the design goal, but there are still things that need to be tested in a real-life context and during real gameplay.

Limitations of the project scope

Limitations of the project scope

For now, the project only focuses on facilitating people to make healthy food choices and prepare healthy meals. However, when looking at a healthy dietary lifestyle, it's not only about what kind of food people eat. Besides having a meal with low nutritional value, the problem might be eating a very low amount of food or eating irregularly, for example, not having breakfast.

In addition, according to the feedback from the expert test, these days design interventions about lifestyle are often multi-

target, e.g., nutrition and exercise or smoking and alcohol abusing. Therefore it would create more value for the target group if the concept cooperates with more disciplines.

5.3. Recommendations

Based on the conclusion and limitations, recommendations for further development are given as follows.

Recommendations for further development

More entertainment for longer gameplay

In order to keep the game simple for people to start playing easily, it is fine to have fewer functions. However, as the game progresses, there should be more game layers to attract people to explore and keep them coming back. It also has to be a little bit challenging because sometimes we underestimate the low SES group, and this will make feel stigmatized and don't wanna use the design. A couple of mini-games and a library of activities that players can do with their dragon can be provided at different stages, perhaps according the growth of the dragon. For example, the players can teach their dragon new skills and then unlock new games.

Changing the form of interaction can also make the game more entertaining to play, technology like AR can be applied to "bring the dragon to the real world", and then the players can go shopping with their dragons and make food decisions together.

Enhance personalization and representation

The personalization in the game can be enhanced to strengthen the emotional bond between users and the dragon, which is essential for people to take the game seriously and really try to look after their dragons well. For instance, maybe people can take a snapshot of their garden or bedroom and use it as the game background, and it creates a feeling that the dragon lives in their house. Besides, two designers in the expert test mentioned that the visual style of the game and the dragon is cute and looks more for children, and some adults might have different preferences. Since it is difficult to pick up one style that fits everyone's preference, maybe the game can also let the players create their own dragon styles. Avatars of the users can be created in the game and showed together with their dragons to make the representation clearer and stronger.

More integration with the context and related behavior

For further design steps, the game can integrate with relevant lifestyle behaviors, for example, exercise. The dietitian mentioned that sometimes exercise is even a bigger problem than the nutrition part in terms of changing food behavior, and it's easier to tackle within the game (e.g., based on the step-counting). Involving exercise or moving enables the game to calculate how much energy and nutrition the players need from eating, and provide better suggestion and feedback based on their situation of that day. The updated design intervention can start with a small group, e.g., based on the community or healthcare center to see how it works.

The context is also considered important because people’s food behaviors tend to influenced by context. When having a party or festival, people usually eat a lot of unhealthy food. Therefore the game can try to simulate different context (e.g., eating with others instead of eating alone, celebrating for

a special event) according to the input from the players.

Specify the food knowledge in the interaction and simplify the way of presenting

The food knowledge of individual ingredient is still quite tense, which is a list of nutritional values and may be too complex for the target group. The nutrition label can be redesigned into two or three new factors, and these can be factors related to the dragons. For instance, this food can make the dragon sleep well and that food can decrease the bad mood. Moreover, instead of only showing objective health values(e. g., help with digestion), subjective health values (e.g., make people feel happy) that are close to people's experience and easier to understand can also be illustrated and shown to people through the dragon. Meanwhile, the visualization of short-term and long-term benefits of the meals and eating habits are going to be optimized to make users better understand the impact of the food they eat.

Another recommendation to emphasis food knowledge is based on the taste profile. Now people can only see the profile; it may be interesting to allow them to edit it. When the dragon has a bad profile with many unhealthy eating habits, people can try to feed them good food or educate them to change the profile and make the dragon stronger. If people are trying to educate their dragons, first they need to educate themselves to know which preferences are good and which are bad. There can be a preference list where people can choose a replacement for a bad one; they earn the opportunity to change the profile by answering quiz questions or accomplishing cooking missions, rewards (diamonds, discount,etc.) will be provided after to motivate them as well.

Use database for diet reporting

It is indicated in the final evaluative session that using pictures to report diet would provide inaccurate data, especially for the portion size. Therefore, a database of profiled meals is suggested to be used to facilitate the reporting part. As shown in Figure 44, the diet tracker app FatSecret has a large collection of verified food and recipes, and it covers packaged food as well as restaurant food, which allows users to input relatively accurate recipe by choosing the most similar one.

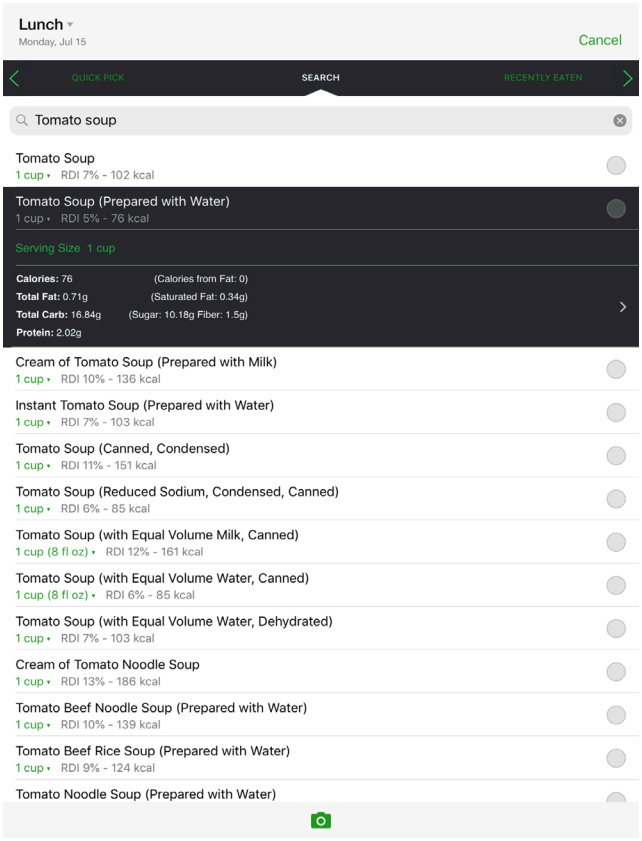


Figure 44. A collection of tomato soup recipes in FatSecret

Recommendations for further validation

As mentioned in the limitations, the concept needs to be completed as a real game which enables users to play in a real-world context for some times. Test about the game experience with low SES users and the transfer effect can be conducted.

5.4. Personal reflection

I was motivated to execute this graduation assignment because I am very interested in the connection and relation between human and food and the reason behind people's food behavior. However, having a little understanding of the people with low SES and knowing that it would be challenging for me to reach them, I started the project with a little bit worry. Although the literature research provided information about the characteristics of low SES people and contextual factors that influence food behaviors, there still needed some research with real users to make the result more convincing and specific.

Since I couldn't speak Dutch, I tried to find a way of doing user research without many verbal communications. I decided to conduct the research by means of intervention, trying to trigger people to take action instead of asking them questions directly. For example, to find the influential factors during food selection, fake food products with different price and calories were made, and the participants can simply choose which one they would like to buy and tell me the reason. And to find which medium works better in conveying information, I handed out flyers and chocolate in front of the supermarket and observed people's reaction. It always made me nervous because I worried that what if people just ignore me or couldn't understand me. Fortunately, the research went well, and I also got some courage from overcoming difficulty.

These interventions required more observation and less talking, which worked well for this project. However, it would be nice to have some co-creative session with users and let them share their routines and daily food behaviors. There were many interesting insights from the user research and I felt that they did not only work for the later design but also helps me as a person to learn about the other people who have different lifestyles.

As for design theories and methodologies, it took me some time to learn the SDT theory and the differences between intrinsic motivation and extrinsic motivation because the design aims to motivate people to consume and report food data and learn food knowledge. Persuasive Game Design model provided a guideline for me to summarize the insights from research and conduct design activities. Before this project, I also did literature research and used theories in my design works, but I felt that in this graduation project the theories were integrated better with design and I often looked back to make sure there was a connection between research, theory, and design.

Designing a game was a very special experience. I never designed games and also not very into playing games. To getting inspirations, I played four different games (3 of them were related to healthcare) during the design stage, analyzing the game element used and the reason why I'm willing to keep playing them. The narrative design part was the most enjoyable part and I did realize the power and enchantment of storytelling in design. I hope that I can use this experience in the future.

The most struggling part for me is to narrow down the design scope and to make choices on what functions or directions should be focused and what should be excluded. When thinking about design idea, I tended to put every function in it and hoped it to solve as

many problems as possible, which usually made the ideas too complex. It's helpful and important to choose something to focus on in early-stage and then develope step by step based on that.

The final design of this project reached my expectation to some extent; it explored new possibilities in conveying and integrating food literacy through game, and I hoped it could be developed further and really benefit low SES people.

In general, I would say this project was very valuable and meaningful to me because it brought me to a new field and pushed me to use the skills I learned during the two years to deal with all the challenges. It's definitely a unique learning experience.

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APPENDICES

Table of content appendices

Appendix A
Test Result in Lidl

1.59€ 200g

2.19€ 200g

A (9) vs B (1)

- I just want the **cheap** one.
- I **didn't even notice** it (the calories).
- I don't check the calories.
- I **don't care** about the energy.

- 100 kcal is a lot.

1.59€ 200g

1.59€ 200g

A (5) vs C (5)

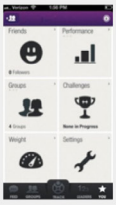
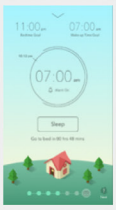
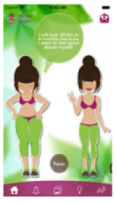
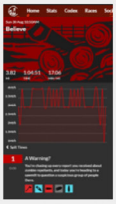
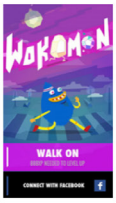
- The energy **doesn't matter**.
- I don't care about the energy. I'm not fat.
- It's still chocolate and I just want to eat chocolate, there's no big difference.
- Because it has **more energy** and, same amount but more energy.

- If the price is the same, I will choose this because it looks healthier.
- It doesn't really matter... maybe this, I don't know.
- Probably the healthier one.

Appendix B
Table of contextual factors

Theme	*Factors*
Attitude	•Attitudes about food behavior towards themselves or others. (positive-neutral-negative, thoughts, prejudices, implicit and explicit) •Attitudes toward the food industry (trust or not) •Give meaning to food items. •Paradox - what you know/want <> what you do
Biological	•Mental or physical condition •Ageing •Ability of self-control or restriction •Genes set the potential of becoming obese. •Variation in appetite is linked to a strong genetic basis
Food literacy	•Knowledge and skills, knowing specific details about food products •Consensus / Doubt / ambivalent •Knowing that you did something good or bad •Understanding the impact of food on one's health, the environment and economy
Motivation	•Intrinsic motivation: engaging in behaviors for their own sake (Patrick & Williams 2012). •Extrinsic motivation: engaging in behaviors for some separable outcome
Psychological	•Inherent needs and values •Influence of mood and emotion. Stress could especially increase the intake of comfort food, which is often energy-dense and high in sugar and fat (Dallman et al., 2003) •Feeling judged or shame when knowing their food behavior is not good •Coping mechanisms: how to resist to extreme temptations or deal with disappointments
Routine / Habits	•Regular eating patterns •Rewards or safe zones to prevent overeating
Social	•Influence of parents and peers •Experiencing special (harmful) life event. •Treatment from professionals. Dieticians focus more on what than why, the expectations often not meet the actual outcome •Influence of Media
Temporal	•Danger zone: a timepoint, place associated with temptations or relapse (breaking routines), eg., evening, holiday

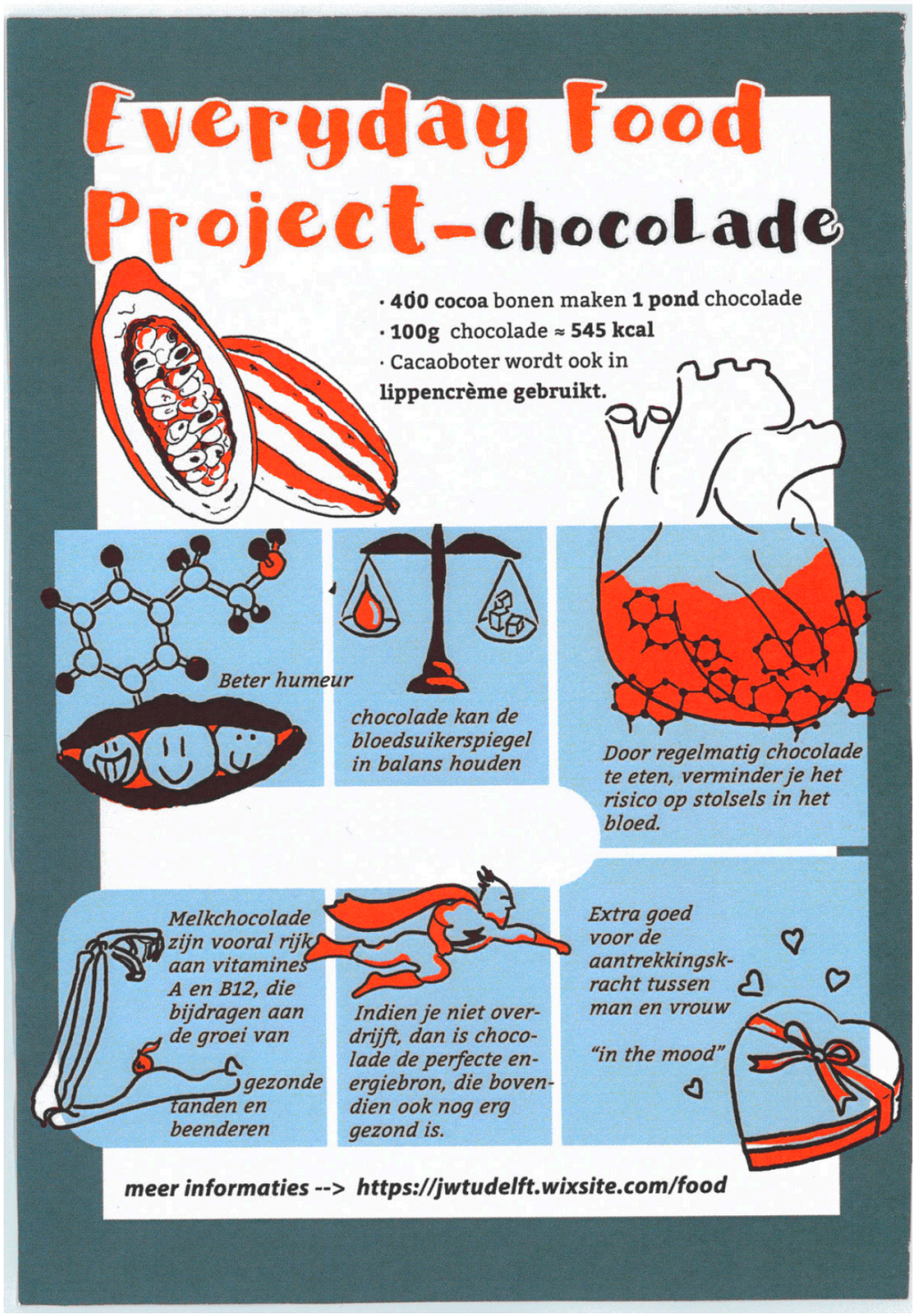
Appendix C
Analysis of gamified healthcare apps

		Domain	Avatars	Feedback	Leader boards	Levels	Progress / Performance graphs	Rewards	Competition	Teams multi-players	Story/ theme	Game elements
Fitocracy		Exercise	1	1	1	1	1	1	0	0	0	challenge rules/goals completion
Forest		Stay focused	0	1	1	0	1	1	1	1	1	completion challenge competition fellowship rules/goals
Sleep Town		Regular Sleep	0	1	1	0	1	1	1	1	1	completion challenge competition fellowship rules/goals
Fortune City		Account	1	1	1	1	1	1	1	0	1	nurture exploration simulation
Walkr		Walking	1	1	1	1	1	1	1	1	1	exploration simulation competition fantasy mystery completion
My Diet Coach		Healthy diet	1	1	0	0	1	1	0	0	0	simulation rules/goals challenge completion
Zombies Run		Jogging	1	1	0	1	1	1	0	0	1	simulation sensation thrill competition completion challenge rules/goals
Wokamon		Walking	1	1	1	0	1	1	1	0	1	nurture completion fantasy fellowship
Total			5	8	7	4	8	7	6	3	6	

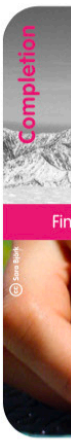
Appendix D
Analysis of dietary apps

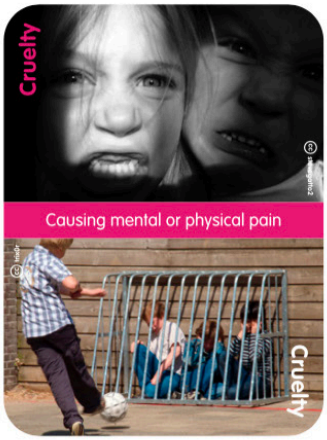
	BMI formula	Calorie counter	Graphs of intake	Recommendation of nutrients intake	Recipes	Modifiable food databases	Online social support	Educational material	Reminders to log	Calendar	Flags for lapses in dietary goal adherence
MyFitnessPal	1	1	1	1	1	1	1	0	1	0	1
See How You Eat	0	0	0	0	0	0	0	1	1	1	0
YAZIO	1	1	1	1	1	1	0	1	1	1	1
Lose It!	0	1	1	1	0	1	1	0	1	1	0
MyPlate Calorie Counter	1	1	1	1	1	1	1	0	1	1	0
YouAte	0	0	1	0	0	0	1	0	1	1	1
Fooducate	1	1	1	1	1	1	1	1	1	1	1
21 DAY FIX TRACKER	0	0	1	1	0	1	0	0	1	1	0
My Diet Coach	1	1	1	1	0	1	1	1	1	1	0
Kalekam	0	0	1	0	1	1	1	0	1	1	0
Lifesum	1	1	1	1	1	1	0	1	1	1	1
Shopwell	0	1	1	1	0	1	1	1	0	1	0
Total	6	8	11	9	6	10	8	6	11	11	5

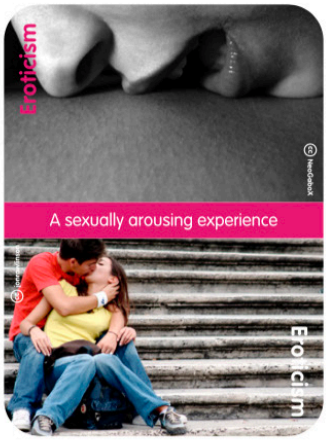
Appendix E
Flyers for user test

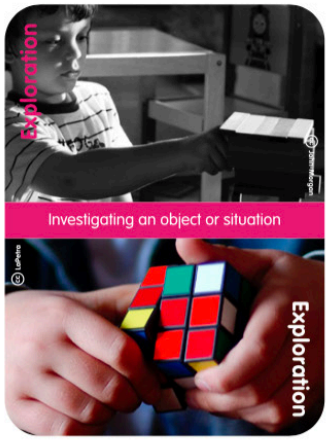


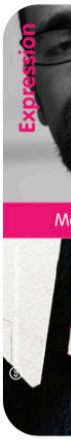
Appendix F
PLEX cards

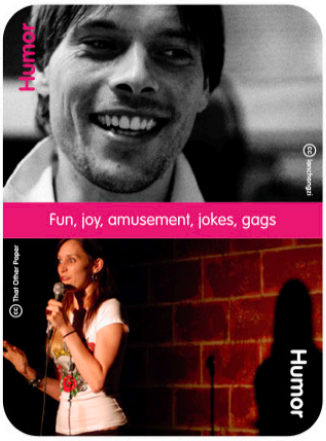


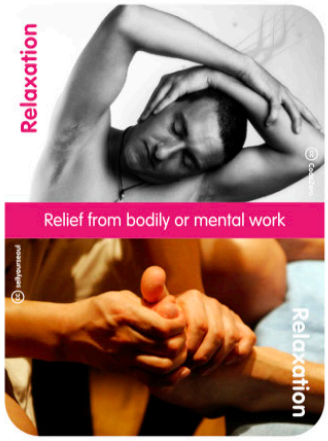


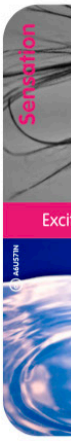


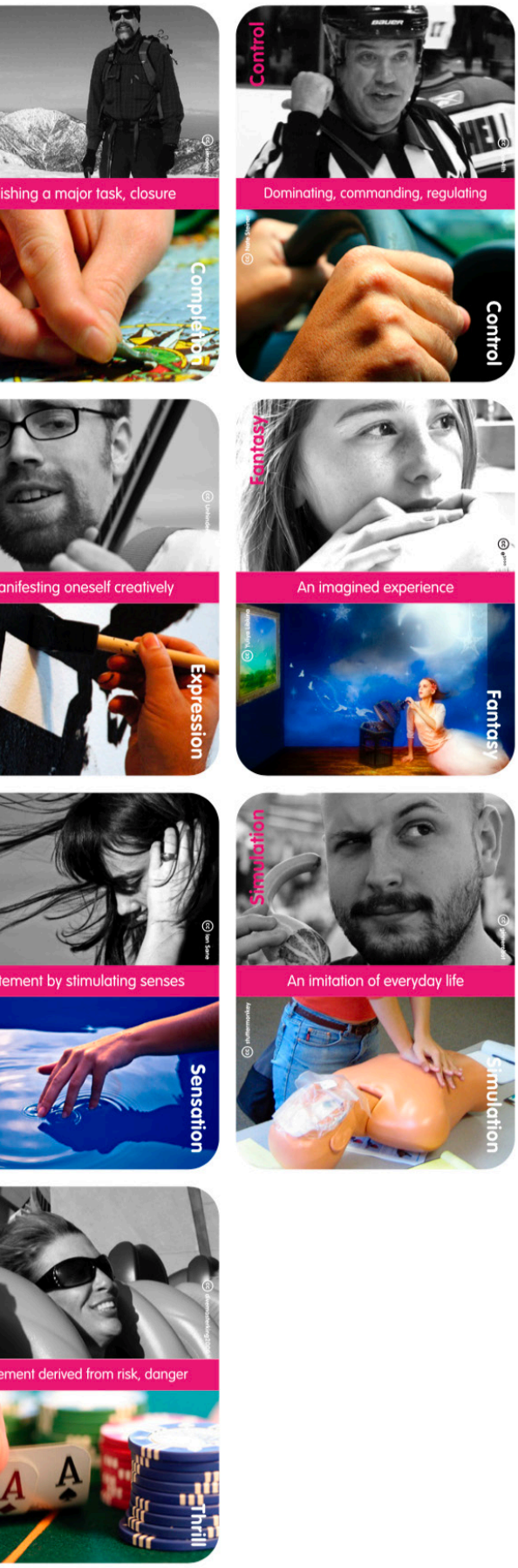












Appendix G
Ideas from the brainstorm session

Idea 1

Game elements

Discovery Competition Challenge

Description

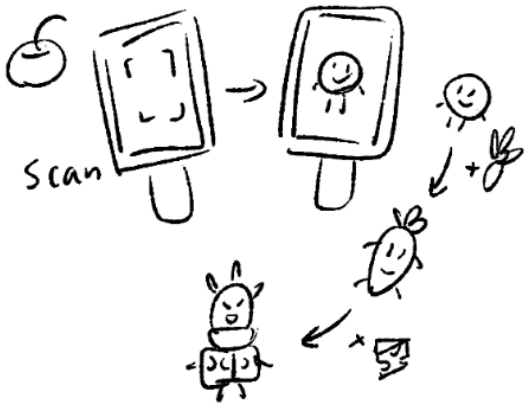
In this idea, users can collect monsters and fight with others' monsters. The appearance and attributes of the monster are based on what food product people bought in the supermarket. To get stronger monsters, people need to choose healthy food products and keep a good nutrition balance. Also, when users collect five monsters, they can get a physical reward from the supermarket. The game will take place on the screen of scanners and mobile phones.

Pros

The idea makes the shopping process interesting and encourages people to choose healthy food indirectly.

Cons

The concept of monsters may be a little bit childish, and its attractiveness depends on the visual style.



Idea 2

Game elements

Nurture Relaxation Control

Description

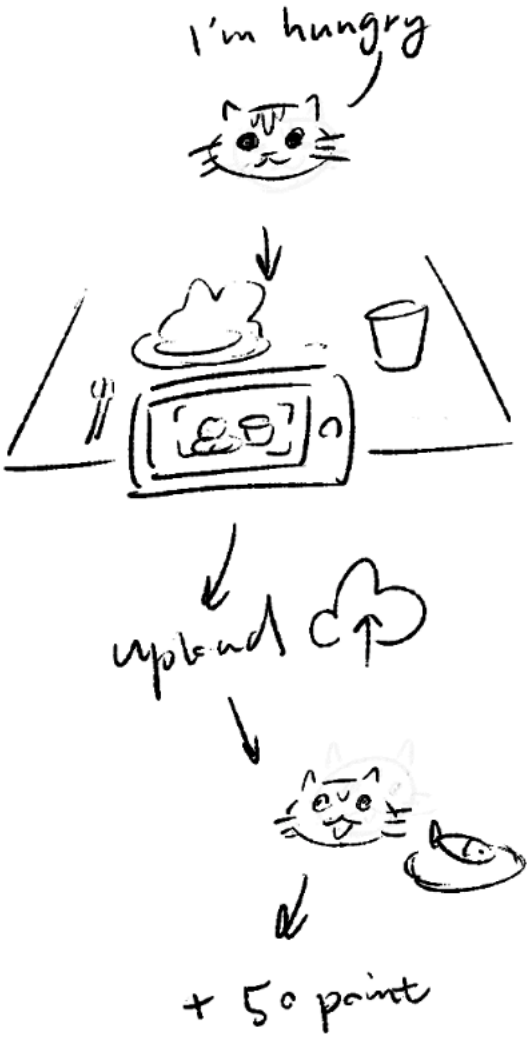
In this idea, users can get a digital pet when choosing a bonus card in the supermarket. The bonus card looks the same as the pet in the app. Users feed their digital pet with what they eat in real life. They can take a picture and upload it to the game, and the pet will get virtual food. The more nutrition the food contains, the healthier the pet will become.

Pros

The story is clear and logical. The physical card can remind people of using the app.

Cons

People can cheat by uploading food pictures from the internet.



Idea 3

Game elements

Discovery Completion Challenge

Description

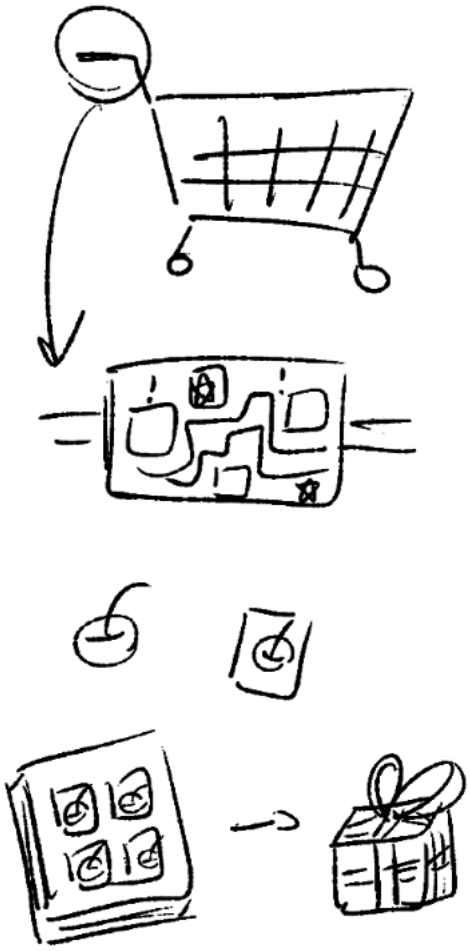
In this idea, customers becoming treasure hunters and the mission is to gather treasures in the supermarket. There will be a screen on the trolley to guide the users and buying the food in a certain area means finding the treasure. People get stickers after paying and they can collect the stickers to exchange for physical rewards.

Pros

The theme is fascinating. Collecting stickers is a thing that people do now and it do works.

Cons

It will cost a lot if using screens on the trolly. People who already have shopping plans may ignore the treasure if it is not what they need.



Idea 4

Game elements

Exploration Completion Fellowship

Description

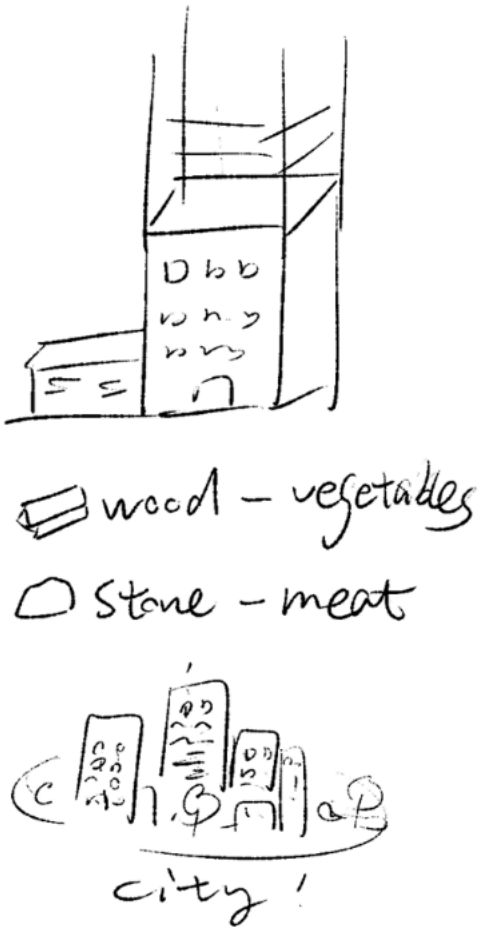
The food products users bought become materials used to build houses in this idea. Vegetables become wood, meat and fish become stone. The users can cooperate with their friend and form a team to build their city together.

Pros

It involves teamwork and may encourage people to play.

Cons

The reason why users need to build the city by using this design instead of playing another game is missing.



Idea 5

Game elements

Discovery Relaxation Control

Discription

In this idea, players are chefs who need to create meals using the food they bought from the supermarket for customers based on their needs. They need to check which food has which nutrient to make sure the meal stays balanced. The better your meal fits customer needs, the more tip or "money" you receive. With the money, the player can upgrade the restaurant or buy virtual food in the game to meet customer needs.

Pros

People can get awareness of healthy eating
This idea can help with meal preparation and provide cooking knowledge for players. Using food bought at the supermarket in the real world to cook meals in the game is a reasonable way to connect the real world and gameplay.

Cons

It takes more time and effort to play the game and may not be attractive for users to serve customers in the game.

Idea 6

Game elements

Exploration Competition Fellowship

Description

Food of the week. Every week there are new ingredients on sale, and people are encouraged to use these ingredients to make a healthy meal. If you post a recipe with enough points scored by others at the end of the week, you can get rewards.

Pros

This idea involves other users, so the social effect is enhanced.

Cons

The focus on providing knowledge or instruction is missing in this idea; it seems people need to explore healthy recipe by themselves. Moreover, the reason to score others is not clear.

Idea 7

Game elements

Nurture Simulation Competition

Description

In this idea, the player can get five nutrient soldiers (vitamin, protein, mineral, fat, carbohydrate) the first time they use the design when shopping. Together these soldiers will fight with the devil to get treasures in the game. The energy level of soldiers goes up when people buy food in the supermarket. Players need to keep their soldier healthy to beat the devil. If one soldier is too weak (eg., the player did not buy meat for a long time, so the protein soldier became very weak) it may be killed by the devil and the player will get a new one with the low level the next time they go shopping.

Pros

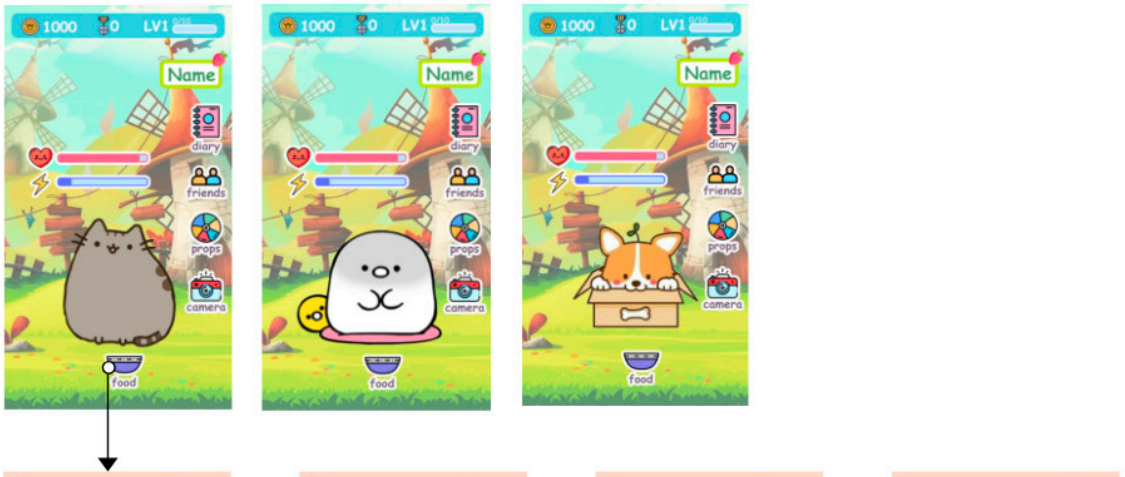
The story is interesting, and the concept of nutrient soldiers clearly shows the connection between the game and healthy food choice in the real world.

Cons

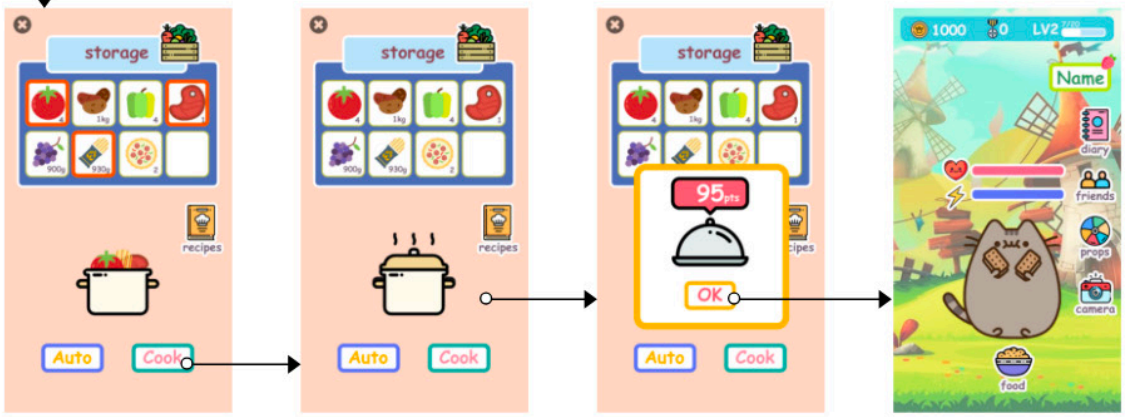
People may build their army with a very strong fat soldier and a very weak vitamin soldier but still win the battle. In this situation, the game will not lead to healthy food choice.

Appendix H
Flowcharts and interfaces of three initial ideas

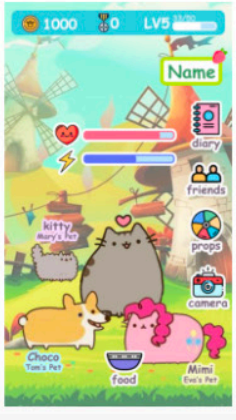
Choose the pet you want to keep



When your pet is hungry, you need to choose ingredients to cook for it.

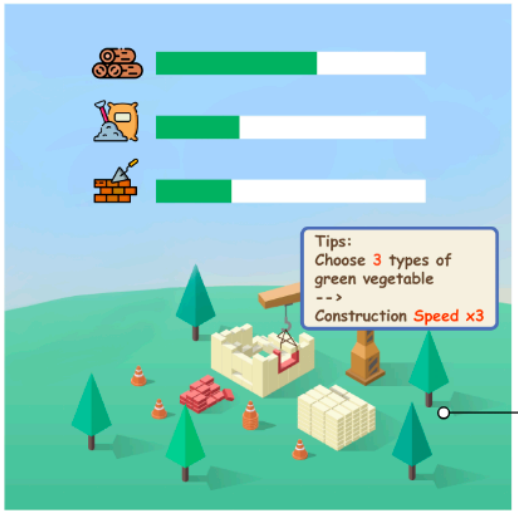


You can check the recipes to get help.
Or choose AUTO mode and get the most healthy meal.



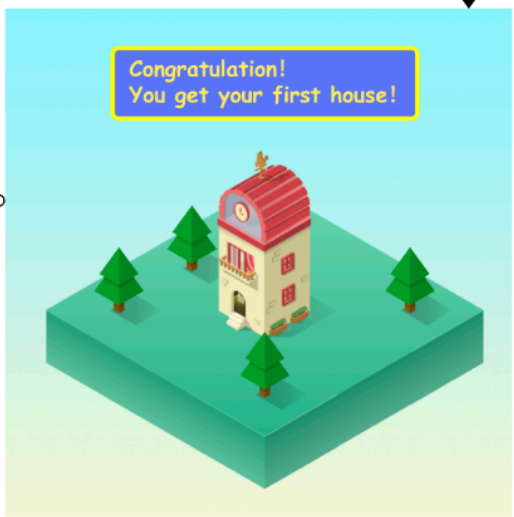
You can visit your friends' garden and let the pets play with their friends.

See game information on the checkout screen and tips about how to get a house faster in the game.

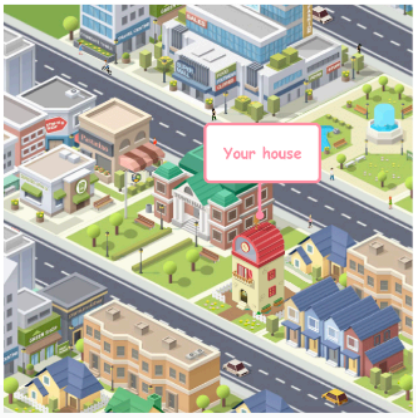


Get the receipt with the picture of “your house in being built”

Get the first house after shopping several times



Alse get the receipt with the picture of your first house

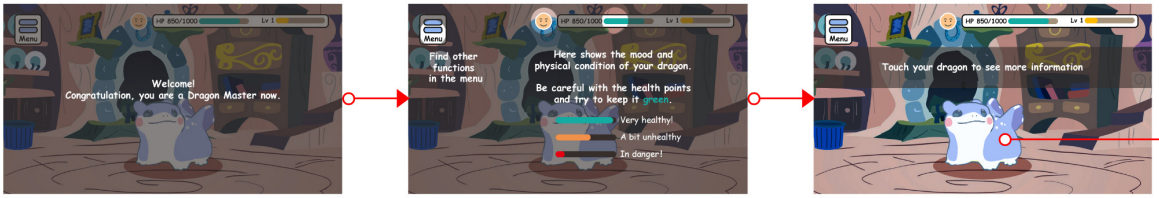


You can find your house and other customers’ building on the checkout screen of the supermarket.

Appendix I
Flowchart and interfaces of two concepts


Adventure
Adventure Team
Magic Level:
Go
Here you can build your own Adventure Team.
Choose monsters with more magic skills will make your team stronger!
The higher magic level (A+B+C+D+E) your team has, the longer the adventure will be, and you can get more treasure!
Magic Level: C
00:02/05:00
Stop
Gifts from the adventure team
Save
Adventure
Shop
Get more
Starry Hat
Crystal Ball
Lavender
Unlock Chance
Purchase Starry Hat?
Yes
No
Bought
Page 1/10
Shop
Library
Vegetables & fruits
Asparagus
Back
Library
Friends
Jesse
Eva
Tim
Martina
Visit
Page 1/2
Friends

Introduction



Time to eat

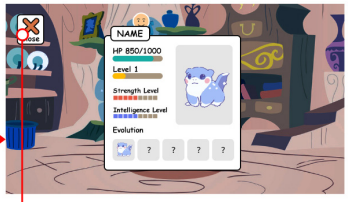
Cook

Tips and Feedback

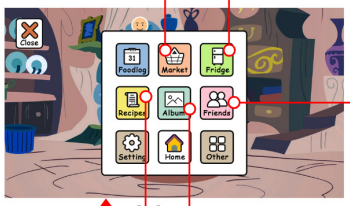
Evolution

Market

Fridge



Profile

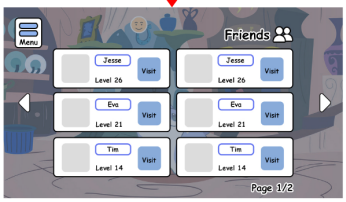


Menu

Home

Recipes

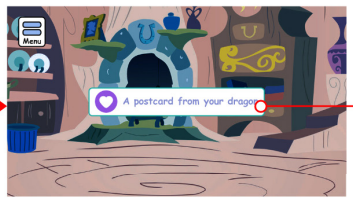
Album



Friends

Feed&Eat

Rewards



Postcard

Appendix J
Materials for user test
Interfaces of the checkout screen

WANT A SUPER MONSTER?
Have a look at the new activity!

Monsters are created by 3 food products.
You can get a monster every time when you buy more than 3 food product!
Collect 10 different monster to get a REAL plush monster.

Download the app
Dive into the magical world of the Super Monsters. Collect 10 different monster to get a REAL plush monster.
Play the best games and learn interesting facts about your favorite food!

WANT A SUPER MONSTER?
Have a look at the new activity!

Monsters are created by 3 food products.
You can get a monster every time when you buy more than
Collect 10 different monster to get a REAL plush monster.

1	Watermeloen	2.49
2	Volle melk	2.20
1	Vastkokende aardappelen	4.29
1	Nederlandse aardbeien	2.99
1	Tomaten	0.89
1	Appelen	2.29

Te betalen 15.15

Download the app
Dive into the magical world of the Super Monsters. Collect 10 different monster to get a REAL plush monster.
Play the best games and learn interesting facts about your favorite food!

Your monster is being generated…

1	Watermeloen	2.49
2	Volle melk	2.20
1	Vastkokende aardappelen	4.29
1	Nederlandse aardbeien	2.99
1	Tomaten	0.89
1	Appelen	2.29

Te betalen	15.15

Download the app
Dive into the magical world of the Super Monsters. Collect 10 different monster to get a REAL plush monster.
Play the best games and learn interesting facts about your favorite food!

Congratulation! Based on your food choices, you get a new monster!

1	Watermeloen	2.49
2	Volle melk	2.20
1	Vastkokende aardappelen	4.29
1	Nederlandse aardbeien	2.99
1	Tomaten	0.89
1	Appelen	2.29

Te betalen	15.15

Download the app
Dive into the magical world of the Super Monsters.
Play the best games and learn interesting facts about your favorite food!
Collect 10 different monster to get a REAL plush monster.

Questionnaire

Information collection

Your information and inputs for this experiment will only be used for research reasons, in order to improve the game concepts. (*please tick on the box)

☐ I have read the text above

1. Gender ☐ Female ☐ Male

2. Age ☐ <20 ☐ 20-29 ☐ 30-39 ☐ 40-49 ☐ 49<

3. Zipcode _____

4. Total number of faminy members (living and eating together) _____

5. What's the composition of your family?

☐ Self ☐ Parents ☐ Children ☐ Other relatives

Evaluating the concepts

Please rate your impression of the Monster concept in terms of following properties.

Enjoyment

	1	2	3	4	5	6	7	
Very dislike	○	○	○	○	○	○	○	Very enjoy

Likelihood of use

	1	2	3	4	5	6	7	
Definitely not consider using	○	○	○	○	○	○	○	Definitely consider using

Ease of understanding

	1	2	3	4	5	6	7	
Very hard to use	○	○	○	○	○	○	○	Very easy to use

Benefits / Helpfulness

	1	2	3	4	5	6	7	
No benefit Very unhelpful	○	○	○	○	○	○	○	Very beneficial Very helpful

Effort of use

	1	2	3	4	5	6	7	
Too much effort	○	○	○	○	○	○	○	No effort

Please rate your impression of the Dragon concept in terms of following properties.

Enjoyment

	1	2	3	4	5	6	7	
Very dislike	○	○	○	○	○	○	○	Very enjoy

Likelihood of use

	1	2	3	4	5	6	7	
Definitely not consider using	○	○	○	○	○	○	○	Definitely consider using

Ease of understanding

	1	2	3	4	5	6	7	
Very hard to use	○	○	○	○	○	○	○	Very easy to use

Benefits / Helpfulness

	1	2	3	4	5	6	7	
No benefit Very unhelpful	○	○	○	○	○	○	○	Very beneficial Very helpful

Effort of use

	1	2	3	4	5	6	7	
Too much effort	○	○	○	○	○	○	○	No effort

1. Which concept do you like more? Why?

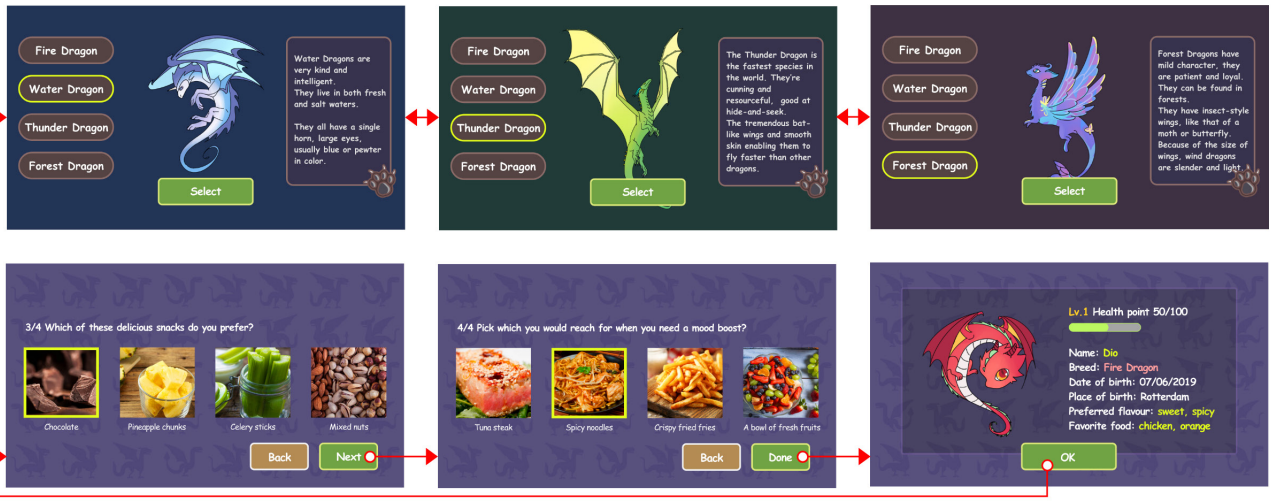
2.Any comments?

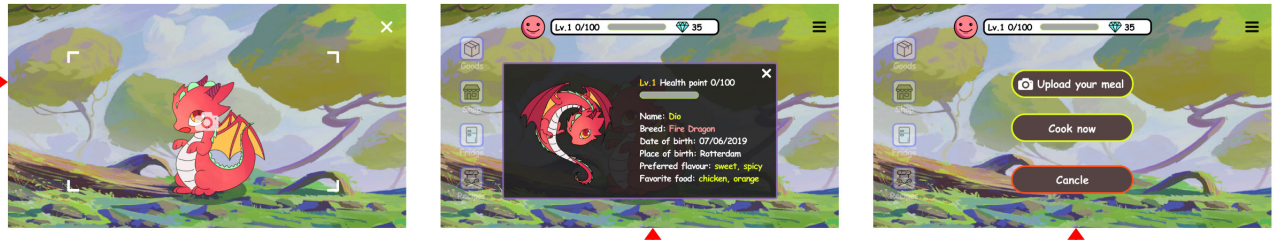
Appendix K Result of user test

Participants	Gender	Age	zipcode	Family composition	Rate for concept Monster	Rate for concept Dragon	Preferred concept	Comments
1	M	20-29	2624DD	4 people no child	7-5-4-5-47	-6-6-6-6	Dragon	• The monsters look too cute for me, maybe it's not really for boys...could be more tough. (—>visual style should be cute but not too cute) • I will choose the Monster one if I feel like a challenge, choose Dragon if I just want to relax. Most of the time I would choose Dragon because I will think while cooking and do not feel like more challenge.
2	F	40-49	2624JH	4 people 2 child	5-1-6-6-47	-3-6-6-3	Dragon	• I don't play games. • I don't want an extra application on my phone. • Prefer the Dragon one because it integrates more of cooking and nourishing things.
3	F	20-29	2628ZL	3 people no child	6-5-7-6-57	-7-7-6-6	Dragon	• I will be more curious if I can't see every monster. (—->use shadow maybe) • Is there any rewards if I read all the books in the library? (—>unlock achievement?) • The dragon (in the app) looks like a dragon who doesn't eat vegetables. Maybe there are different dragons, some like meat and some like vegetables. • The Dragon one is so cute and I'd like to take care of my dragon, just like taking care of myself. (self-reflection)
4	F	20-29	2526BW1	people	5-5-6-6-36	-7-7-6-5	Dragon	• The rules of Monster is complex and there are too many things I need to think about. • My mon would like to use (the Dragon one) if she can get real food. • What if I only want some particular monsters? I'll stop playing after I got them. • Some people may not want a healthy monster, they may just think an unhealthy one looks more cute.
5	F	30-39	2628BA	3 people 1 child	5-5-3-4-36	-6-6-5-5	Dragon	• The Dragon one is easy to understand and it can help me with cooking. • The Monster is funny and interesting, very colourful, which delights me. I think children will like the monsters. But it's too complex.
6	M	30-39	2624HK	5 people 1 child	5-6-4-4-46	-4-5-5-6	Monster	• My children will like to play (the Monster one) but there are too many components. • I need to find out how to get monsters by myself, maybe the game could tell me what food combination can get which monster.(need more recommendations) • I like the Monster one more because I can always get something every time I go shopping. • The Dragon one is more helpful and useful but I'm not very interested in keeping a pet. • Cooking 3 times per day is too much effort and may makes me boring.(—>Automatically cooked after shopping)
7	F	20-29	2628JG	4 people no child	7-6-7-5-56	-2-7-4-1	Monster	• I love the random generating part of the Monster concept and it's more interesting to play. • I'll just buy random food at the beginning or early stage and will be surprised when see the new monster. May want to try other food if always get same monster. • I prefer collecting rather than nurturing. • The Dragon one lacks surprise and it need stronger emotional relation. Maybe I need to do something to get the dragon then it become special to me (—> first do something to get the dragon) • The Dragon one brings extra effort, I will know what to do but won't do as it says.

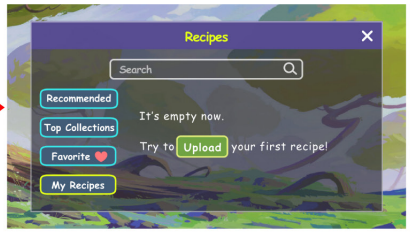
Participants	Gender	Agez	ipcode	Family composition	Rate for concept Monster	Rate for concept Dragon	Preferred concept	Comments
8	M	20-29	2807PB	1 people	5-4-5-3-3	6-6-6-5-3	Dragon	• The Dragon one is more interesting and there more interaction between me and the pet. It has more clear feedback.I can play for longer time. • Kids may like the Monster one. • (For the Monster one)I'd like to play with others (have some social function). If others are playing and I'd like to join. • I don't want to spend time to learn how to collect monster. Just hate learning. • I don't think I'll buy particular food for the dragon because it's just a game.
9	M	20-29	2628GT	3 people 1 child	6-5-4-5-3	6-6-6-6-5	Dragon	• I will be interested to use when I start playing (the Monster). • I don't think it's too cute, no, I like the style. • The Dragon one is easy to understand and play, there is only one task. • Nurturing feels more relaxing, not competitive. • The money in the Dragon game could be used to buy decorations in the game, like the house or something • What if I often go out to eat? Then I don't have ingredients for the pet. Do I still need to feed it? (—>Maybe the pet just stop growing when you don't feed it, instead of becoming hungry or even sick.ư
10	M	20-29	2611GK	4 people no child	5-4-5-4-3	6-6-6-7-5	Dragon	• I like the Dragon more because I can get direct benefit. • The toy (in the Monster concept) doesn't attract me. • The recipe things take effort but are quite useful.
11	F	20-29	2426HH	1 people	7-7-6-7-5	7-7-6-5-6	Monster	• Like the experience of collecting monsters, and willing to know the food combination, • Have no patient to keep a pet. • May just but same food every week.(for the Dragon concept) • Will there also be monsters in the supermarket? I may want to buy the food at that moment if I saw the monster next to it.(—> put monsters next to the food products to connect the real world experience to the game more)
12	F	20-29	1034XE	2 people no children	5-2-3-4-2	5-5-5-4-4	Dragon	• Love the visual style. • Too many things in the Monster concept, too complex. • Like the idea of showing the real food you bought in the game.
13	F	30-39	2624XD	5 people 3 child	5-5-4-5-5	6-5-6-5-3	Dragon	• Anyway I can get a monster without thinking. It's interesting. • I like the feeling of watching the pet growing up. • I want the Dragon one be easier to start. • It can cooperate with restaurant. • I need to remember the time to feed the pet. (—> set notification alarm based on the eating time of players or just let them set the alarm by themselves)
14	F	30-39	2628PZ	4 people 2 child	6-6-5-5-6	5-5-7-6-5	Monster	• The monsters are cute and I'd like to get all of them. • I may be disappointed if I can't get the one I want when I buy the correct food. • Doing the same thing (just feeding the pet) every day is kind of boring for me. • But I think the recipes will be helpful.

Appendix L
Flowchart of the final concept


Fire Dragon
Water Dragon
Thunder Dragon
Forest Dragon
Select
Water Dragons are very kind and intelligent. They live in both fresh and salt waters.
They all have a single horn, large eyes, usually blue or pewter in color.
The Thunder Dragon is the fastest species in the world. They're cunning and resourceful, good at hide-and-seek.
The tremendous bat-like wings and smooth skin enabling them to fly faster than other dragons.
Forest Dragons have mild character, they are patient and loyal. They can be found in forests.
They have insect-style wings, like that of a moth or butterfly. Because of the size of wings, wind dragons are slender and light.
3/4 Which of these delicious snacks do you prefer?
Chocolate
Pineapple chunks
Celery sticks
Mixed nuts
Back
Next
4/4 Pick which you would reach for when you need a mood boost?
Tuna steak
Spicy noodles
Crispy fried fries
A bowl of fresh fruits
Back
Done
Lv.1 Health point 50/100
Name: Dio
Breed: Fire Dragon
Date of birth: 07/06/2019
Place of birth: Rotterdam
Preferred flavour: sweet, spicy
Favorite food: chicken, orange
OK


Lv.1 0/100
35
Lv.1 Health point 0/100
Name: Dio
Breed: Fire Dragon
Date of birth: 07/06/2019
Place of birth: Rotterdam
Preferred flavour: sweet, spicy
Favorite food: chicken, orange
Upload your meal
Cook now
Cancle


Recipes
Roasted tomato soup
Health point 90
Ingredients
Tomato - 1/4 kg
Onion - 1/4
Garlic - 1/2 clove
Olive Oil - 1/2 tablespoon
Nutrition Facts
179 Calories / Serving
Fat 0.5g
Carbohydrates 18g
Dietary Fiber 3g
Sugars 11g
15mins
1hr 10mins
1 Servings


Recipes
Search
Recommended
Top Collections
Favorite
My Recipes
It's empty now.
Try to Upload your first recipe!


Shop
Accessories
Food
Islands
Starry Hat
Bonetooth Necklace
Waterfall
Purchase Starry Hat?
Yes
No
A pretty hat made by Wizard. Dragons always like starts.
90
50
15
20
35


Cooking
Here are the recommended recipes based on the ingredients you have
Sort by
Healthy
Quick & Easy
Popular
Roasted tomato soup
Soup & Sandwich
Tomato pasta
Cook
Lv.1 0/100
35
Upload your meal
Cook now
Cancle
Follow the recipes
Invent new recipe
Cancle
Cooking
Choose ingredients
Next
Upload your meal
Name of the meal
Add detailed information to get extra
Ingredient
Ingredient
10
10
Upload
Lv.1 50/100
Health point +50
Yum yum
10
Save
Dragon Book
Foodlog
Get Diamonds
Friends
Achievements
Account
Dragon Book
Fire Dragon
???
???
???
Achievements
100% Cook 1 meal
100% Cook 5 meals
100% Feed the dragon for 1 week
Cuddle Toy
30% Cook 10 Dutch meals
Get Diamonds
Watch a short video
GO
Food knowledge quiz
GO
Fortune wheel
GO
Share the game with friends
GO
Quiz
True or false?
Trans fats are good for your health.
(Trans fats are usually used in margarine, snack food, packaged baked goods, and for frying fast food.)
True
False
Quiz
Correct!
The primary health risk identified for trans fat consumption is an elevated risk of coronary artery disease (CAD).
10
Save
Foodlog
Day
Week
Month
Year
Carbohydrate
Protein
Fat
Salad: Arugula with Pear
Roasted tomato soup
Chicken Breasts with Grilled Pineapple
Foodlog
Day
Week
Month
Year
Health point
Dishes


Cooking
Roasted tomato soup
Health point 90
Ingredients
Tomato - 1/4 kg
Onion - 1/4
Garlic - 1/2 clove
Olive Oil - 1/2 tablespoon
Nutrition Facts
179 Calories / Serving
Fat 0.5g
Carbohydrates 18g
Dietary Fiber 3g
Sugars 11g
15mins
1hr 10mins
1 Servings
Cook
Lv.1 90/100
35
Health point +90
Yum yum
10
Save
Cooking
Choose seasoning
Spicy sauce
Seasoned salt
Soy sauce
White vinegar
Pesto
Back
Next
Cooking
Name your dish
Name
With extra
Add detailed steps
OR
Cook
Lv.1 90/100
35
Health point +90
Yum yum
Lv.1 90/100
35
10
Save
Lv.1 90/100
45
Tomato soup is really nice! You can add a sprinkle of sugar and salt if your tomatoes seem overly acidic
Lv.3 170/220
79
I guess I ate too many fried foods and now I seem to get indigestion. Could you give me some ginger tea?
Lv.3 170/220
79
Get Ginger in Shop
Yes
No
Shop
Accessories
Food
Islands
Biscuit
Sandwich
Ginger
10
15
20
Ginger can help quell nausea and balance blood sugar. You may need it when the dragon is ill.
50
Achievements
100% Cook 5 meals
100% Feed the dragon for 1 week
30% Cook 10 Dutch meals
10% Cook 10 British meals
Cuddle Toy
10
Save
Achievements
100% Feed the dragon for 1 week
40% Cook 10 Dutch meals
20% Cook 10 British meals
15% Login for 30 days
Cuddle Toy
Save
Achievements
40% Cook 10 Dutch meals
20% Cook 10 British meals
15% Login for 30 days
10% Cook 100 meals
Save
Quiz
Incorrect!
The primary health risk identified for trans fat consumption is an elevated risk of coronary artery disease (CAD).
2
Save
Fortune wheel
Start
Fortune wheel
5 € coupon
Start