Designing for empowerment: Bolstering knowledge and skills to aid sustainable awareness and actions

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DESIGNING FOR EMPOWERMENT

Bolstering knowledge and skills to aid sustainable awareness and actions

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PERSUASION

PRACTICE-ORIETEND DESIGN

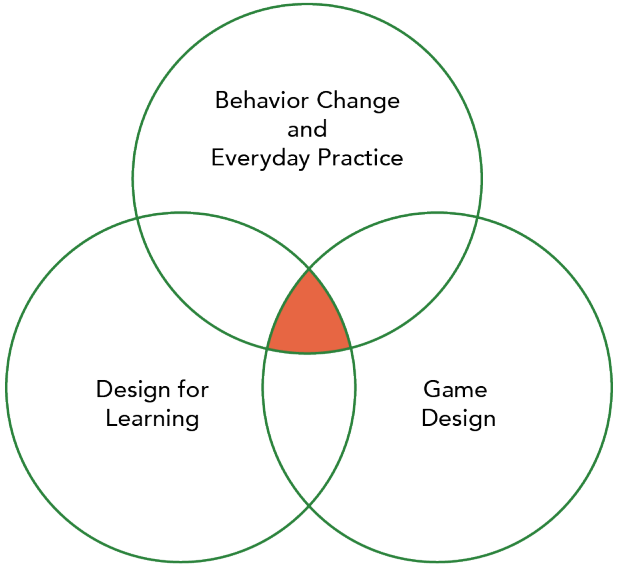
DESIGN FOR LEARNING

ABSTRACT

Over time, our lifestyles accrete habits and become rigid. While many behavior change projects focus on the active part of our daily practices, trying to foster incremental, micro-level behavior change, they often fail to facilitate lifestyle change in the broad sense due to the rigidity of our everyday lives.

For example, in aiming to enforce portion control, designers could focus on the size of a plate, but this interaction-driven approach frequently fails to encourage people to adopt a healthier eating style long-term. When looking at a challenge like aiding healthy and sustainable eating, there are many factors that warrant consideration in the process. The health, environmental, economical, and personal preferences of people all affect personal food-related practice. Therefore, how might design be used to empower people to adopt lifestyle change?

This thesis is an exploration of how design can be used to empower people to explore a new and effective lifestyle. It is not about persuading people to live a predetermined sustainable lifestyle, but rather equip people with knowledge and skills so that they can make conscious choices on the topic of sustainability. By drawing on social practice theory, transformational game design, and learning design, I explore how gaming principles can be leveraged to build a learning space for people to engage with knowledge about sustainability. This study culminates in a game prototype that aims to enable a lifestyle shift and further dialogue on what it means to design for everyday practice.



INTRODUCTION

Design for behavior change is a well-explored topic in the study of human computer interaction. Designers frequently leverage findings from psychology and behavioral economics in their design approaches aimed at changing people's behaviors. But is this an effective approach to address the issue of dramatic lifestyle change? Can we eventually land on a dramatically different lifestyle through multiple small interventions? In this chapter, I am going to cover the initial idea of using persuasive technology to change human behavior and the dramatically different view on human behavior as seen from a practice-oriented design perspective.

Persuasion

B.J. Fogg proposed the term, Persuasive Technology (Fogg, 2002), in the late 90s to describe interactive computing systems designed to change people's attitudes or behaviors. He explained his idea through a behavior model: B=MAT (See Figure 1), which means that for a Behavior(B) to occur, Motivation(M), Ability(A), and Trigger(T) must take place at the same moment. Otherwise, the action will not be taken. Persuasive technology presents opportunities for behavior change such as sustainable practices. Based on this model, eco-visualization focuses on displaying intangible energy consumption as a trigger for people to save more energy. Unsurprising given the interaction-driven approach for persuasion, it has been subject to various criticisms such as overly focusing on incremented over systemic change and quantifiable individual consumption.

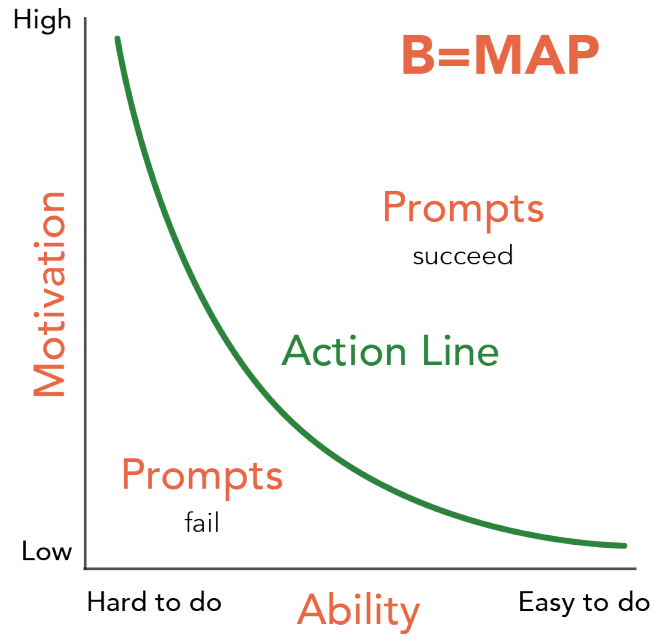


Figure 1. Fogg Behavior Model (Fogg, B. J., 2002).

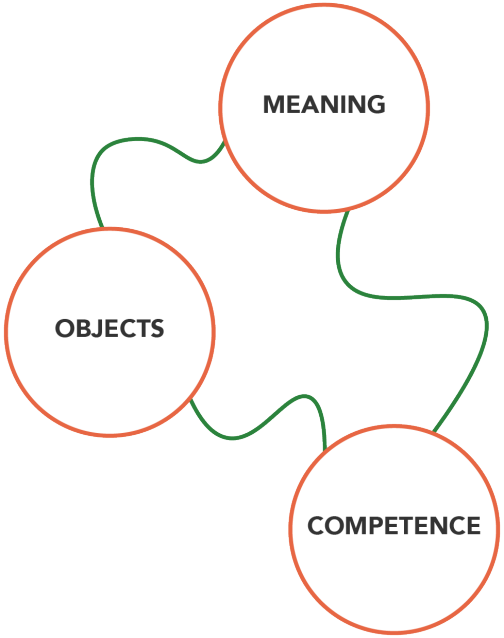


Figure 2. Adapted Object-Meaning-Competence model of practices (Scott et al., 2012).

Practice-oriented design

If persuasive sustainability is narrowly focused, what are other ways to design for the sustainable lifestyle change? Through the lens of social practice theory (Shove, 2007), everyday activities are the intertwined result of meanings, objects, and competence (See Figure 2). Many behaviors are embedded so deeply in human lives that people often aren't cognizant of the decisions they make that impact them. For example, a person might decide to increase the temperature of air conditioning to save energy but remain unaware that taking a shower, brushing teeth, or conducting other small everyday practices has the potential to lead to more sustainable practices as well. Deriving from social practice theory, practice-oriented design (Scott et al., 2012) provides a novel approach to facilitating sustainable behavior. It leverages social practices that are overlooked by psychology as opportunities to strengthen sustainability efforts.

Design for learning

In order to design for people to explore practice, learning knowledge and practicing skills is essential. If people don't have knowledge about what food is more sustainable than others, it is difficult for them to learn how to adopt a sustainable diet. As a result, design for learning plays a major role in my thesis study.

Educator, Bernice McCarthy, proposed a framework for learning titled the 4MAT system, in, About Learning (McCarthy, 1996). The framework suggest that any meaningful learning experience has 4 different stages (See Figure 3) including:

- Why is this relevant to the learner?
- What does learner need to know?
- How will learner take action to create desired outcome?
- If the learn is to be success, how will s/he need to adapt, refine and reinvent?

Since my study consider the learning perspective of the everyday practice, 4MAT framework could help me to make sure the design approaches create meaningful learning experience.

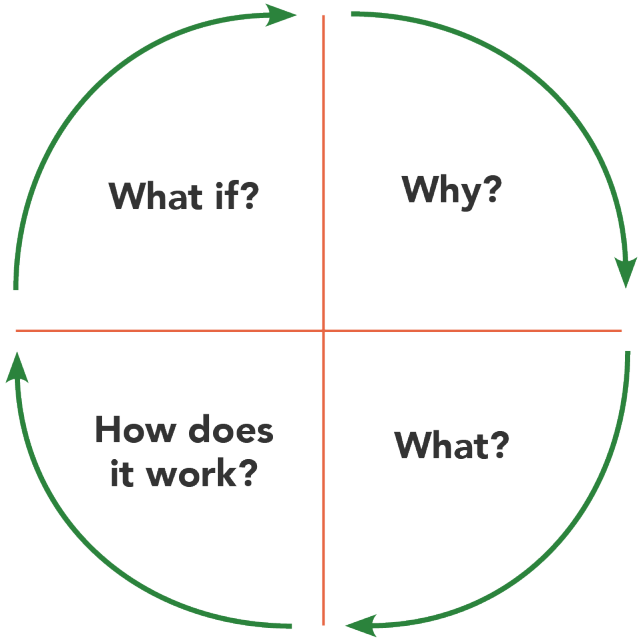


Figure 3. 4MAT Framework (McCarthy, B., 2012).

1

BEHAVIOR CHANGE AND EVERYDAY PRACTICE

GAME DESIGN

DESIGN FOR LEARNING

PRIMARY RESEARCH

In the previous chapter, I described three main topics that are essential to my thesis study. In this chapter, I outline my primary research, which consisted of literature and artifact reviews on three major topics—behavior change and everyday practices, game design, and design for learning.

Behavior change and everyday practice

Radical Sustainable Innovation — *Tokinwise, C.*

In this article, Tonkinwise argues that “the bigness of unsustainability comes from how many small things are going to need to change” and he draws a two by two matrix to point out how design could contribute to sustainability. In this matrix, the four quadrants are 1) Get the product eco-right, 2) Get people to buy/use a sustainable product, 3) Break through social innovation and 4) Holistic mindset conversion. In each quadrant, the approach to design would be different.

This article provides an overarching framework of design for sustainability. Most of the current efforts focus on the first and second quadrants. Engineers and designers work hard to make products eco-right, then sell them to the consumers. The job for interaction designers is located in the second quadrant where interaction-driven behaviors are created to be more sustainable. However, the third quadrant challenges interaction designers to think more holistically about human's behavior. How can designers isolate a behavior and try to make it more sustainable without considering the overall social context? Does a sustainable lifestyle simply mean minimal consumption of food, water, energy and any other resource? At the end of the article, Tonkinwise writes “What makes radical (sustainable innovation) 'radical' is its opposition to everything is not sufficiently radical.” How can design help people radically shift people's way of living? This article prompted me to look for studies that highlight how current behavior change works and how to design for lifestyle shift.

Sustainably Unpersuaded — *Brynjarsdottir, H. et al.*

Interaction designers who seek to design for individual behavior change often follow a popular approaches that utilizes persuasive technology. By leveraging the principles of behavior economics and the interactivity of technology, interaction designers can change people's behavior through persuasion. However, in this paper “sustainably unpersuaded”, Pierce et al. analyze 36 HCI conference publications that focus on environmental sustainability from 2009 to 2011 and criticize current persuasive sustainability projects that fail to address the real problems at hand because 1) they define sustainability too narrowly, 2) they focus too strong on individuals, 3) they assume rational actors swayed by information, 4) they are too distant from live use, and 5) they have trouble dealing with dynamic over time. In all cases, Pierce et al. argue that individual and simple acts limit how we imagine change.

This publication points out the blind spots in designing for sustainable behavior change through persuasion techniques, which informed the direction of this study. First of all, I explored the benefit for designers' focus to move from specific, isolated behaviors to more extensive, complex sets of social and cultural practice. Secondly, I investigated design approaches that include users' participation and shift from prescription to reflection. Thirdly, I studied persuasion as a process that doesn't aiming for ideal behavior but rather mindset or motivation change.

The Design for Everyday Life — *Shove E.*

The Design for Everyday Life written by Elizabeth Shove observes design through the lens of social practice theory. It points out how each product innovation relates to the change in everyday practice. She explains that instead of designing a product that meets people's needs, the designer should look at the desired everyday practice and design for it. As a result, design artifacts are themselves the implication of the new practice. Concluding from four empirical studies, including a kitchen renewal, a DIY project, a digital photography project and a plastic material project, this book points out that everyday practice is static and dynamic at the same time.

Shove introduces a diagram entitled, the dynamic of having and doing (See Figure 4). The circle marked 'A' represent current practice, where having and doing intersect. The 'past' area to the left of 'A' reminds us that current practice is organized by existing materials and by a prior mode of doing. 'B' represents future practice. This is the conjunction of future materials and future modes of doing. It's important to note that there are three routes that people can move from 'A' to 'B':

- **Route one:** Realizing the future image of doing demands the acquisition of new materials.
- **Route two:** 'B' is simply transpiring. 'A' and 'B' are pretty much the same.
- **Route three:** Achieving 'B' involves making different use of what already exists or doing things differently.

This diagram helped me understand the subtle dynamic characteristics in people's everyday practice. While everyday life tends to fall into a rigid pattern, people still constantly reconfigure their practice. Route one, image of having, illustrates people's imagination about a preferable practice supported by new tools. Route two, current and preferable practice are the same. The practice is in the rigid pattern and there is no imagination for changing. Route three, image of doing, illustrates people's imagination about a preferable practice supported by new knowledge or skill. In short, I believe designers can reconfigure everyday practice by introducing new tools, new knowledge, or skills to the user.

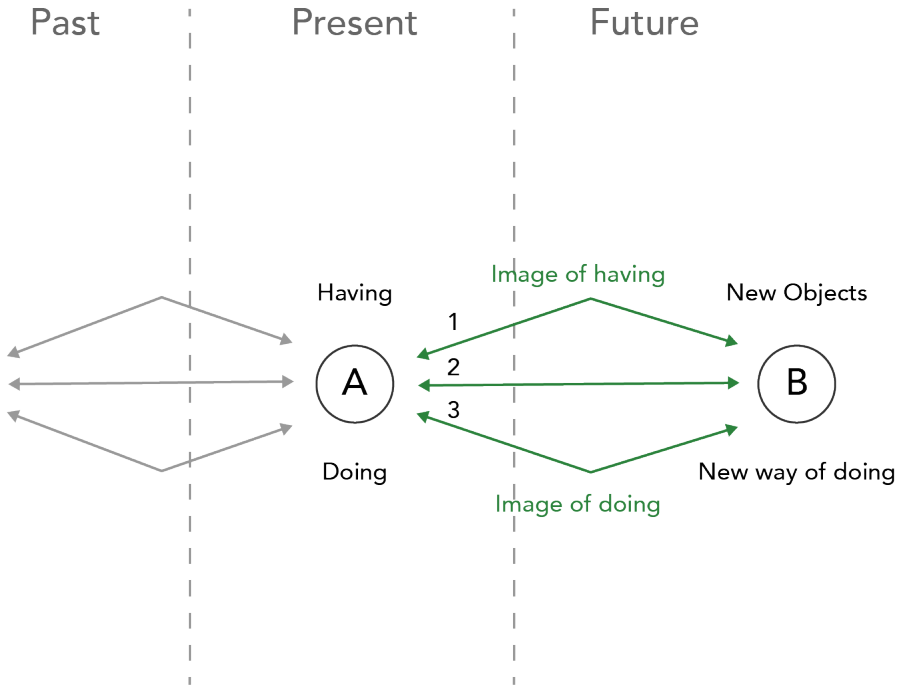


Figure 4. The image of having and doing (Shove, 2007)

Designing eco-feedback systems for everyday life

— Strengers, Y.

Decreasing household energy consumption through energy visualization is a popular topic in persuasive sustainability because energy consumption can be easily quantified to determine whether a project achieves its goal or not. However, Strengers takes a different approach by evaluating the impact of in-house energy display (See Figure 5) on people's day-to-day practice change. Through his studies, Strengers found that the effect of the energy display was very limited. For example, household members who are interested in eco-feedback may not control the consumption practices in the home, such as regulating central heating and cooling, or may not be challenged to change their expectations and aspirations, such as reducing time spent watching a plasma tv. In short, the energy display does help reduce some energy consumption according to the research data presented in the research paper, but it does not create a major lifestyle shift.

I think this research clearly points out the limitation of the persuasive approach on designing for sustainable behavior. Through the practice-oriented design framework,the introduction of the energy display dose reconfigure people's everyday practice as the framework suggests. However, it is really hard for designers to make people act as they intend. There are two other factors—meaning, and competence—in play. Without carefully consider the other two elements in the design intervention, the behavior change caused by object-only approach might be not ideal and fail to achieve the goal of major lifestyle shift.

Figure 5. In-house energy display. Retrieved from http://www.knowyourmobile.com/accessories/24293/best-smart-meters-uk-everything-you-need-to-know

Designing for sustainable food practices in the home

— De Borja, J., Kuijer, S. C., & Aprile, W. A.

In this article, Kuijer applies a practice-oriented approach to sustainable food practice design. She asked 1) What are the (un) sustainable aspects in the food system? 2) What conventions, objects, and skills influence the development of food practice? 3) What food acquisition activities are undertaken by participants?, 4) What are the source of conventions, objects, and skills? She argues that new practices are often not adopted because most of the time people autonomously act on their conviction or follow what society expects, which is very hard to change through external force. As a result, the timing of reconfiguring practice is important. When will the rigid pattern become vulnerable? For example, eating deer meat may seem unusual in an everyday context but could become seen as common in a fine-dining restaurant or at a special occasion like Christmas.

This study tries to discover the meaning element of food practices in everyday life. Eating practice is not just about rational considerations such as health or cost, but also about family and culture, which leads to personal preference and taste. Shifting meaning in the practice could be a powerful tool to change people's behavior. For my study, there were two implication about shifting the meaning. 1) Timing is important. Therefore, I sought a change-ready group for which to design. When people go through major life shifts, such as moving to a new place, having a baby, etc, they are in the midst of changes. Therefore, this serves as a great time to also change their practice. 2) I found that introducing new meaning was easier than change the current meaning. For example, rather than asking people to eat less red meat and more salad, introducing vegetarian Indian cuisine was more effective because it is an exotic cuisine, which does not need to align with any existing meaning.

Implications of social practice theory for sustainable design.

— Kuijer, S. C.

Although "The design of everyday life" illustrates the importance of using practice rather than behavior as a unit-of-design, Shove did not explicitly cover details about how to design for practice nor did she focus on the topic of sustainability. As a student of Shove, Kuijer provides a throughout overview on the implication of social practice theory in sustainable design. The first part takes practice as a unit-of-analysis. It covers multiple research methods that obtain data on everyday practices and provides suggestions on the potential problem researchers might encounter in the research process. The second part takes practice as a unit-of-design. With all the distinctive characteristics of social practice, it requires unique ways of prototyping everyday practice. The thesis provides an overview understanding of how to prototype practice and inherent pros and cons. The third part covers several empirical studies that focus on the previous practice-oriented design project.

The thesis provides me with an overview of the current development of practice-oriented design on the topic of sustainability. The research methods and prototyping techniques on everyday practice benefited my study. For research, this article mentions in-situ observation with supplemental interviews as a standard approach. However, considering the nature of the practice, I found that using cultural probes or playful workbooks as a way to obtain data or even support participants' self-analysis, was an effective approach as well.

In terms of practice prototyping, the article also provides reviews of several existing approaches such as experiments in practice (Scott et al. 2011) trigger product studies (Kuijer and De Jong 2012), try-it-out experiments (Karakat 2009) and generative improv performance (Kuijer et al. 2013). I found that these approaches are either hard to implement (require simulated environment) or hard to see the immediate impact. As the practice-oriented design framework points out, practice can't be designed but only intervened.

Design Change by Living Change — *Kakee, S., Conny, B., and Jaco, Q.*

To further understand how practice prototyping works, I reviewed the publications that I listed in the previous literature review. I found that the method of experiment in practice served as a bedrock for me to think about how to prototype practice in my own study.

Experiment in practice is an approach developed by Kakee Scott that I leveraged in my thesis investigation. The goal for participants in this study was to create and try out different ways of bathing that are lower in resource consumption than showering. The study consisted of several steps for experiment in practices. (See Figure 6). A workbook guided participants to unpack their bath routine into the elements of meanings, competence, and objects. The workbook also asked participants to recall how their bathing style had change through their lifetime. With those understandings in mind, participants were asked to develop their own experiments and perform these practices in their own home for a period of two weeks. During the study, participants interacted with each other on a blog. After two weeks, participants came together for a reflection and co-design session. Three months after the study, they were interviewed to determine possible lasting effects of the study.

Experiment in practice was not be the only method I could have used to prototype practice but I thought it created a great structure for my study. It helps people reflect and map out their practice to prepare them to create new practice. It utilizes a blog for participants to communicate with each other and to get inspiration from others. Socially acceptable behavior is another important aspect of social practice. It includes a wrap-up the study with a final reflection session and a follow-up interview to understand the lasting effect.

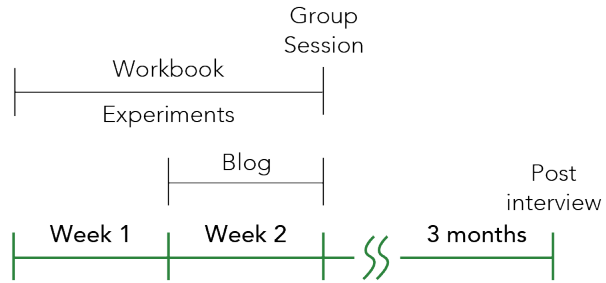


Figure 6. Set-up of experiments in practice study. (Scott et al., 2012)

Cool Biz Campaign

The Cool Biz campaign is a Japanese campaign initiated by the Japanese Ministry of the Environment from summer 2005 as a means to help reduce Japanese electricity consumption by limiting the use of air conditioning. The policy in the beginning went beyond motivating people to change indoor temperature. By encouraging people to consider a higher temperature in offices, they began to consider the importance of dressing appropriately. As a result, a proto-practice was developed involving reconfiguration of meaning, competence, and objects to address office fashion. Designers were requested to create 'cool' office attire, and educational materials were made to teach people how to dress during the summer. The campaign also tried to established the new standard through promotion by government officials and industry leaders, who challenged the proper ways of dressing. Acting outside of the norm was further facilitated, for example, with stickers saying "Excuse my dressing, I'm doing Cool Biz". After its launch, the campaign gained additional creative ways of stay cool, such as getting CoolBiz haircut, using an electric fan, and planning meetings in a small conference room with adjustable air conditioning. As a result, the Ministry estimated that the campaign resulted in a 460,000-ton reduction in CO2 emission, the equivalent volume of CO2 emitted by about 1 million households for one month.

The comprehensive campaign can be understood through the practice-oriented design framework. The campaign did not directly address the goal by persuading or motivating people to set the temperature higher. Instead, designers focused on everyday practice and worked on office dressing as an introduction to practice reconfiguration. When the new element was introduced, the practice reconfigured and brought in other new elements. Many other creative ways of staying cool were invented by the people not designers. The campaign serves as a large-scale success story for practice-oriented design. It indicates that large scale of change and wild scale of adoption is possible.

Commuter Science — *Leber, B.*

Brett Leber is an alumnus in the School of Design at the Carnegie Mellon. In his master thesis project, Commuter Science, Leber tried to design for people who want to bike to work. He argued that a substantial lifestyle change is hard to break into smaller pieces. For example, driving a car or bicycle to work are significantly different and cause the restructuring of personal schedules as well as many areas of your life (What a person can carry, how they dress for the weather, how they negotiate and break routine) As a result, he tried to focus on the process of trying out, or trialing, new practice. Through low-risk, design-enabled experiments in our daily lives, users might be able to find new ways of living their everyday life. Through the rigorous researches process inspired by the social practice theory, the author eventually proposed a riding buddy service. Users can register on the website, and the service providers coordinate an expert riding buddy for the user. Then the riders meet and talk about their goals and motivations, and make a riding plan. Finally, the user rides with an expert to trial out the experience.

While the author uses a practice-oriented design framework for his project, I think he avoids the direct conflict with the meaning elements. Essentially, the riding buddy service he designed targets those people with a motivation to bike to work. However, the approach of trialing is well considered. Everyday practice is a rigid and unconscious part of people's daily life. It is hard to learn new practices conceptually without living through them. As a result, I believe low risk experiment would be a great approach to address the barrier of dramatic lifestyle change. By lowering the barrier, people with less motivation may be willing to engage a new practice as well.

Game design

Rules of play: game design fundamentals
— Salen, K., & Zimmerman, E.

Dutch historian and cultural theorist Johan Huizinga proposes the idea of Homo Ludens— humans defined as playful creatures —, which might be the antidote to a rigid everyday life. (Huizinga, 1938) Later on, the concept of the Magic Circle (K Salen, E. Zimmerman, 2004) was inspired by Homo Ludens. The Magic circle (See Figure 7) is the space in which the normal rules and reality of the world are suspended and replaced by the artificial rules. When people become players, they are temporarily detached from who they are in the real world and immersed into the environment acting like somebody else. Players ignore the social norm or personal meaning of the practice but make choices based on rules and feedback. As a result, the Magic Circle provides a great opportunity to learn and experience new practice when people are inside the Magic Circle.

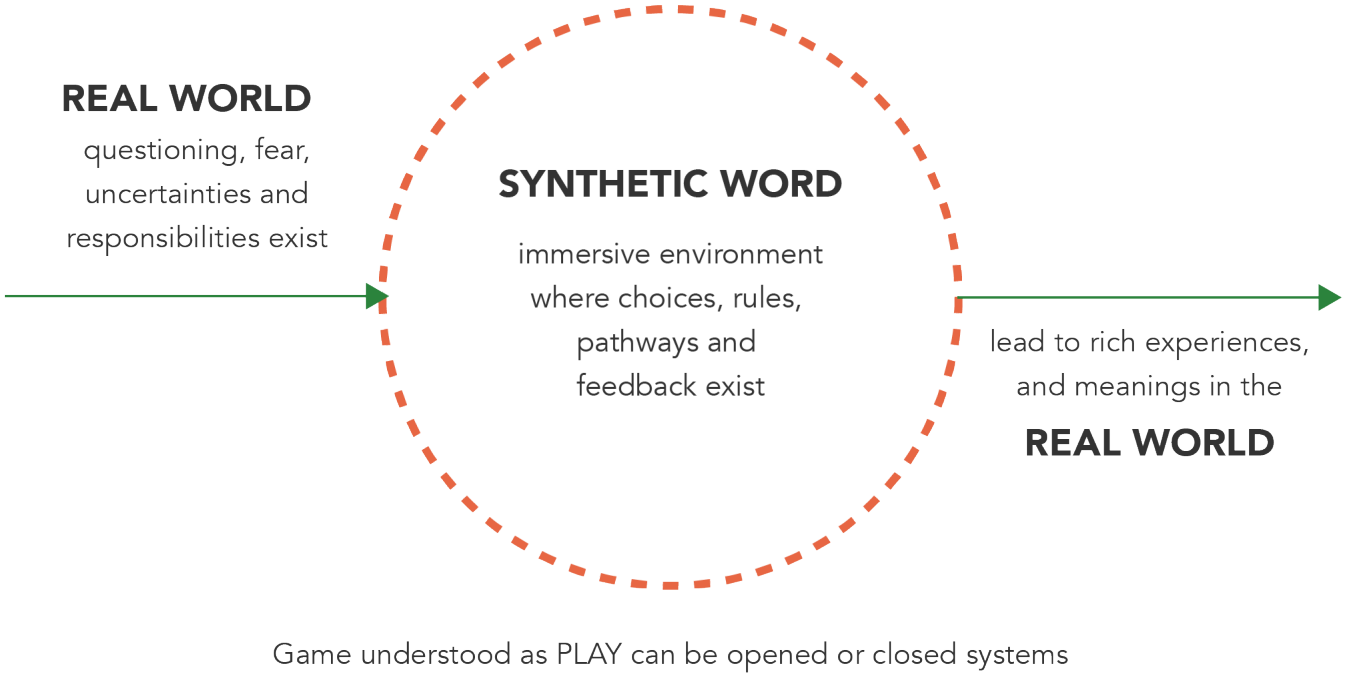


Figure 7. The Magic Circle (Salen, K. & Zimmerman, E., 2003) as interpreted by Stacie Rohrbach in Learner Experience Design course.

SuperBetter — *McGonigal, J.*

Jane McGonigal is a visionary game designer. She wrote, Reality Broken in 2011, which details how to harness the power of games to boost global happiness. In her latest book, SuperBetter, she further expands on the topic, by highlighting individuals how talk about how one can live gamefully in your everyday life. She points out eight rules readers can follow to design a gameful life experience. They are 1) Challenge yourself, 2) Use power-ups, 3) Identify bad guys, 4) Design quest, 5) Recruit allies, 6) Create secret identity, 7) Achieve epic win, 8) Keep score. She also provides three game examples for readers to try. The idea of living gamefully sounds unpractical but McGonial actually provides many rigorous academic researches to back up her proposal.

Responding to the idea of the Magic circle in the previous section, I found this book helpful in building a prototype for people to experience new practices or another way of living. By leveraging these game rules, I designed an engaging experience for participants to learn and explore the possibility of living more sustainably.

Figure 8. Buffalo: The Name Dropping Game. (n.d.). Retrieved May 15th, 2019, from https://tiltfactor.org/game/buffalo/

Buffalo: The Name Dropping Game

Professor Kaufman in the HCI Institute at Carnegie Mellon designed the game Buffalo (See Figure 8) to address the issues of social stereotypes and biases. In Buffalo, players simultaneously flip cards from two decks. The "orange deck" contains cards that list adjectives, including ones based on age, race, …etc. The "blue deck" contains cards listing nouns, including professions, roles/types, and ideological …etc. Then using the noun-adjective combination formed by the cards drawn, players race to collect the cards by identifying a real person or fictional character who matches the revealed pair. As the play progresses, Buffalo activates a wide array of combinations of social categories and attributes, including pairings that are often novel, surprising, or unexpected (e.g., tattooed visionary, South American philosopher, mischievous professor). In this way, the game aims to expand players' mental representations of numerous social categories with a host of new exemplars that playgroups offer. The intention of the game is largely unrecognized by players. However, Buffalo gameplay effectively promoted broader and more conclusive perceptions of social groups and raised players' concern about their own potential biases.

Accompanying the development of the game, a paper was published to provide details about the impact of the game. The method of hiding the true intention of the game is named embedded design. The embedded design strategy was beneficial to my study since not everyone is interested in the idea of sustainability. By not explicitly illustrating my design intention, the prototype can potentially attract more attention and be more effective than engaging in those that are blatantly obvious.

Design for learning

How learning works: seven research-based principles for smart teaching — *Ambrose, S. A. et al.*

While knowledge and skill are obvious in every learning experience, building relevance in the first quadrant is a crucial factor for the whole learning experience to succeed. In How Learning Works (Ambrose et. al, 2010), Ambrose et. al describe the principles of motivation (See Figure 9), which I found it very helpful throughout my thesis investigation. To build motivation for the learner, the designer must consider two factors: value and expectancy. What value does the learner hold for the experience in order to accept and engage in the learning challenge? , In addition, expectancy focuses on the degree to which a learner believe they can achieve a specific task. If a challenge is too difficult, they might deem it unattainable and hence, hold a low expectancy for it.

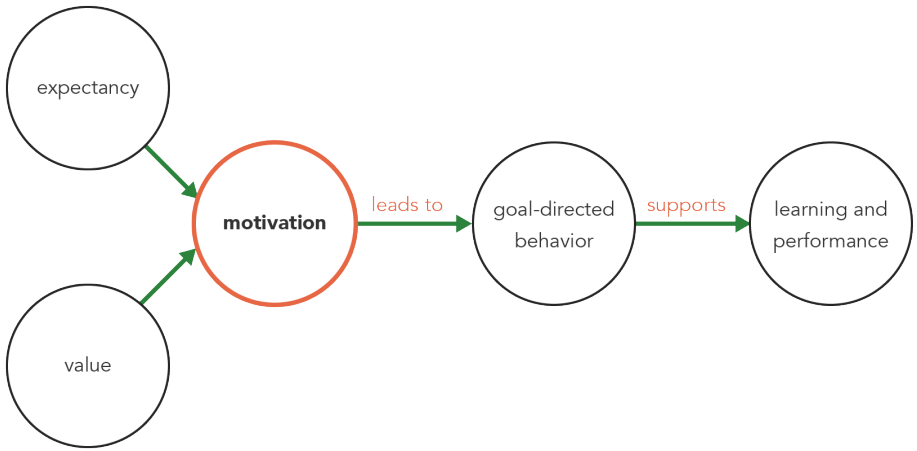


Figure 9. Principles of Motivation (Ambrose et. al, 2010)

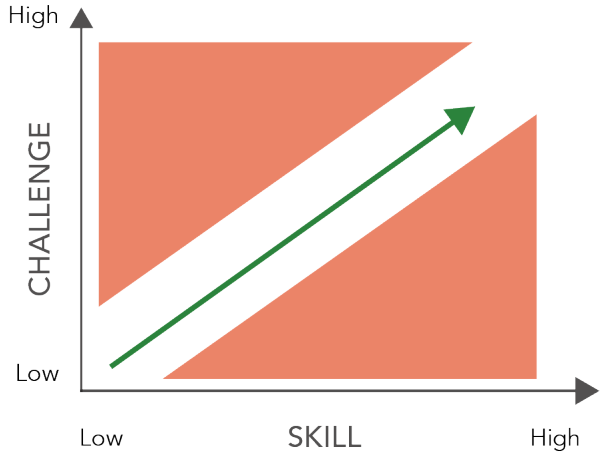


Figure 10. Flow Theory (Csikszentmihalyi, 1998)

Design for how people learn — *Dirksen, J.*

The level of difficulty aligns with the flow theory (Csikszentmihalyi, 1998). In the simplest terms, a flow is the narrow channel where learners find themselves between boredom and anxiety (See Figure 10). As long as the learning materials are designed to scaffold the appropriate level of challenge, the learner is likely to keep engaging with the content.

2

ONLINE SURVEY

IN-PERSON INTERVIEW

HIDDEN FACT WORKSHOP

EXPLORATORY RESEARCH

Based on the understanding gained from the literature and artifact reviews, I became aware that sustainable behavior was a wide topic. There are many aspects in people's everyday lives that I could possibly address on. As a result, I chose to conduct studies that would help me narrow my thesis to a specific domain. In this stage, I conducted an online survey, interviews, and a workshop.

Study Information

Total Responses : 33 people

Identity : 26 international students / 7 local residents from foreign countries

Countries of origin : 25 Taiwanese / 4 Chinese / 2 Indian / 2 European

The aspect of sustainability targeted : Eating and cooking / Waste creating and processing / Plastic use / Energy consumption

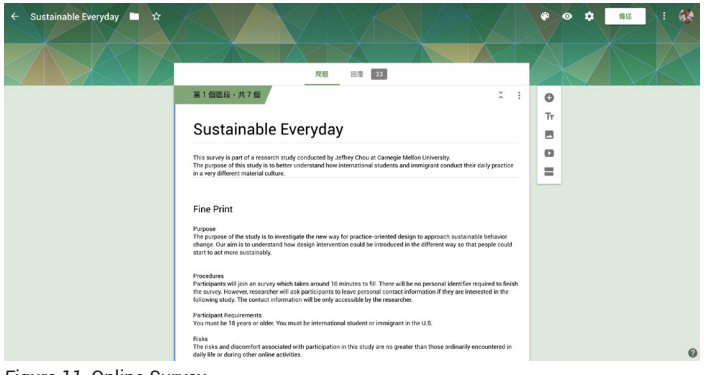


Figure 11. Online Survey

Online Survey

Study Premise

I conducted an online survey with international students who just came to US. Utilizing the online communities that I have access to, I received responses mostly from Taiwanese and Chinese students. I believed that international students would serve as a great target audience because they go through a major life event and reconfigure many of their everyday practices in the process. They might either adapt some American ways of living or keep existing practices from their own countries. I was curious to learn how they made practice decisions. I speculated that the reasons behind their behavior might serve as the bedrock for my further study.

Study Protocol

The survey content (See Figure 11) covers four important aspects of sustainability in daily life including eating and cooking, waste creating and processing, plastic use and energy consumption. I asked participants to explain what causes them to decide to adopt an American way of living and what practices they preserved from their prior culture.

Analysis and Synthesis

I analyzed the outcomes and synthesized them into several observations including:

1. People expressed positive meaning toward a tangible outcome. If they bring a shopping bag to shop for groceries, saving plastic bags immediately creates a sense of achievement. However, if people decide not to use an electric kettle to save energy, the intangible outcome is less engaging and visible.
2. People expressed their concern for the environment but also perceived problems as a systematic issue that is unsolvable by personal behavior. For example, Taiwan has a world-famous recycling system so nearly all of the Taiwanese students that join the survey express serious disappointment about what they are able to do with their garbage in their apartment.
3. Based on the previous point, there is a misconception about garbage. If people check the waste reduction hierarchy—reduce, reuse, recycle. Most people focus on the recycle aspect, which is actually the least helpful action to take to avoid waste. While there is potential to consume less or even become a minimalist, it could still be a systematic problem for most people. Therefore, problems such as overpackaging, discounts on large quantities of products, etc., are preventing people from consuming less.
4. The problem of overusing plastic bags is perceived as a systematic problem that many people care about. Participants even suggest a systematic solution in the survey such as going to Whole Foods or Trader Joe's (because they only provide paper bags) or enacting a law to charge for plastic bags.
5. I discovered that the food topic comprises several of the topics I mentioned above. People expressed their concern for food waste in the US, and plastic bag and package use during groceries shopping. Although the survey results did not mention a lot about energy consumption in cooking and food storage, I think they are also involved in the food topic.

Despite sustainability being such a big problem that requires multi-dimensional approach, I decided to focus on the topic of food related practices for two reason. First of all, people have more agency in food related practice than other topic. Essentially, we make decisions on what we eat in a daily basis. The short term impact of design intervention could be easily evaluated. Secondly, unlike other topics highly connect to efficiency or convenience, food practices are rich meaning. People's cultural background, family memory ...etc all play a role in the food decision we make which makes it a great place to further explore through practice-oriented design.

Study information

Total Participants : 6 people

Identity : 6 International students (4 from the School of Design at Carnegie Mellon)

Time : 30 minutes

Goal : To further understand people's food-related everyday practice while adopting the food culture and options in the US.

In-person Interview

Study Premise

The first online survey helped me explore sustainability perspectives in people's everyday practice and commit to studying food-related practice. To further understand details about how international students adopt food culture and options in the US, I asked participants from the online survey to conduct in-person interviews. I talked to six international students to learn more about their food related practice.

Study Protocol

I conducted 30 minutes face-to-face interview sessions with the six participants to try to understand their current food knowledge and cooking skills. Furthermore, I also tried to understand their new or kept food-related practices after they moved to the US. With both responses, I aimed to learn the connections between people's competence and practice reconfiguration in food-related practice.

Analysis and Synthesis

1. All interviewees mentioned that they have their own agency on their food choices. Before coming to the US, they all lived with their family so their eating options were limited by the social context—their family. The options they have now mainly come from people who cook for them.
2. One participant mentioned that after she moved here, she ate a meatless meal once a week, which she was never able to do when she live with her family. When I asked her about her reasons for making this decision, she said that she understands the environmental impact of meat and wants to be more environmentally friendly. She was not able to do that when she lived with her family before. Therefore, she now has full agency over her food consumption and decided to initiate the new practice.
3. Three interviewees pointed out that they face difficulty when grocery shopping in the supermarket. With limited food knowledge and cooking skills, interviewees find themselves overwhelmed by the choices they have in the supermarket. As a result, they will only buy what is familiar and miss opportunities to explore new options or alternatives.

Study information

Total Participants: 8 peoples (4 people per session)

Time: 20 minutes per session

Goal: To understand the tension between context and condition when making food decisions

See Appendix A for more information on card design

Figure 12. Hidden Fact Workshop

Hidden fact workshop

Study Premise

Besides understanding people's food-related everyday practice, I aimed to learn more about people's mental models relative to sustainable food choices and decision making.

Study Protocol

"Hidden Fact" is a card decks comprised of ingredients cards, context cards and condition cards (See Figure 12).There are four types of ingredient cards, 1) Carbohydrate, 2) Protein, 3) Fruit and 4) Vegetable. The workshop is conducted with four participants and one facilitator per session. Below are the steps of the workshop:

1. In the beginning, participants draw three cards from each type of ingredients.
2. The facilitator flips a context card and participants start to assemble their breakfast by combining food cards based on the context prompt. One example context reads "It is Monday morning, you need to rush to the class. The breakfast should not take too long to prepare." The prompts are intentionally ambiguous to encourage participants to fill in details with their own interpretation and understanding.
3. Once they finish the assembly, they talk about their combination and explain how it addresses the context effectively.

4. Once the conversation is finished, the facilitator flips a condition card, which indicates an extra condition that participants should meet through their combination. One example condition reads “You just learned about the concept of carbon footprint, so you want to eat more environmentally friendly”. Once again, the prompt is intentionally ambiguous to encourage participants to fill in details with their own interpretation and understanding.
5. Once they reassemble their combination, they flip over all of the cards in their combination. On the back of each condition card, there is information about the topic—in this case, carbon footprint. The text is intent to help them learn whether their decisions are effective or ineffective and have conversations about them.

Analysis and Synthesis

My research question investigates “What are people's mental models about making food choices?” What I have learned includes:

1. People's cooking skill and food knowledge is largely based on their cultural background, which significantly affects what they build through the card deck.
2. The narratives of their combinations also connect to the kitchen appliances and tools participants have at their homes. For example, if a participant has a glass jar and has used it before, they might say “I use my jar in the kitchen to make overnight oats”. The jar become an entity in their memory that they use to support their narrative on the context.
3. Experienced cooks take sustainability into consideration with a higher level of perception. For example, they often buy organic products or go to farmers' markets for sustainability reasons. These approaches are considered eco-friendly without really understand the impact of their actions. My assumption is that there are many facets to consider in order to make sustainable food choices. As a result, people tend to follow a high-level concept (like shopping at a farmer’s market) only.

Discoveries

In the exploratory research stage, I conducted three research activities including an online survey, interview and 'Hidden Fact' card deck workshop. The survey helped me determine food as the domain to explore in my thesis study. The interview helped me understand people's food-related everyday practice. The workshop helped me understand people's mental models about food choices.

3

REFRAMING RESEARCH QUESTION

DEFINING KEY TERMS

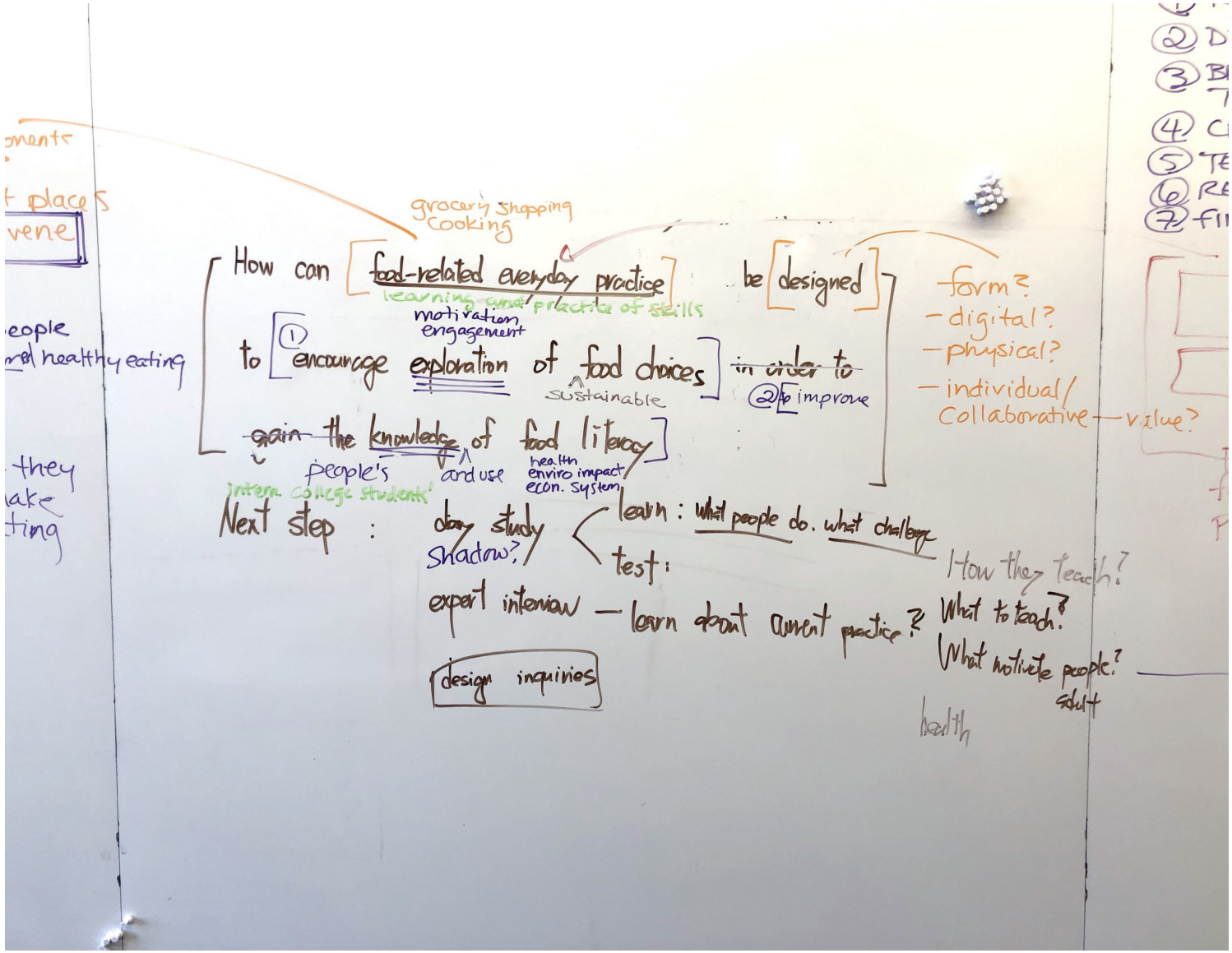
SHADOWING

GENERATIVE RESEARCH

The second stage of my study focused on generative research. The discoveries that I made during the previous exploratory stage helped me commit to studying the topic of food-related practices. Therefore, in this stage I defined key terms in my research question, which I reframed. I also conducted interviews with vegetarians and shadowing people as they did their grocery shopping.

Reframing research question

Even though I had narrowed my research topic in the previous exploratory phase, there were still many facets of sustainability in food that warranted exploration. Furthermore, I needed to better define what I wanted to learn through my design intervention. As a result, I discussed with my advisor ways of reframing my initial research question.


How can food-related everyday practice be designed
grocery shopping
cooking
learning and practice of skills
motivation
engagement
to encourage exploration of food choices in order to improve
sustainable
gain the knowledge of food literacy
people's
and use
health
enviro impact
econ. system
form?
- digital?
- physical?
- individual/
Collaborative — value?
Next step :
intern. college students
day study
shadow?
learn : what people do. what challenge
test:
expert interview — learn about current practice?
How they teach?
What to teach?
What motivate people?
adult
design inquiries
health

Reframed research question

The new research question further guided the direction of my study. Nonetheless, there still remained key questions that need to be answered.

- **Food-related practice:** What practice warrants improvement? What are the components of the steps? Where are appropriate places to intervene? What serves as a good intervention point?
- **Be designed:** In what form? Physical? Digital? Individual? Collaborative?
- **Encourage exploration:** How to encourage? What are the principles of motivation building could be leveraged here?
- **Food literacy:** What is the definition of food literacy? What does it mean if a person is food literate?

How can food-related everyday practice be designed to encourage exploration of sustainable food choices to improve people's knowledge and use of food literacy?

Defining key terms

To build motivation on learning food literacy, the book How Learning Works suggests that learners must understand the value of learning a subject. While sustainability might not be a topic that everyone cares about, I assume that being healthy is something everyone values.

The mental model of eating healthy

People will generally agree that they would love to eat healthier. However, "healthy" is vague term and might be interpreted differently by people. Thus, I needed to understand people's mental model about healthy eating to inform the content of my design.

I conducted quick research on campus. I asked people to use one sentence to describe what "healthy diet" means to them? And if that ideal healthy diet is 100%, what level are they in right now and why. I randomly asked 16 people around campus these questions and distilled three bullet points from their responses:

- Take both body health and mental health into account: A healthy diet means a diet that can make your body and mind sustainable. I think achieving this goal requires the skill to be self-reflective about one's body and mental health, which is difficult for people to do.
- Balanced diet: Through the interview, people often mention that they try to achieve a balanced diet but regardless of scientific research, they all interpret "balance" in very different ways. They mentioned a balance between raw food and processed food, or carbohydrates, protein, vegetables, and fruit. Some interviewees describe it as simply more fruit and vegetables in their diet.
- Avoiding "bad" food: Besides a balanced diet, people talked about avoiding certain kinds of food including processed food, fried, food and high-fat food.

The scientific study about eating healthy

New claims regarding what constitutes healthy eating, such as paleo diet, ketogenic diet, plant-based diet, ... etc. continually arise. I decided to use a plant-based diet as my guideline to inform the content of my design approach because the principle of eating less meat and diary in a plant-based diet matches the principle of less carbon emission in a sustainable diet.

It's important to note, that there is no clear definition of what constitutes a plant-based diet because it can vary greatly depending on the extent to which a person includes animal product in the diet. Nonetheless, the basic principles of a plant-based diet:

- Emphasizes whole, minimally processed foods.
- Limits or avoids animal products.
- Focuses on plants, including vegetables, fruits, whole grains, legumes, seeds and nuts, which should make up the majority of what you eat.
- Excludes refined foods, like added sugars, white flour and processed oils.
- Pays special attention to food quality, with many proponents of the plant-based diet promoting locally sourced, organic food whenever possible.

In terms of its health value, many studies have demonstrated that plant-based diets are effective for weight loss and also help people maintain weight long-term. Furthermore, it can also reduce the risk of developing heart disease, certain cancers, cognitive decline, and diabetes.

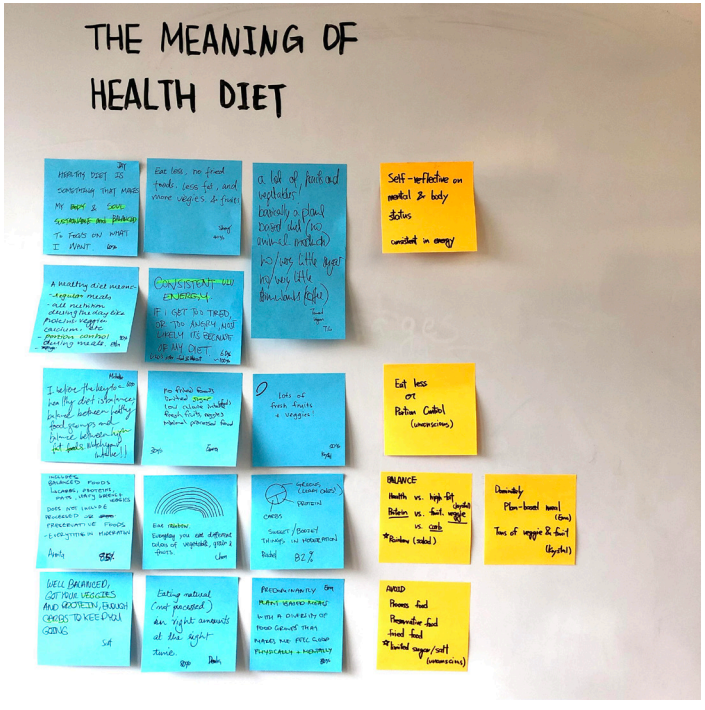


Figure 13. The meaning of healthy diet

Guidelines for sustainable food

There are many facets to consider regarding environmental sustainability in food choices. To develop the content of the design intervention, I decided to choose a quantitative metric to inform the content I provided to people. Through my secondary research, I realized that there are two major approaches to quantify the environmental impact of food: Carbon emission and water consumption. While water consumption is a concrete metaphor for people to understand, I decided to use carbon emission as my metric because it is applicable to other topics and strongly correlates to one principle of the sustainable food choice: eating locally and seasonally.

The below carbon footprint knowledge and tips about food choices are from the book, How Bad are Bananas: The Carbon footprint of Everything. (Berners-Lee, M. 2011) I used it to develop the content for my final design approach. *(See Appendix B for more information)*

Carbon Emission about foot

1. 66% of impact is from farms. Heating of greenhouses to grow crops out of season or in countries that don't have the right climate would be a carbon intense option.
2. Transportation accounts for 1%. Long road transportation is as bad as plane transportation. It is fine to eat apples, oranges, and bananas since they are mainly transported by ship.
3. Meat and dairy products are carbon intense.
4. Greenhouse farming, such as growing tomato in the winter, is problematic because they are air-freighted to their final destinations.
5. Packaging accounts for 6%. In fact, paper and cardboard are carbon intensive. Plastic is not energy intensive but recycling is another issue.
   Biodegradeable plastic is problematic because when it degrades, it will emit greenhouse gases.
6. Glass used as a package is intensive to make. If you want a beer, buy canned beer.
7. Steel and alumni is carbon intensive but you only need a little and it is easy and less energy intensive to recycle than glass.
8. Food waste is a big problem. We waste around ¼ of the food that is produced.
9. Refrigeration accounts for 6% in grocery stores.

Low-Carbon Tips

1. Eat what you buy, eradicating food waste. (25%)
2. Reduce meat and dairy product to aid sensible reduction. (25%)
3. Eat seasonal by avoiding greenhouse farming and air-freighted food. Another tip is to avoid food that has a short shelf life and not in season. (10%)
4. Avoid low-yield varies of food such as cherry tomatoes and baby corn (3%)
5. Avoid excessive packaging (3-5%)
6. Recycle packaging (2-3%)
7. Eat misshaped fruit and vegetables (1%)
8. Use low carbon cooking techniques, such as boiling water with a lid on or using a microwave wisely. (5%)

Study Information

Total Number of Shadowings: 3 times

Participants:

One participant with excellent food knowledge and cooking skills who wants to learn a new recipe and take the shopping list to Whole Foods.

One busy graduate school couple with medium-high food knowledge and skills who does weekly grocery shopping at Giant Eagle.

One participant with minimal food knowledge and skills who does weekly grocery shopping at Trader Joe's.

Goal: Understand people's grocery shopping practice and possibly identify effective points to intervene.

Figure 14. Shadowing grocery shopping

Shadowing grocery shopping

Study Premise

To understand people's decision making during grocery shopping. There are two major observation I want to conduct. First, what kind of food do people buy and why? What do they intent to make out of the food? Second, among the same kind of food, why people pick this one rather than others. What are the considerations behind the decision?

Study Protocol

I shadowed the participants as they shopped for groceries. (See Figure 14). When someone put something in the shopping cart I asked them why they choose the item and how they were going to use it.

Analysis and Synthesis

I printed out the photo of each step in participants' journey in the groceries store and wrote the name of the purchased item. Furthermore, I recorded their rationale for their decision-making and made side notes about each object (how a product is displayed, what the information appears on the sign, what kind of product attributed is empathize), competence and meaning (why they choose one rather than another, what is their consideration, where do their learn the knowledge about their consideration ...etc) (See Figure 15).

1. **Cost-sensitive by intuition**: One participant mentioned that he cared about the cost of products but he did not do math while shopping. He a Giant Eagle brand organic product because the grocery store brand is cheaper and organic is often interpreted as healthier. My assumption is that calculating the math and comparing products takes too much time and effort for people to do it. More often, they simply follow certain general principles to take action.
2. **Balancing inventory and shopping frequency:** Many decision-making activities also take inventory into consideration. Do they still have it? What are the 'must have' items? Participants tried to maintain the balance between freshness of the inventories and the frequency of shopping.
3. **Knowledge is crucial for reducing food waste of fresh produce:** Most fresh produce does not provide expiration date information so people need to know what fresh food looks like.
4. **The mental model of unhealthy:** I anticipated that one participant with very minimal cooking experience and time would buy many microwaveable meals or pre-packaged food for convenience purposes. However, he treated those foods as unhealthy options and would rather eat in the restaurant.
5. **The intention to do something different:** One participant walked to the seafood section and told me that he really wanted to eat salmon but didn't know how to cook it. I promised to give him a cooking lesson so he immediately put a box of salmon in his shopping cart.

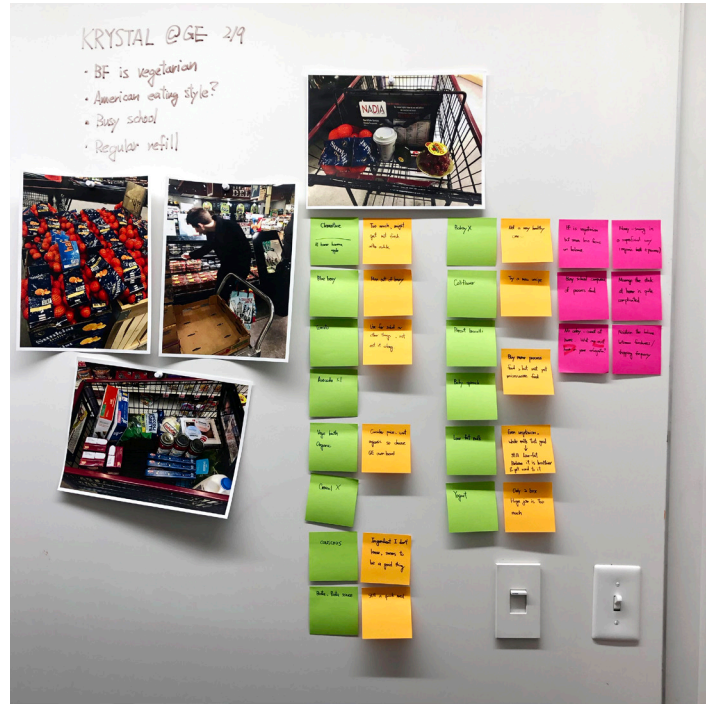


Figure 15. Synthesis observations

4

2ND ARTIFACT REVIEWS
IDEATION
CONCEPT SPEED DATING

IDEATION AND CONCEPT DEVELOPMENT

Before diving into ideation, I conducted a quick artifact review to understand current approaches that guide sustainable food choices and how they link to knowledge learning and skill practicing.

Artifacts of sustainability in food choices

The Crunch (thecrunch.wellcome.ac.uk)

The Crunch, funded by Wellcome Trust in the UK, is a website that includes exciting free activities and resources about how our food, health, and planet are all interconnected.

Table in the right (See Figure 16) describes the true cost of a traditional English breakfast. It highlights a shocking fact that meals like a full English breakfast creates serious environmental impacts. While viewers are shocked by the number, do they take action to address it and if so what do they do? This diagram offers insights into sustainable food choices. However, without providing proper skills (how to do it) or enough motivation (want to do it), the desired behavior might not be taken.

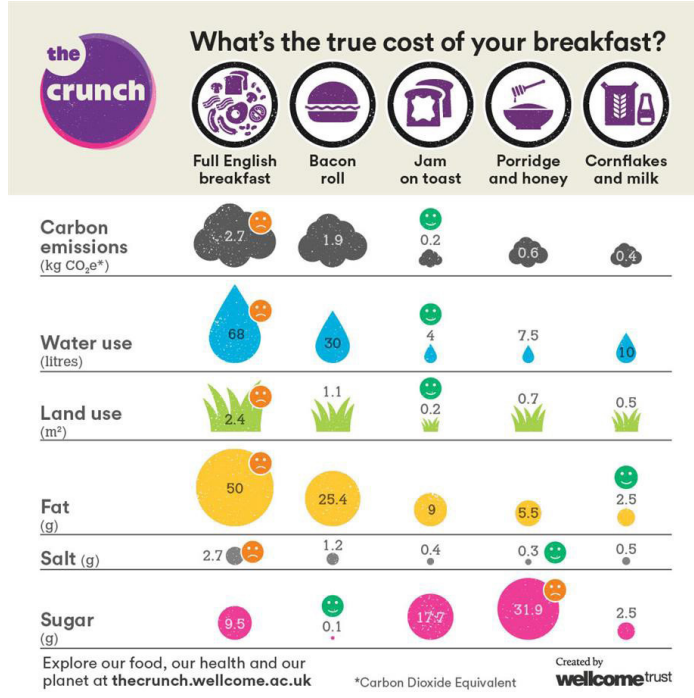


Figure 16. "What's the true cost of your breakfast?". (n.d.). Retrieved May 15th, 2019, from http://thecrunch.wellcome.ac.uk

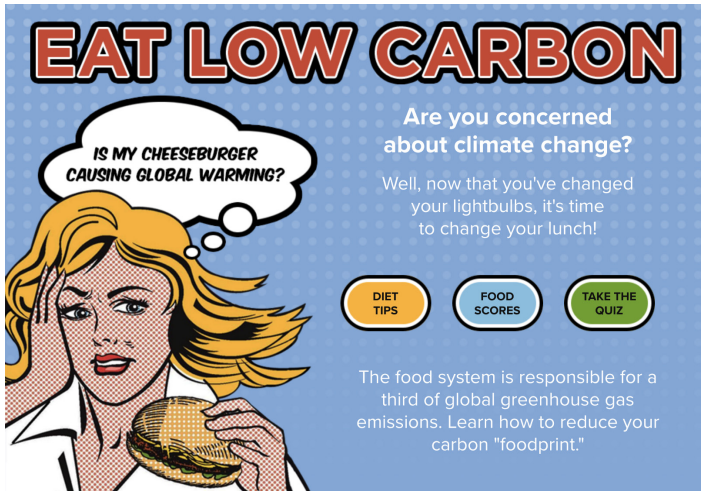


Figure 17. Eat Low Carbon website. (n.d.). Retrieved May 15th, 2019, from http://eatlowcarbon.org

Eat Low Carbon (eatlowcarbon.org)

Eatlowcarbon.org (See Figure 17) is a website that teaches people about the carbon footprint for their food choices. It consists of three parts:

1. **Diet Tips:** In this part, the website provides five general guidelines and detailed explanations.
2. **Food Scores:** This section provides food scores (a higher score means higher carbon footprint) for what people often eat in the U.S. Using common foods as examples and comparing them is a good way to construct a general understanding of the carbon footprint of various foods.
3. **Quiz:** Take the quiz and see what you have learned from the material.

The information on the website is helpful because the content is represented clearly and it clarifies some common misunderstandings about the carbon footprint of foods. However, it provides little information that encourages people to take actions.

1. The general guidelines function as high-level concepts so it is hard for people to take immediate actions. I think only expert cooks could immediately reflect on the content and start to make conscious food choices.
2. The lack of feedback is also adds to the problem of sustainable behavior since most he environmental issues are built from an individual's behavior. If a person decides to eat less beef and cheese, they can't see their contribution to an overall goal and end up disappointed about the whole system.

Farmstand - The app helps you find local farmers' markets

Purchasing seasonal and regional food is sustainable and that's why it is always recommended to shop at a local farmer's market. Farmstand app (See Figure 18) helps people find nearby farmers' markets and co-ops in their area where they can buy local, fresh, and organic produce and foods. This app functions as an information hub of local farmers' markets and is very useful for people who actively look for related information.

I think this app benefits people who look for such information, especially for those who are foreign to a new place. It tells them where to buy local fresh produce. However, the app plays a passive role in behavior change. It only bridges the knowledge gap about the farmers' markets but does not tell users what could be done. For those who rarely cook, shopping in farmers' markets is much more difficult than in grocery store.

Figure 18. Farmstand, app helps you find local farmer's market. (n.d.). Retrieved May 15th, 2019, from http://www.farmstandapp.com

Oroeco - Personal Carbon Emission Tracker

Oroeco is an app (See Figure 19) that keeps track of what people do each day and makes suggestions for how to reduce their carbon footprint. Oroeco empowers users by

- **Tracking:** It helps people see how every aspect of their life connects to climate change, from their home energy and transportation decisions, to their diet, shopping, and entertainment choices.
- **Link to spending:** It automatically tracks the climate impacts of how people spend their money with the world's most powerful carbon footprint calculator.
- **Suggestions:** It save money and the planet with personalized tips and actions that describe how people can lower their impact for the environment.

Social perspective: It enables people to compare, collaborate, and compete with their friends, family, and neighbors.

Points, Levels and Badge: It enables people to level up to earn badges and Climate Champion status for doing their part for the planet.

This app is an eco-visualization approach to reducing carbon footprint. It minimizes the effort of inputting data and provides personalized tips for the actions people can take. Furthermore, it includes some gamification approaches to build motivation. What is missing in this project is the learning perspective. I believe the designer makes assumption that once users do the carbon emission reducing tips, they learn how to do them and will continue these actions. This is usually not the case. Everyone's behavior has some sort of resilient and is hard to change immediately. The gamification part tries to deal with the problem of personal motivation but it uses extrinsic motivation

Figure 19. Oroeco, personal carbon footprint tracking app. (n.d.). Retrieved May 15th, 2019, from http://www.oroeco.com

Save Food from the Fridge

Save Food from the Fridge is a speculative design project (See Figure 20) that focuses on learning traditional ways of storing food through designed objects. Jihyun Ryou, the designer of this project, has found that people hand over the responsibility for taking care of food to the refrigerator. As people lost the knowledge of treating food properly, foods became rotten faster, which increased unnecessary food waste.

I found this project fascinating because rather than telling people what to do abstractly, the designer used the form to show people how to do it. The design is simple and powerful to communicate the knowledge of food storage. It is a, effective learning design. However, since the design focuses on specific food items (ex. Egg, apple, green onion ...etc) it would be hard for users to extend the knowledge they gain to different items.

Figure 20. Save Food From the Fridge. (n.d.). Retrieved May 15th, 2019, from http://www.savefoodfromthefridge.com/

Figure 21. Healthy Cooking for Congregation. (n.d.). Retrieved May 15th, 2019, from https://www.institute.org/bronx-health-reach/our-work/faith-based-outreach-initiative/culinary-initiative/

Healthy cooking for congregation

Bronx Health REACH worked with a church member trained in food service management to develop a resource manual for church culinary committee members. Healthy Cooking for your Congregation is a six-week program that provides information on selecting, preparing, and serving healthy versions of favorite meals in church kitchens. As a result, changes to menus used in church events include:

- Less fat and salt in prepared dishes.
- Selection of foods rich in fiber and prepared with more whole grains.
- More vegetables, fruits, and other whole foods available to congregants.
- Limiting or eliminating sugar sweetened beverages.
- Reduced portion sizes.

It is a great program that takes knowledge learning and skill training as the major considerations for healthy lifestyle change. Furthermore, rather than teaching participants about “healthy recipes”, the program provides participants’ with favorite recipes and helps them change them into healthier versions. This approach makes the learning activity personal, relevant, and build motivation for the participants. However, since this program takes 6-week, it could be a potential barrier for people who do not have great motivation to eat healthier or are not aware of the benefits of eating healthier. Furthermore, for people with zero or minimal cooking skill might not have a “favorite recipe” to use as a starting point. As a result, the program might not able to help those kind of people.

Ideation and mapping

Informed by the previous artifact reviews, I started my ideation stage. As practice-oriented design argues, new element(s) should be introduced to reconfigure a practice. As a result, I used a practice-oriented design framework (meanings, competence and objects) to ideate potential design interventions. Below are several idea examples that take different types of elements into consideration.

- **Meanings:** An idea is cooking buddy from various cultural backgrounds. While the meaning part of the food-related practice is heavily shaped by people's family background and personal taste, exotic ingredients or foods could introduce new meaning to sustainable diet and avoid direct conflict with personal preference.
- **Competence:** This idea is a beginner's guide book that focuses on developing a sustainable diet. Directly introducing competence elements might prove difficult in reconfiguring practice among three elements because knowledge and skill require a learning process to acquire. It would be hard to guide people who are not interested in sustainability through the process. A better approach could be to add a meaning element into the idea. Learning sustainability practice through exotic foods, such as vegetarian Indian recipe or a tofu Chinese recipe, could potentially create more motivation.
- **Objects:** This idea proposes adding carbon emission information to produce labelling. While many people buy groceries based on quality and price, I believe it is possible to add another dimension to the process, such as carbon emission information. The challenge is determining ways of representing the information to encourage engagement that will eventually lead to changes in people's shopping decisions.

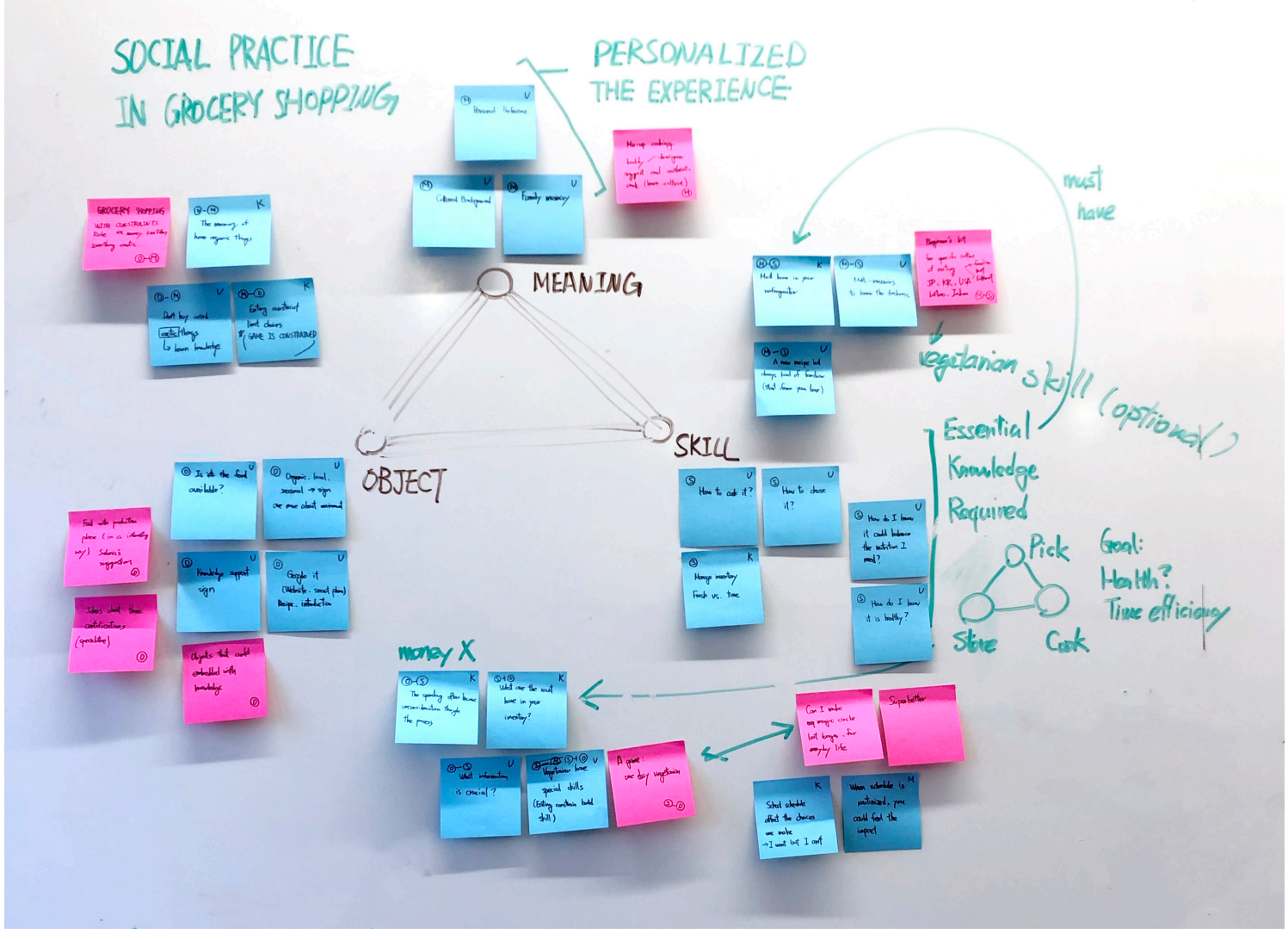


Figure 22. Social practice in grocery shopping and ideation by the elements in practice.

One potential problem I found during the ideation phase is that people's knowledge and skill level might be varied. Also, my ideas are place in the context of multiple places such as a grocery store, kitchen, farmer's market, etc. As a result, I decided to mapping my idea into two dimensions to frame a clear overview.

In the diagram (See Figure 23), the X-axis represents knowledge and skill level. I roughly divided ideas into 1) targeting novices, 2) targeting experts and 3) targeting both. The Y-axis represents the categories of ideas. The categories include knowledge and skill about groceries, knowledge and skill about cooking, and a tool for documenting process for self-reflection.

Through the mapping exercise, I identified holes and ideas that could be combined.

	For novice		For both			For expert	
Food Knowledge	Weekday breakfast making challenge	Sustainable dining map for campus	Food transportation visualization	Exotic sustainable recipe kit	Weekday breakfast making challenge	One new ingredeint at a time challenge	PITACO make taco with all local ingredients
			Game about Food Transportation	Food label with carbon footprint	Carbon footprint dashboard		
Cooking Skill	Cross culture cooking buddy program		Weekend sustainable meal prep challenge			mix-and-match cooking experiment	Sustainable meal cooking club
Progress tracking Self-reflection			Baking challenge visualizing sugar			Balanced meal food diary	Farmer's market Wiki

Prefered idea

Figure 23. Ideas mapping based on the knowledge/skill level and context

Concept storyboards

Concept 1: Exotic Food Recipe App

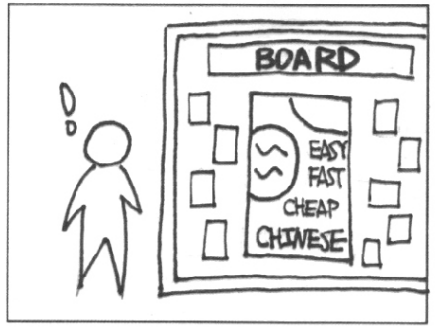
Rationale behind the concept

The concept (See Figure 24) targets current students at school and introduces cheaper, faster, and exotic foods as incentives to motivate student start self-cooking through this recipe app.

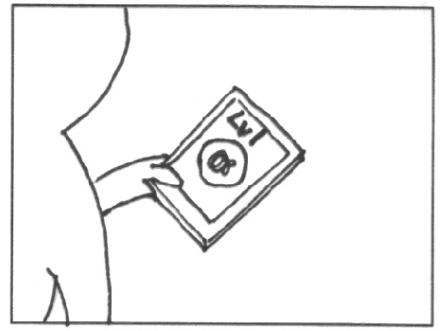
Feedback

- It might be more actionable if the app is promoted in the grocery store rather than the dining hall in school.
- Sharing what you have accomplished on social media seems shallow. It might be more fun and engaging to share the moment of preparing or cooking.
- Making learning new recipes a fun and enjoyable activity should be the major consideration in this concept.

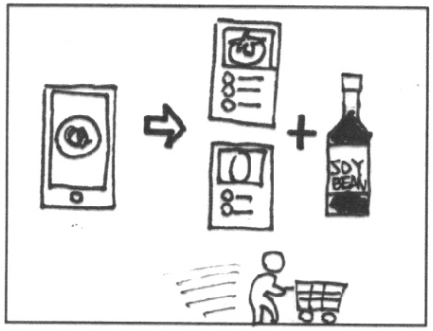
Adam is a freshman at CMU. School's dining service is limited and not very healthy.
He wants to try something different but school life is often too busy and his budget is limited as well.



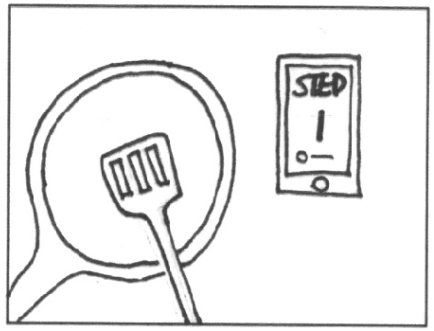
He saw an app promotion poster at the food court. It says that it is easy, fast and cheap Chinese recipe app for American students. "How about trying something healthy and Chinese?" he thinks.



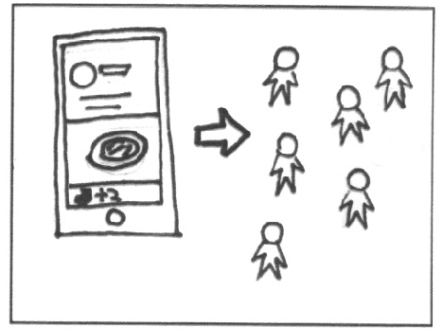
He downloads and opens the app. For the first level, he is able to choose from several simple Chinese recipes to start with.



Each recipe will contain several ingredients that are purchasable in the regular market. There will be also some special seasonings that are not familiar with the user.



After a trip to the grocery store, the user will follow the cooking instructions to cook.



After the user cook the food, he is encouraged to share on the social network with his friends.

Figure 24. Concept 1: Exotic cooking recipe app

Concept 2: One Pot Meal Recipe App with sustainability indicator

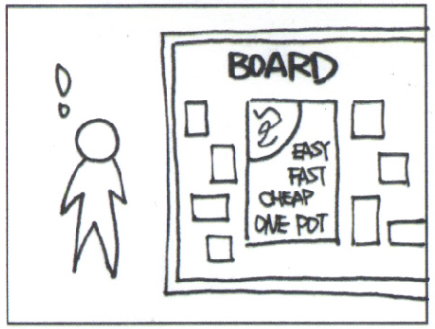
Rationale behind the concept

One-pot meal prep recipes (see Figure 25) are still promoted as cheaper and faster ways of cooking to help people who do not have much experience cooking. Adding an extra function that focuses on replacing mainstream ingredients with sustainable alternative,could teach people sustainable food options through the recipe preparing process.

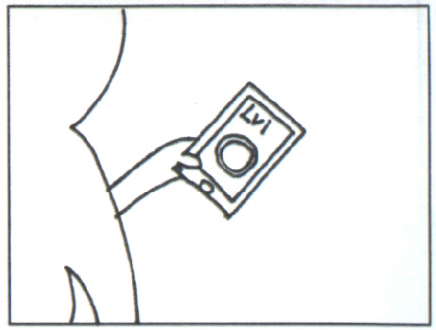
Feedback

- People like the idea of learning food knowledge during grocery shopping. It is a more rich experience than learning from a textbook.
- The idea of using a slider as way to switch ingredients is interesting but does not include much learning.
- Scaffolding the content to reflect a sustainable diet makes sense. However, the slider is probably not the best option to include because you could replace one thing with another without using a middle ground.

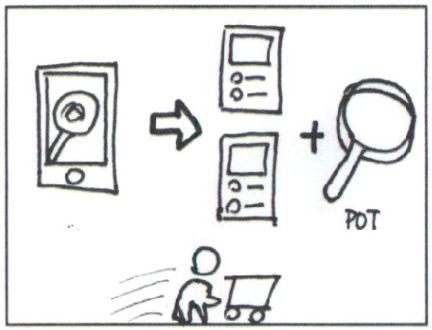
Chen is an international student who starts her new life in Pittsburgh. To save money, she wants to start learning cooking. However, there are so many unfamiliar ingredients in the grocery store. She does not know how to start.



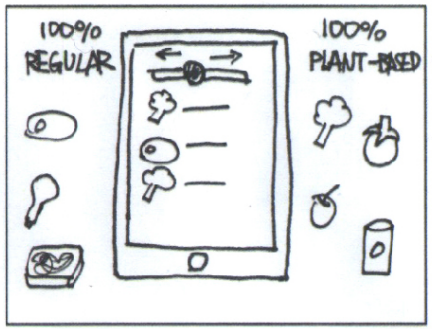
She saw the promotion of the one-pot-meal app that is easy, fast and cheap.
This app is what she needs.



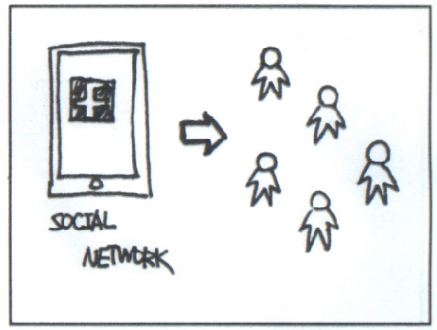
She immediately downloads the app.
There are several recipes she could choose to start with at the first level.



She follows the ingredient guide for buying food in the grocery store.
At the same time, she is also learning about the food option here.



The app intends to promote the plant-based diet. However, by adjusting the bar in the app, she could switch between sustainable food option and popular food option.



After finishing the meal, users are encouraged to share on the social network with her friends.

Figure 25. Concept 2: One pot meal recipe app

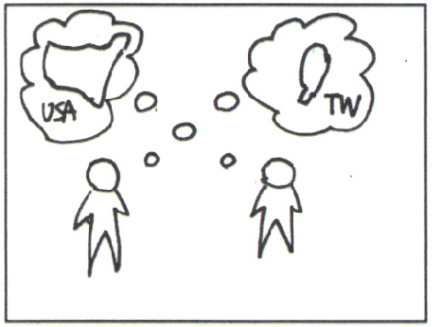
Concept 3: Cultural Cooking Buddy

Rationale behind the concept

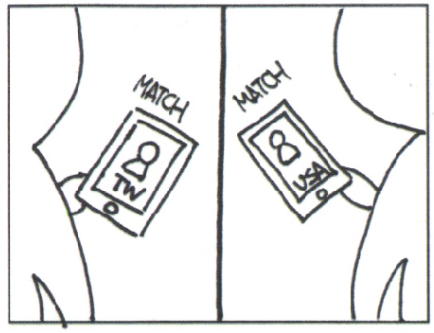
The third concept (See Figure 26) tries to leverage person-to-person interaction. It resembles a language exchange and replaces the topic with food because native people know the food culture best. It intents to be an activity where participants can learn food knowledge from each other.

Feedback

- The concept includes the digital app and face-to-face interaction. However the storyboard does not clearly define the role or task between the app and participants.
- People like the idea of including other people in the process of learning. However, inviting strangers to your own place to cook would be weird. Learning and cooking together at a public event would be totally fine. It really depend on the context to decide who can go through the learning process with you.

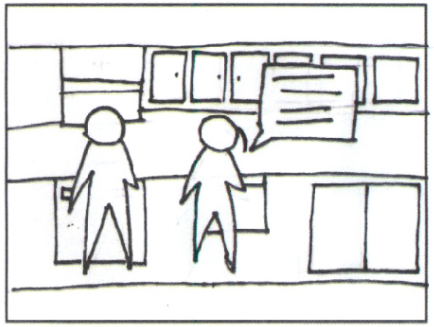


Henry is an American student who loves Chinese food and wants to learn how to cook it. At the same time, Michael has the same thoughts, but he is from Taiwan. He wants to learn how to cook authentic American food.

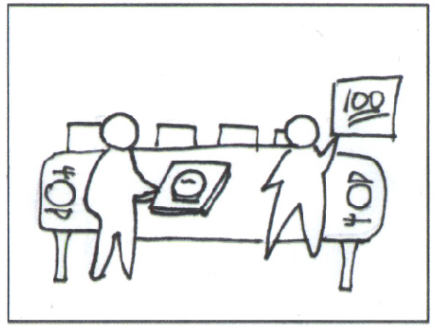


The app FoodMatch matches them.

Henry leads Michael to the grocery store. Teach him where to get the ingredients and also share about American food culture. App at the same time provides information to support the tour at the same time.



Back to Michael's home, Henry teaches him how to cook authentic American food. The app will provide cooking instructions.



Once Michael finish, Henry will taste and provide feedback about how to improve next time.

Then the second round starts, Michael will lead Henry to shop and cook.

Figure 26. Concept 3: Cultural cooking buddy

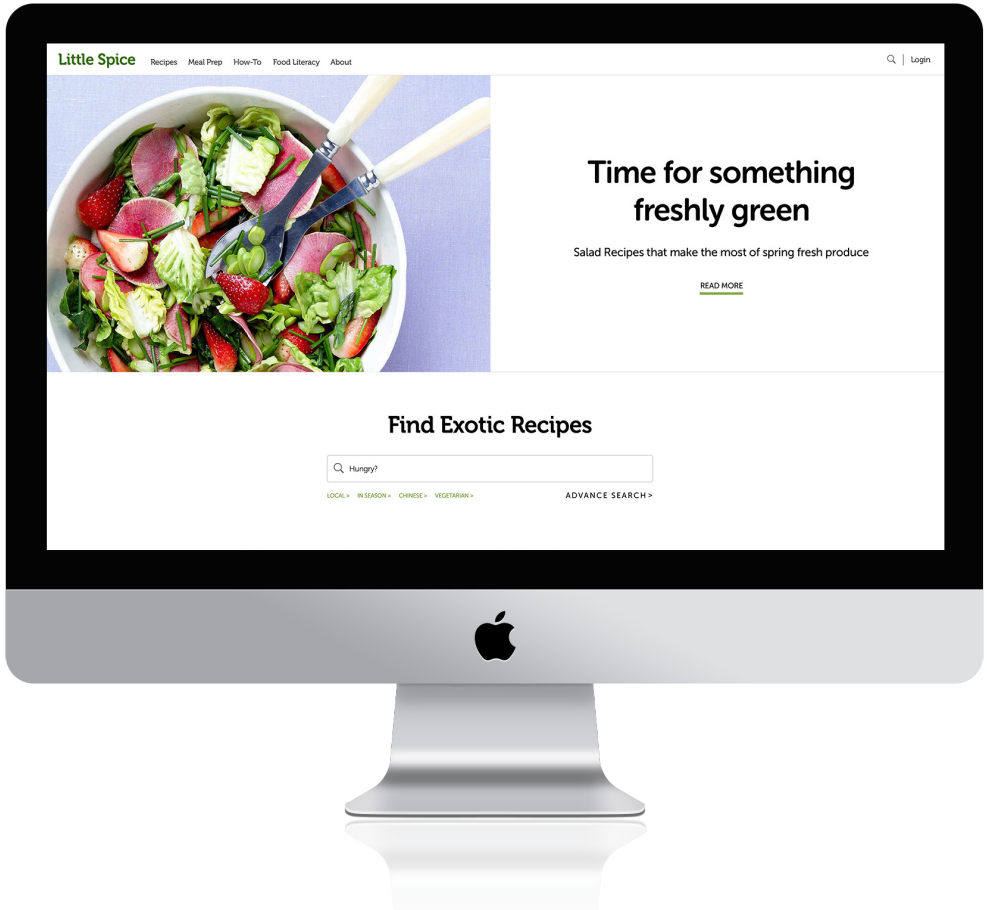
5

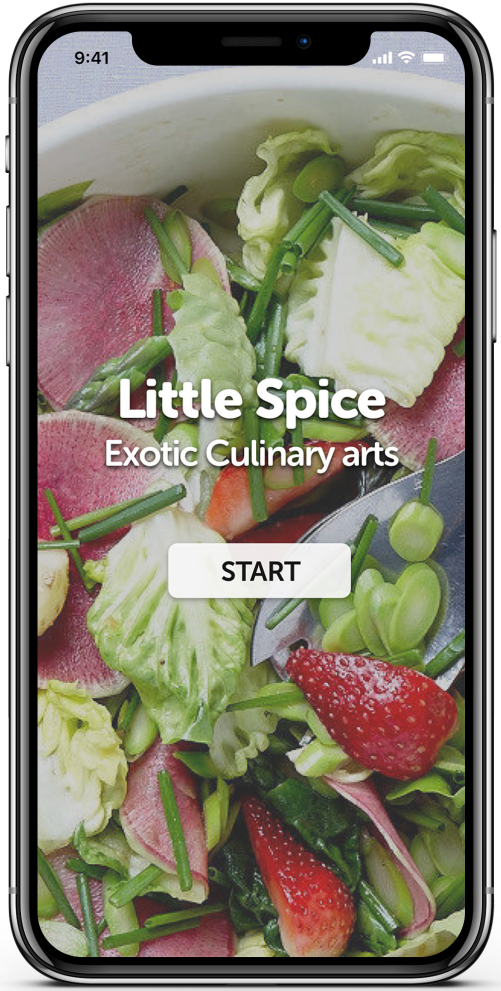
PROTOTYPE EVALUATION

PROTOTYPE AND EVALUATE DESIGN

As a next step, I referred back to the subtitle of my study topic, bolstering knowledge and skills to aid sustainable awareness and actions. The final design approach is a 4-phase exotic recipe learning exercise. These phases include: 1) Planning the shopping list, 2) Grocery shopping, 3) Managing food inventory and 4) Cooking. In each phase, besides learning the recipe itself, I intend to expose people to the knowledge of a sustainable diet and provide situations for practicing. Last but not least, I decided to leverage exotic food based on my previous interviews. I believe this approach has a higher chance of creating motivation and avoiding direct conflict with people cultural taste.

Through the previous concept speed dating, I included elements that received positive feedback into my final design approach.


Little Spice
Recipes
Meal Prep
How-To
Food Literacy
About
Login
Time for something freshly green
Salad Recipes that make the most of spring fresh produce
READ MORE
Find Exotic Recipes
Hungry?
LOCAL >
IN SEASON >
CHINESE >
VEGETARIAN >
ADVANCE SEARCH >


9:41
Little Spice
Exotic Culinary arts
START


9:41
Little Spice
Select one flavor to start with
Chinese
Japanese
Taiwanese
Indian

Phase 1 Planning

Learning goal

To understand if and how people substitute ingredients in the recipe with sustainable alternatives.

Foundational Principles

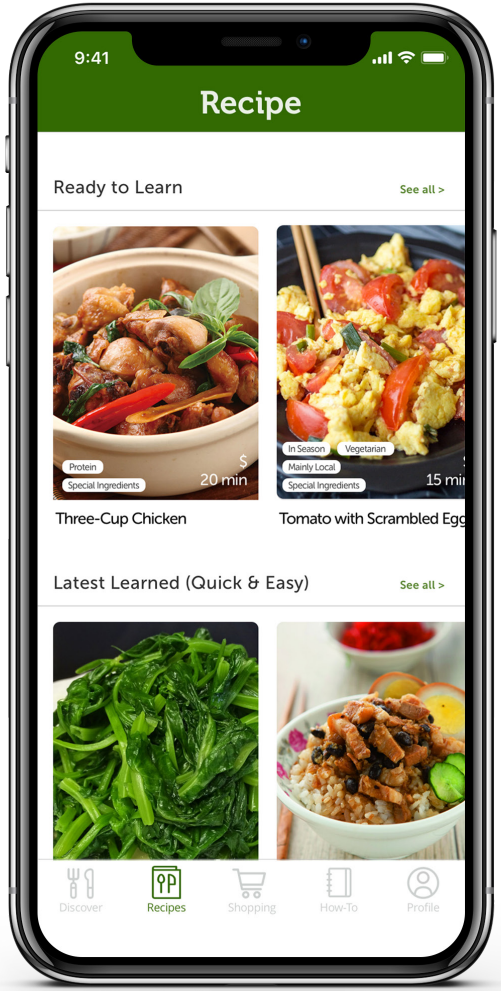
Attracting Attention.

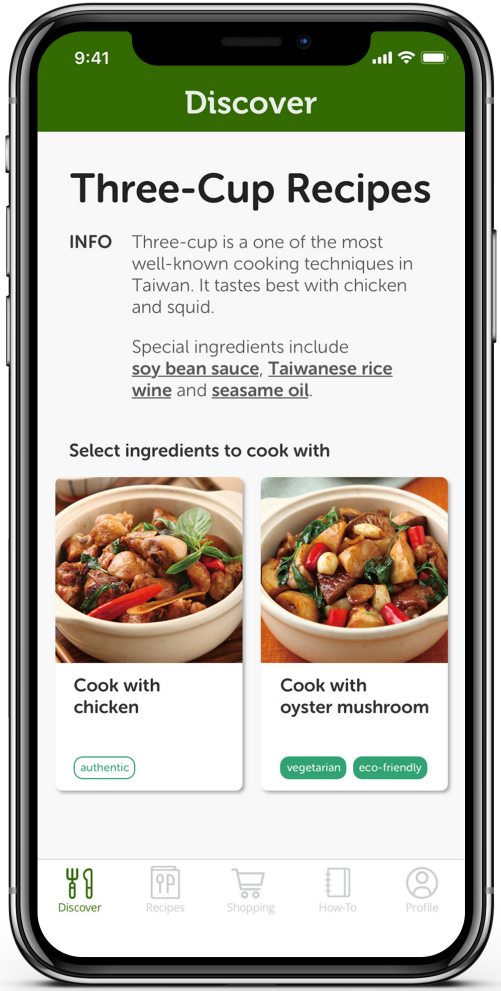
Evaluation Metrics

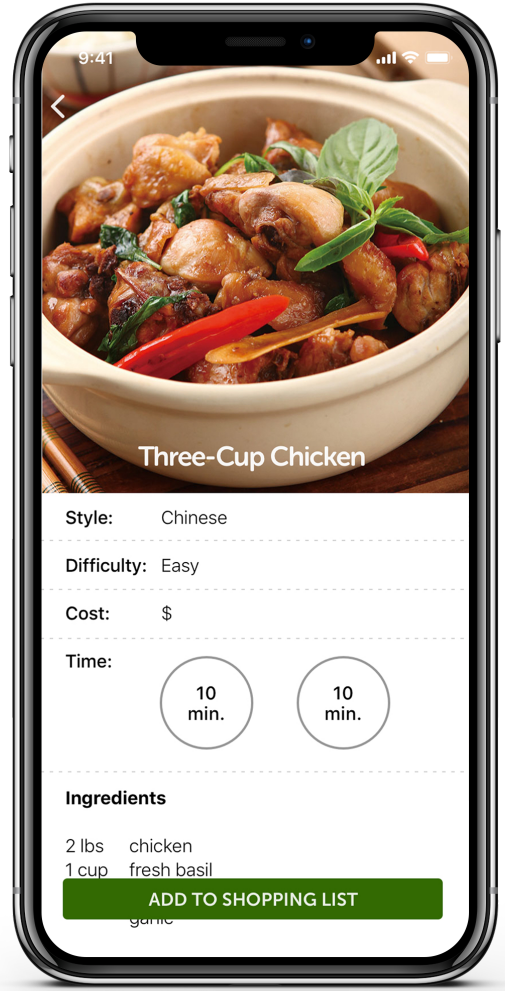
- Do people understand the environmental impact of different ingredients?
- Do people plan to alter recipes using sustainable substitutions?

Hypothesis

The first phase of learning a new recipe involves planning the shopping list. Since my design approach focuses on exotic recipes, people might not have predetermined thoughts and knowledge about how certain ingredients integrate with each other. This serves as a great opportunity to introduce multiple available options. For example, Three-Cup is a famous and delicious Chinese cooking method. It typically includes chicken but it tastes good with oysters and mushrooms as well. Going through this learning process, people will learn 1) how the environmental impact of chicken is different than mushrooms, 2) how the sustainable Three-Cup cooking method can serve as a sustainable alternative to conventional cooking.




9:41
Discover
Three-Cup Recipes
INFO
Three-cup is a one of the most well-known cooking techniques in Taiwan. It tastes best with chicken and squid.
Special ingredients include soy bean sauce, Taiwanese rice wine and seasame oil.
Select ingredients to cook with
Cook with chicken
authentic
Cook with oyster mushroom
vegetarian
eco-friendly
Discover
Recipes
Shopping
How-To
Profile


9:41
Three-Cup Chicken
Style: Chinese
Difficulty: Easy
Cost: $
Time:
10 min.
10 min.
Ingredients
2 lbs chicken
1 cup fresh basil
ADD TO SHOPPING LIST

Phase 2 Grocery shopping

Learning goal

To understand if and how low carbon footprint options impact people's food practices

Foundational Principles

Learning Flow Model

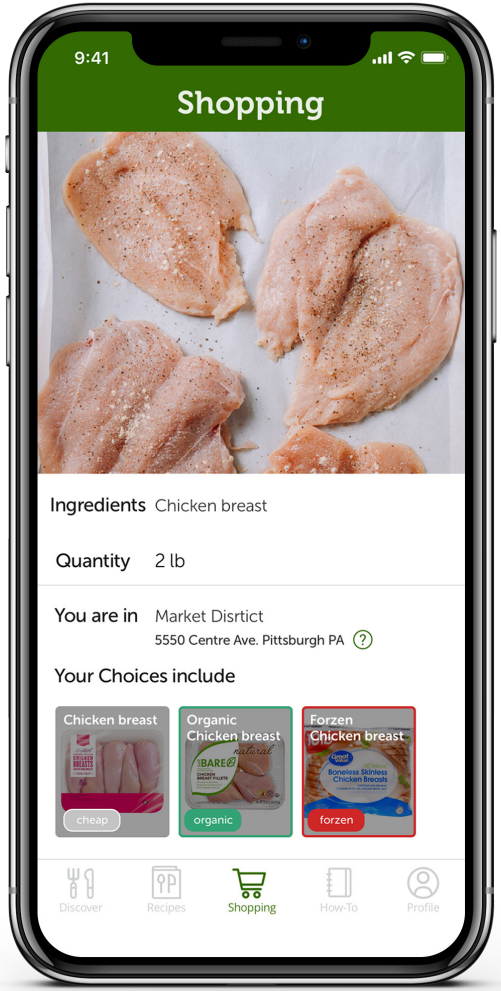
Evaluation Metrics

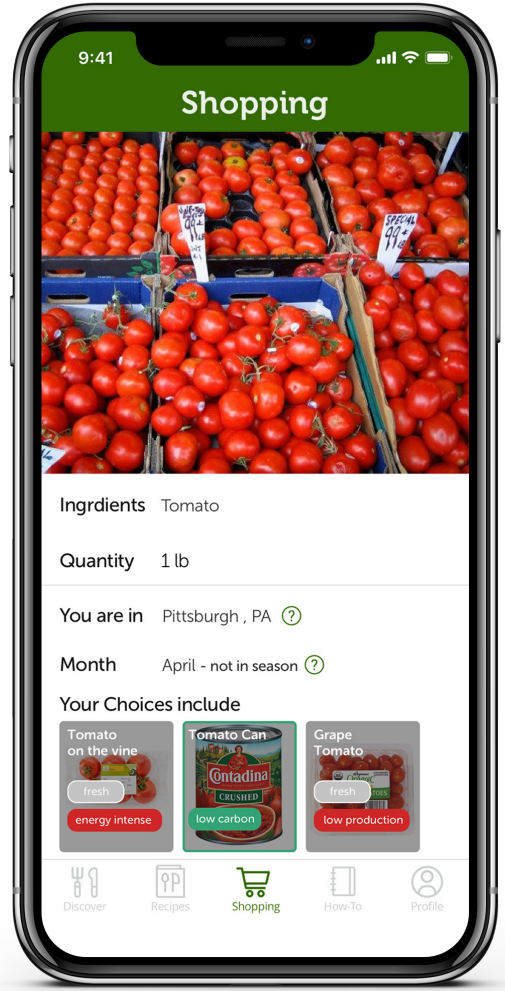
- Do people understand the idea of carbon footprint of food?
- Do people know what constitutes produce with a low carbon emission?
- Do people apply what they learn and make sustainable food purchasing decision?

Hypothesis

The second phase of learning a new recipe is grocery shopping. In the grocery store, people can find multiple options for one ingredient. For example, if someone is learning how to make stir-fried tomato and scrambled eggs they are faced with numerous tomato options. What kind of tomato best suits recipe? Roma tomato? Tomato on the vine? Canned tomato? More often, people are overwhelmed by the choices they have and tend to follow instructions if they are very specific. Thus, this process serves as another opportunity for people to learn about sustainable food options.

Based on a person's location and time of the year, the design will make appropriate suggestions. For example, during winter, buying canned tomato is more environmental friendly than purchasing fresh ones which are grown in a greenhouse powered by fossil fuels. Thus, something as common as tomato can serve as great opportunities to learn about sustainability.


9:41
Shopping
Ingredients Chicken breast
Quantity 2 lb
You are in Market Disrtict
5550 Centre Ave. Pittsburgh PA
Your Choices include
Chicken breast
cheap
Organic Chicken breast
organic
Forzen Chicken breast
forzen
Discover
Recipes
Shopping
How-To
Profile


9:41
Shopping
Ingrdients Tomato
Quantity 1 lb
You are in Pittsburgh , PA
Month April - not in season
Your Choices include
Tomato on the vine
fresh
energy intense
Tomato Can
low carbon
Grape Tomato
fresh
low production
Discover
Recipes
Shopping
How-To
Profile

Phase 3 Food inventory

Learning goal

To understand if people know how to store food and manage inventory properly to reduce food waste.

Foundational Principles

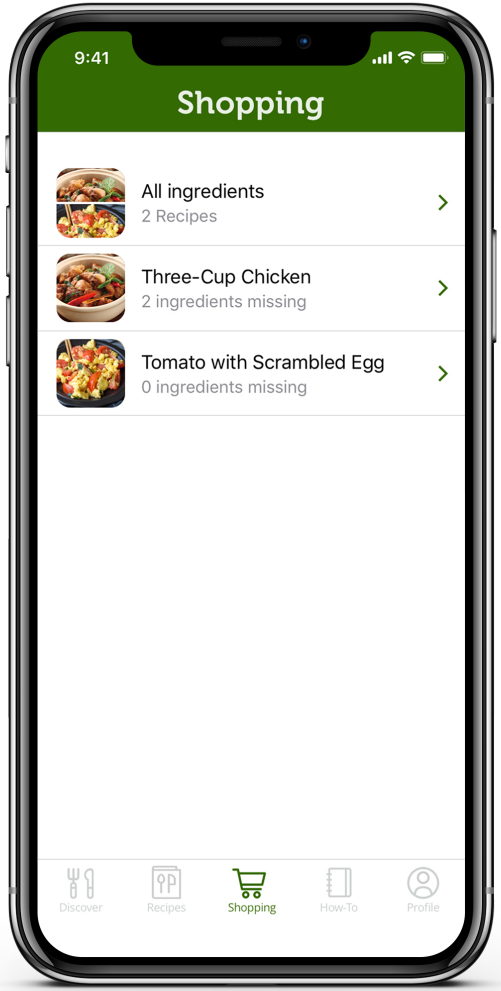
Scaffolding the learning incline

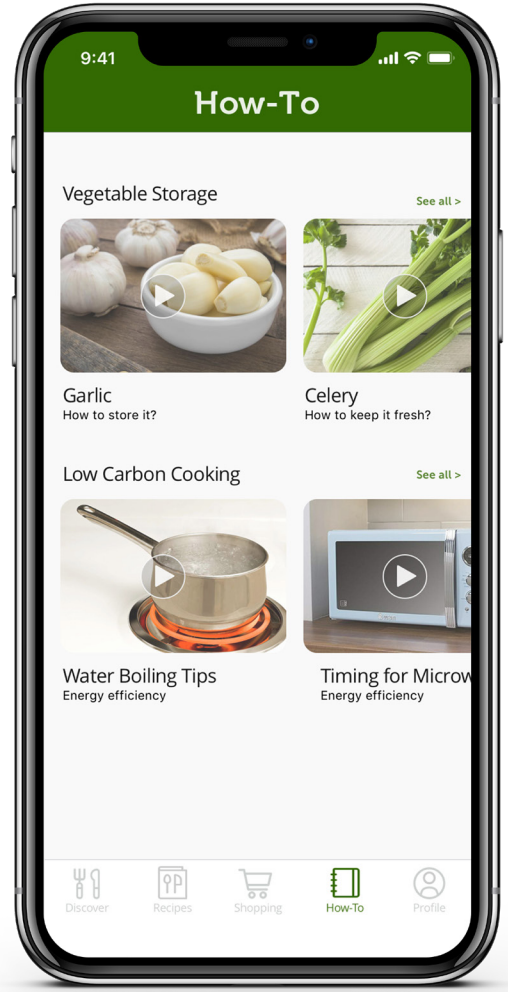
Evaluation Metrics

- Do people understand storage methods for different food ingredients?
- Do people know how to mix-and-match food surplus in the refrigerator rather than throwing them away?
- Does people know how to manage food inventory properly so that they eat the food they have before it expires?

Hypothesis

The third phase of learning a new recipe focuses on managing inventory. It also links back to the first phase of planning shopping list. As food waste causes of the carbon emission in this field, managing a refrigerator properly requires comprehensive knowledge and skill. While people tend to not throw away food that still edible, they often lack knowledge about how to deal with what's remain after cooking the recipe. As a result, the design provides best practices for food storage and links the ingredients to other recipes.


9:41
Shopping
All ingredients
2 Recipes
Three-Cup Chicken
2 ingredients missing
Tomato with Scrambled Egg
0 ingredients missing
Discover
Recipes
Shopping
How-To
Profile


9:41
How-To
Vegetable Storage
See all >
Garlic
How to store it?
Celery
How to keep it fresh?
Low Carbon Cooking
See all >
Water Boiling Tips
Energy efficiency
Timing for Microw
Energy efficiency
Discover
Recipes
Shopping
How-To
Profile

Phase 4 Cooking

Learning goal

To understand if and how people use low carbon cooking practices to reduce energy consumption

Foundational Principles

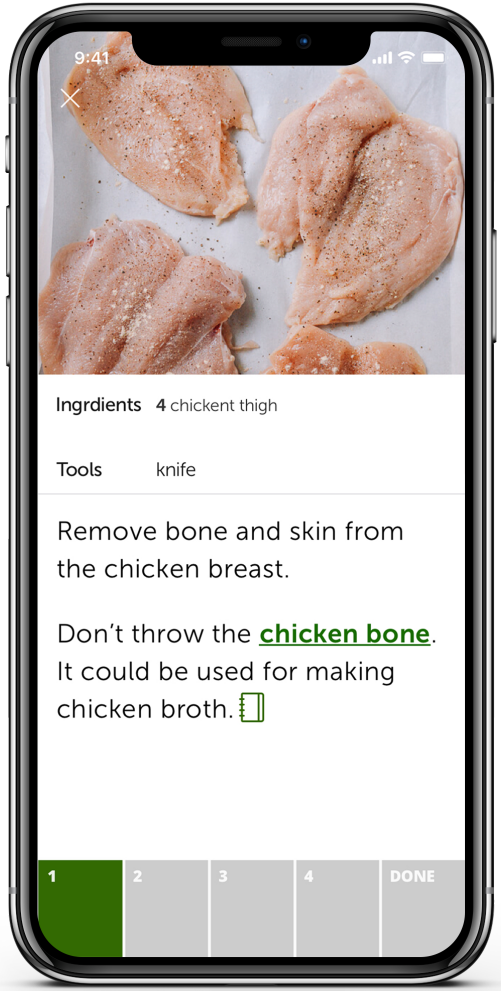
Cycle of practice and feedback

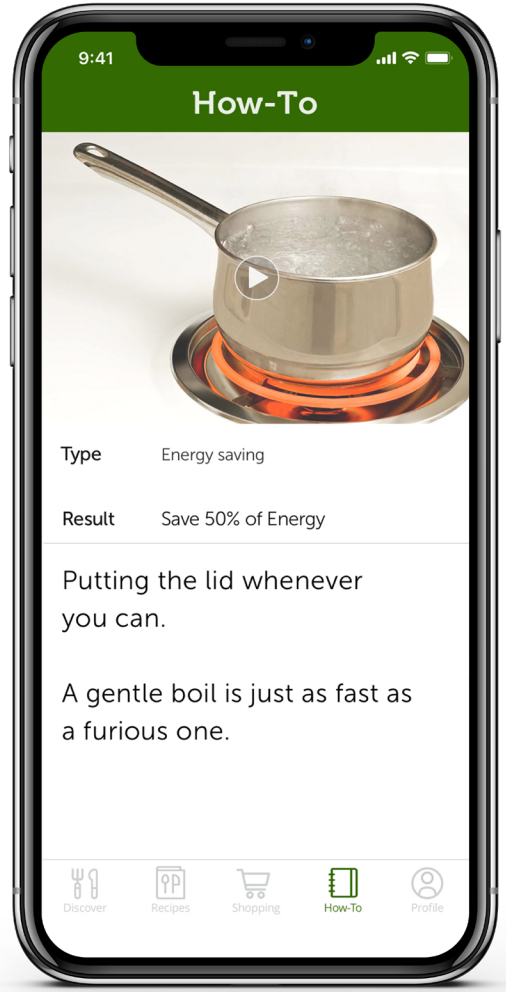
Evaluation Metrics

- Do people understand the general principles of low carbon cooking practice?
- Do people apply what they learn to their cooking practice?

Hypothesis

The fourth phase of learning a new recipe involves cooking it. This process serves as an opportunity to introduce best cooking practices with low energy consumption. For example, putting a lid on a pot while boiling water or using a microwave to heat food rather than oven conserves energy. The design provides information about the energy consumption of different cooking practices to help people learn through the cooking process.


9:41
Ingrdients 4 chickent thigh
Tools knife
Remove bone and skin from the chicken breast.
Don't throw the chicken bone. It could be used for making chicken broth.
1
2
3
4
DONE


9:41
How-To
Type Energy saving
Result Save 50% of Energy
Putting the lid whenever you can.
A gentle boil is just as fast as a furious one.
Discover
Recipes
Shopping
How-To
Profile

6

LESSON LEARNED
NEXT STEPS

CONCLUSION

Potential application of lessons learned

For interaction designer student who focus on design for behavior change, I believe there are three major takeaways from this study.

- **Practice is not one entity:** It's important to consider practice not as one entity but multiple elements and their connections for which to design. Otherwise, the design approach may only lead to limited impact. My final design approach tries to address competence element and avoid direct conflict with meaning element.
- **Leverage the vulnerable moment of the practice:** Designers may find it beneficial to seek appropriate moments to intervene because they typically lead to effective outcomes. In my final design approach, I found that introducing a new recipe to people served as an effective point to intervene.
- **Design for intervention not solution:** Practices are inherently participatory and can't be directly designed. Designer can introduce interventions and let people reconfigure information so that the new practice makes sense in their everyday life. For this reason, Little Spice is presented as a learning and decision making support tool but it does not point out the ideal sustainable solution.

Potential next steps

This thesis study serves as a starting point for developing methods that empower people to make informed sustainable decisions. In practice-oriented design, the element of competence (e.g. learning knowledge and skill about everyday practice) is still largely unexplored. I see two future directions for further study on the topic.

The first focuses on empowering people with knowledge and skills that can address long-term, radical lifestyle change. One constraint of this study is that the time scope limited me in understanding the long-term effect of the final design approach. Over time, new practices will eventually fall into a rigid pattern too. Therefore, how could design periodically intervene, causing the rigid pattern to reconfigure practices toward sustainable lifestyles?

The second investigates how sustainability knowledge about everyday practice can lead to system thinking that focuses on sustainability. One thing I had not considered was the impact that food choices can have on the economy. The information associated with this topic is complicated and interpretations of sustainability can vary without one single right answer existing. Therefore, I focused my study on individuals. For them, learning the carbon footprint and using it to guide food choices serves as first level of understanding. Nonetheless, learning the implications of industrial agriculture can potentially be more powerful for radical lifestyle change. Thus, how can design unfold knowledge to empower systems thinking about the implication of their behavior?

A practice-oriented approach for designing for behavior change reframes the work that interaction designers do. This thesis study explores new approach for practice-oriented design by including knowledge learning and skill practicing through the process of practice reconfiguration. By bolstering knowledge and skills, this project aims to aid sustainable awareness and action to prepare people for radical lifestyle change.

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APPENDIXES

Appendix A. Hidden Fact Card Deck

Cheese
$3.29 / 8 oz

Cheese

4460 — Carbon emissions (kg CO_2)

2300 — Water use (litres)

Hidden Facts

Egg
$1.39 / 12 ct

Egg

1620 — Carbon emissions (kg CO_2)

2400 — Water use (litres)

Hidden Facts

Egg - Cage Free
$2.49 / 12 ct

Eff - Cage Free

1290 — Carbon emissions (kg CO_2)

2400 — Water use (litres)

Hidden Facts

Yogurt
$2.99 / 32 oz

Yogurt

820 — Carbon emissions (kg CO_2)

1090 — Water use (litres)

Hidden Facts

Yogurt Flavored
$2.99 / 32 oz

Yogurt Flavored

820 — Carbon emissions (kg CO_2)

1090 — Water use (litres)

Hidden Facts

Milk
$3.84 / 128 oz

Oatmeal

3710 — Carbon emissions (kg CO_2)

3800 — Water use (litres)

Hidden Facts

Milk - Grassfed
$7.49 / 128 oz

Milk - Grassfed

2050 — Carbon emissions (kg CO_2)

2800 — Water use (litres)

Hidden Facts

Banana
$2.99 / lb

Banana

120 — Carbon emissions (kg CO_2)

390 — Water use (litres)

Hidden Facts

Strawberry
$2.99 / lb

Strawberry

120 — Carbon emissions (kg CO_2)

160 — Water use (litres)

Hidden Facts

Apple
$3.79 / lb

Apple

80 — Carbon emissions (kg CO_2)

320 — Water use (litres)

Hidden Facts

Avocado
$3.99 / lb

Avocado

1100 — Carbon emissions (kg CO_2)

900 — Water use (litres)

Hidden Facts

Tomato
$3.79 / lb

Tomato

110 — Carbon emissions (kg CO_2)

80 — Water use (litres)

Hidden Facts

Kiwi
$3.79 / lb

Kiwi

732 — Carbon emissions (kg CO_2)

230 — Water use (litres)

Hidden Facts

Orange
$3.79 / lb

Orange

60 — Carbon emissions (kg CO_2)

210 — Water use (litres)

Hidden Facts

Jam
$3.29 / 12 oz

Jam

380 — Carbon emissions (kg CO_2)

200 — Water use (litres)

Hidden Facts

Peanut Butter
$2.59 / 16 oz

Peanut Butter

690 — Carbon emissions (kg CO_2)

3400 — Water use (litres)

Hidden Facts

Honey
$2.49 / 12 oz

Honey

480 — Carbon emissions (kg CO_2)

10 — Water use (litres)

Hidden Facts

Roast Beef
$4.49 / 8 oz

Roast Beef

4000 — Carbon emissions (kg CO_2)

3400 — Water use (litres)

Hidden Facts

Bacon
$4.49 / 8 oz

Bacon

1240 — Carbon emissions (kg CO_2)

2200 — Water use (litres)

Hidden Facts

Chicken Breast
$6.29 / 8 oz

Chicken Breast

850 — Carbon emissions (kg CO_2)

1800 — Water use (litres)

Hidden Facts

Roast Turkey
$4.99 / 8 oz

Roast Turkey

1060 — Carbon emissions (kg CO_2)

2000 — Water use (litres)

Hidden Facts

Orange Juice
$3.99

Orange Juice

425 Carbon emissions (kg CO_2)

460 Water use (litres)

Hidden Facts

Apple Juice
$3.29

Apple Juice

234 Carbon emissions (kg CO_2)

520 Water use (litres)

Hidden Facts

Coffee
$4.99

Coffee

1140 Carbon emissions (kg CO_2)

2200 Water use (litres)

Hidden Facts

White Bread
$2.99

White Bread

380 Carbon emissions (kg CO_2)

590 Water use (litres)

Hidden Facts

Whole Wheat
$2.99

Whole Wheat

380 Carbon emissions (kg CO_2)

590 Water use (litres)

Hidden Facts

Cereal
$3.79

Cereal

700 Carbon emissions (kg CO_2)

745 Water use (litres)

Hidden Facts

Granola
$3.99

Granola

980 Carbon emissions (kg CO_2)

800 Water use (litres)

Hidden Facts

Oatmeal
$3.79

Oatmeal

220 Carbon emissions (kg CO_2)

1152 Water use (litres)

Hidden Facts

You remembered your elementary school teacher said raw food is better than the processed ones.

Hidden Facts

You just learned an idea call food carbon footpring, so you want your food to be more eco-friendly.

Hidden Facts

You just learned agriculture accounts for 70% of human water consumption so you want your food to be more eco-friendly

Hidden Facts

Try to eat more local food to avoid making more green house gas.

Hidden Facts

Come out with your regular breakfast combination.

Hidden Facts

You want to have a balanced breakfast

Hidden Facts

It is Monday morning, you need to rush to class. The breakfast should not take much time to prepare.

Hidden Facts

It is Saturday morning. You have spare time to make a good breakfast.

Hidden Facts

You rather spend money on other things and keep it minimal on food budget.

Hidden Facts

You are willing spend whatever it takes to eat more healthier.

Hidden Facts

Try to eat something more seasonal.

Hidden Facts

You are willing to try something you are not familirar with.

Hidden Facts

Appendix B. Carbon footprint of common food

Item	Carbon Emission
Tap Water (1 cup)	0.06g
Boiling water (1 quart)	70g
Apple (local / in-season)	10g
Apple (avg.)	80g
Banana (import)	80g
Orange	90g
Tea	74g
Large size Latte	343g
Strawberries (A basket)	150g
Bottle Water (500 ml)	160g
Carrots (1 kg)	300g
Beer (1 pint)	900g
Potato (1 lb)	370g
Milk (1 pint)	723g
A loaf of bread (1 kg)	800g

Item	Carbon Emission
Asparagus (A bunch)	1.9kg
Cheese Burger	2.5kg
Rice	4kg
Steak (4 oz)	2kg
Eggs (A dozen)	3.6kg
Tomatoes (in-season)	0.4kg
Tomatoes (Out-season)	50kg
Trout (1 kg)	6.9kg
Cheese (1 kg)	12kg
Lamb leg (1 kg)	17kg