I, Luying Sun, hereby submit this original work as part of the requirements for the degree of Master of Design in Design.

It is entitled:
Product + Service: The Intangible Smart in Everyday Products

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Product + Service: The Intangible Smart in Everyday Products

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Graduate School
of the University of Cincinnati
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by

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Abstract

This thesis aims to interpret the service dimension of interactive products and to develop a tool to design services for a product in the early development process. A variety of case studies were conducted to explore the service dimension and the relationship between the product and the user. Three attributes, Awareness, Feedback and Context, were developed as a Product Service Ideation Tool. In the tool evaluation study, after introducing the Nest Learning Thermostat, participants were asked to design services for a refrigerator. In the light of the study, the tool is more effective to generate ideas than random ideation. The Product Service Ideation Tool gives participants a basic understanding of service and guides them through the attributes of the relationship between the product and the user to create more advanced solutions.

Keywords: product, service, interaction, design, ideation
Acknowledgements

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1 Introduction

“There are now more computers in the world than there are people” (Lucas, Ballay, & McManus, 2012, p.2). More specifically, the computers in the form of microprocessors which are manufactured each year are more than the number of people on earth. According to Trillions, “the accurate production of the microprocessors are hard to come by, but a reasonable estimate is ten billion processors per year” (Lucas, Ballay, & McManus, 2012, p.2). But if those processors do not only exist in computers, where could they possibly go? The answer is everywhere.

Remember the appliances at home. You can control the washing machine, the microwave and the DVD player by simply press some combination of buttons. You can read the information from the thermostat, the smoke alarm and clock by looking at the digits on the screen. That’s all accomplished by the input and output of a processor. The processors are going in everyday objects; this is where the term “Ubiquitous Computing” comes from.

Within the emerging Ubiquitous Computing, the function of everyday things is changing. They are able to know you, communicate with you and serve you thoughtfully, or in one word, smart. The difference between a smart product and a stand-alone product is the smart one serves people better. It can provide people diversified services that a normal object cannot imagine.

With the interactive and information technology growing, traditional everyday objects are approaching some new challenges.

A product does not exist in isolation. Even back to 1972, a film made by Charles Ray Eames, Polaroid SX-70 (Figure 1.1) mentioned the word “system”. They talked about how this camera was in an invisible system, which is the coordination of the technology and materials. Since they would get immediate feedback through this system, it turned the user from the observer into part of the event. If the old product is in the system of technology and materials,
the new product is involved in the system of service. We can perceive the product as a touch point of a service. People enjoy the service through the smart product. It can create experience for people and make them feel special. One of the best examples is the Nest Learning Thermostat (Figure 1.2).

Nest created not only a simple round interactive thermostat, but also a service of temperature and energy management at home. People can get access to this service through the thermostat, a smartphone or any web browser, to let the system help them save energy and set the temperature by learning their life pattern. It brings people a good user experience by optimizing the installation process, providing people a user-friendly interface to control and program it anytime and anywhere. It integrates information about people and the environment to
make better decisions for the home. Conversely, it shows people how much energy they use and save by giving the visualized information back to them. “It is an innovative product surrounded by an eco-system of service and customer-friendly smarts” (Edson, 2012, p.172).

In this bigger picture of products with services, “products are part of an ever-expanding universe that emanates from the product to the context around it, and spreads from there to systems, experiences, and platforms that surround the customer and create loyalty to the brand” (Edson, 2012, p.104). Furthermore, fulfilling the customer’s needs, wants and desires will not be accomplished only by the form and function from the individual product, but also through the services around the product. Different service attributes would satisfy the different needs from the consumer on the same product. Designers coordinate all the elements in this system by zooming out for a panoramic view of the system, and zooming in to every detail in order to ensure all design elements reflect a solution to some problems.

The objective of this thesis is to interpret the service dimension of an interactive product with a systematic approach, and to develop a tool for ideation in the early service product development process.

Multiple research methods are used in this thesis. Chapter one is the introduction, which outlines the background behind the concept of “Ubiquitous Computing”, as well as the service as a wider context integrated into products. In Chapter two, various product case studies and diagrams are used to interpret what the service for a product is. Chapter three develops and evaluates a framework for service ideation by conducting case studies, a series of interviews and surveys. The Nest Learning Thermostat is the most important case study throughout this thesis. In Chapter two and Chapter three, I am trying to find out why its service is successful and how to design a service product like Nest. The development of the tool is mainly based on the research
findings from Nest and consumer interaction. Chapter four includes a conclusion, limitation, and further discussions.
2 What is the Service for A Product?

If we divide an interactive product into two categories – hardware and software – it is not difficult to recognize that the hardware is made of materials and mechanics that form the function of an object. A thermostat’s hardware is a plastic panel, a knob and some buttons. What about the software? The software in the product is shown to people as an interface or some intangible factors. As for a thermostat, the software is the changing digit on the screen. For a long time, the industrial designer worked on how to make the hardware function better for people. However, as the ubiquitous computing technology develops, the intangible factors can do more things than the physical products. Therefore, the cooperation of the hardware and software becomes the new challenge for designers.

2.1 Experience vs. Service

For an interactive product, the intangible factors have been described as “User Experience”. In Marc Hassenzahl’s study of User Experience and Experience Design, it describes how the Philips Wake-up Light (Figure 2.1) simulates sunrise to wake people naturally and labels the product as an experience design. The form of the lamp is simple, and the light bulb inside brightens gradually. It works with an app in a smart phone to set up the time and alarm music. Unlike most of the alarms that wake people suddenly, it creates a healthy and natural way for people to get up every morning. Hassenzahl said it contributes not to the aesthetics of things, but to the aesthetics of experiences. Beyond the material and function, “the experience is what is owned - an immaterial, personal story. The product is only of interest as it is identified as being
crucial in creating the experience” (Hassenzahl, 2013). The intangible factor is the experience through the product, and the story being told by the product.

From the perspective of service, the interpretation of the intangible factors is different from the experience: “A service is an activity that enhances an experience; it often requires an array of products to deliver its core activity” (Cagan & Vogel, 2012, p.8). If we explain the service of the wake up light, that would be the healthy wake-up and sleeping light control service, including the features of wake-up lighting and alarm, fall asleep dimming and bedtime routines track (Figure 2.2). This healthy wake-up and sleeping light control service enhances a natural and healthy wake-up and sleeping experience. It requires a lamp and an app to control and program to deliver the sunrise simulation activity. With the lamp as the main touch point of the service and other interaction touch points from a smart phone, the service is able to cover a wider context of waking up and sleeping.

So the difference between experience and service is that the experience emphasizes how the product tells a personal story and how the user encounters the particular product, while the service involves the product and the user into a bigger system.
2.2 Levels of service

Since the service for a product creates a bigger system, it is able to involve more stakeholders. By involving the different stakeholders, the service system can be described as three levels.

2.2.1 Level one: one-way interaction

The most common interaction between the product and the user is when the user actually utilize the product a company sold to him or her (Figure 2.3).
2.2.2 Level two: two-way interaction

However, for interactive products, the question is what role the service is. In traditional service design, “Services are the intangible means to provide value, often through activities or accommodation” (Cagan & Vogel, 2012, p262). Service design is not only focused on customers, but also on service providers and stakeholders. One important element of service design is Touch point. “Every contact point between a customer and the service provider is Touch point” (Stickdorn, 2011). Touch points can be broad and varied, such as products, interfaces, print materials, environments and people. Zooming out to see the bigger background behind the product, we can put the company and the user into one picture (Figure 2.4). The picture is a service system. No doubt, the product is the main touch point. Both the company and the user are stakeholders, which means the system should benefit both of them. On one hand, users get the full services around the product. On the other hand, the company has the access to the primary data about the user behavior once they are using the product. By means of the raw user behavior data, different departments from the company can select the one that is helpful for them to develop the next generation or other products and services.

![Figure 2.4](image-url)
2.2.3 Level three: third point of engagement

Between the company and user, there is a third point of engagement (Figure 2.5). It could be the retail, supplier, and other products from the company… On this service platform, this point can include any, or even all of them, depending on how large the system is. As they become the stakeholders of the service system, they can share the data collected from all parties, and utilize whatever is beneficial. Figures 2.6-2.8 are Nests’ point of engagement.

Figure 2.5
See what Nest and your energy provider can do together:

- **Get a Nest Thermostat**
  Your energy company wants you to have a Nest Thermostat so you can start saving energy. And money. [Learn more](#)

- **Rush Hour Rewards™**
  Nest Thermostat can help you save energy during peak hours. What's even better? Your energy company will pay for it. [Learn more](#)

- **Seasonal Savings**
  As the weather changes, Nest Thermostat can help you save by making small adjustments to the temperatures in your schedule. [Learn more](#)

- **Find your savings**
  See what programs, rebates and special savings your energy provider offers. [Learn more](#)

---

**Figure 2.6**

**Nest Certified Professionals**

Every company you see here has been trained and certified by Nest to ensure they offer the best possible service. Contact them to buy a Nest product or arrange installation.

- **Green Cincinnati Education Advocacy**
  Thermofast install $249, each add $129
  Smoke + CO Alarm basic install $129, each add $129
  [No written reviews](#)
  [2.42 Miles away](#) Cincinnati, OH 45202
  [CONTACT](#)

- **Cinema Elements**
  Thermostat basic install $249, each add $129
  Smoke + CO Alarm basic install $129, each add $129
  [No written reviews](#)
  [2.76 Miles away](#) Cincinnati, OH 45202
  [CONTACT](#)

- **SAME**
  Contact for pricing
  [No written reviews](#)
  [2.87 Miles away](#) Cincinnati, OH 45214
  [CONTACT](#)

---

**Figure 2.7**
2.3 Focus

The product service system is a zooming out concept for a panoramic view of an interactive product. By understanding the scope of the argument, this thesis focuses on the relationship between the product and user within the service system (Figure 2.9).
2.4 Case Study of Thermostats

2.4.1 Method

In analyzing the service dimension of interactive products, the approach of Moving to the Upper Right from *Creating Breakthrough Products* by Jonathan Cagan and Craig Vogel can be adapted to select competitor products: “If you look at most positioning maps, the optimum quadrant is usually the upper right, where each positioning attribute is maximized” (Cagan & Vogel, 2012, P6). The two axles are technology and style. The product is displayed relative to its competition. The Upper Right, which represents the integration of style and technology is the most successful product.

To compare the service dimension, four thermostats have been selected to fit in the Upper Right positioning map. In Figure 2.10, A is the standard thermostat that only has the basic function. B is a high-end thermostat that applies many electronic technologies. C is highly stylized. D is the Nest Learning Thermostat integrating both high style and technology.
2.4.2 **A: Standard thermostat**

The primary considerations for determining the position in the quadrant are 1) low cost and 2) easy manufacturing. If analyzing this product in terms of person and system, we can see this is a stand-alone product that only has interaction with users. Without a system as a support for better service, the basic function can be done well; however, when it comes to complex tasks, it becomes a puzzle (Figure 2.11). For instance, even though it looks simple, consumers still need a technician for installation and set-up. Usually, it can be programmed for customized purpose, but the users have to work with it as well as referring to the manual that interprets the weird engineering code. As a result, the programmable function is barely used.
2.4.3 B: High-tech thermostat

Touch screen, voice control and Wi-Fi-enabled remote control using an app identify this as a technology innovation driven product. It maximizes features but almost ignores lifestyle effects (Cagan & Vogel, 2012, P49). Unlike the previously mentioned thermostat, there is a web system to provide service that tries to cover the context around temperature control; as a result, some of them are redundant and not user-friendly. For example, there are seven types of information on a regular interface, including page labels, time and date, outdoor temperature and humidity, air conditioning status, indoor temperature and humidity, schedule status and setting temperature and buttons. Despite being the priority, it still takes more time to get the useful
information. It requires a skilled user to gain familiarity with all the manuals and then use it effectively.

2.4.4 C: Stylized thermostat

The Netatmo thermostat is a style driven product. There are no buttons on the control panel, instead, only a small display, a panel and light frame. It is a minimalist design. It would match the room where it is installed with the different color films, but it is not ergonomic. There are two numbers on the screen. People have to press the panel waiting for the changing to differentiate the indoor and setting temperature, although one is filled, the other is just outline. Based on the web system, working with a smart phone comes with more features such as remote
control, schedule and energy report. Compare to how Nest provides service, Netatmo touches some directions, but not the whole system. Besides, it was introduced two years after Nest; it followed Nest’s strategy with a variety of similar functionalities.

Figure 2.13

2.4.5 D: Nest Learning Thermostat

Nest is a combination of contemporary lifestyle and interactive technology. There are three main services that Nest provides to users: install and setup, energy saving and web system.

*Install and setup*

Rather than paying for a technician to install and setup the thermostat to the air conditioning system, Nest makes the user do it. It is packaged with everything the user needs for quick and easy installation, including a screwdriver, trim plates, wire labels and a built-in air level. As the first interaction with the product, users will make it work within 20-30 minutes.
**Energy saving**

Studies show that approximately 50 percent of energy used in the average American home comes from thermostat control. This is an opportunity Nest innovates for energy saving service. Nest developed a lot of detailed features to save energy. When users adjust the temperature, Nest informs them of how long it will take to reach that target. Instead of setting up a lower temperature to cool down the room faster, it tells the user a desired one to balance comfort and energy saving. The Nest Leaf is designed to encourage people to make energy-efficient choices. If users see a green leaf appear, they will know they are just a single degree away from energy efficiency. Activity sensors can detect whether anyone is at home. If no one is around, it will automatically turn down. Energy history and monthly energy reports give users feedback about their energy use and how Nest works during the day. In addition, Nest partners with energy providers and encourages users to sign up for Rush Hour Rewards to reduce the rush hour energy use in hot summers, which gives incentives to users and at the same time benefits energy companies.

**Web system**

Meanwhile, connecting with Wi-Fi enables remote control and programmable capability from a smart phone, tablet or computer. With a Nest account, users can control both Nest Thermostats and Smoke Detectors, and maybe other future Nest products. The Internet connection also enables the built-in software to be updated once a new one is available.

The system behind Nest integrates regulation, web systems and energy providers, which forms a full service system benefitting all stakeholders (Figure 2.14). Compared to Nest, the A thermostat is a non-service product, both the B and C thermostats can be identified as semi-service products with different incompletion.
2.5 Summary

If we take a step back to see the whole picture of a successful service product like Nest, its service system creates a wider context for more interaction and communication with the user, or in other words, promotes the relationship between the product and the user. That means its services embody the relationship between the product and the user.
3 How to Design Services for A Product?

Nest not only is an integrated product with lifestyle, ergonomics and features, but also creates a comprehensive service system to enhance the relationship between the product and the user. That means it is necessary to explore how Nest enhances the relationship and develops services for users. By rearranging Nest’s service features and analyzing other case studies, a tool for designing services for a product was developed and evaluated in this chapter.

3.1 The Product Service Ideation Tool development process

Nest has many features. In the previous chapter, the features are organized by marketing strategy, or in other words selling point, which is fully reflected on the website or any other advertisement. But in order to find out how services work between Nest and users, I probed into those features and reorganized them.

I discovered that when people are using Nest, it appears they are having a nice conversation. Firstly, they communicate with each other. Secondly, along with the interaction goes the fact that both of them know each other better. Finally, they always have a topic that both of them are interested in. Therefore, I define the service for a product as a constant dialogue between a product and users, and there are three attributes: awareness, feedback and context.

3.1.1 Awareness

As dialogue gets started, two people will introduce themselves first. Nest does the same. During the first week of use, Nest will learn how and when people adjust the temperature. After the first week, it will set the right temperature at the right time for the user. In order to be smart
at temperature, it also keeps an eye on indoor humidity and local weather. Sun Block can solve the problem that, sometimes, the sun on the thermostat will affect the accuracy of sensing the temperature. The activity sensor tells the system that the room is empty, so it is time to turn it down. In summary, in order to provide better service, Nest is aware of user lifestyle and the environment.

Nest is not the only product with awareness features. The automatic crash response from OnStar services can be alerted by sensors and open a direct connection between the vehicle and an emergency advisor, who can send help and is armed with relative information to the precise location. Simple awareness also brings people better service. Cars unlock the door when the key is approaching; the lights will turn on when people are passing by.

The longer and deeper the relationship goes, the more highly awareness increases between the two. During this time, the product will know about you, learn about you, understand you and then provide you with better service.

### 3.1.2 Feedback

The difference between monologue and dialogue is that there is an exchange of information in dialogue. For the user, the exchanged information is feedback on the service from the product. One of the feedback features Nest gives to the user is the energy report. By analyzing users’ data, the Nest Energy Report will let them know how the Nest has worked during a month, a month-to-month comparison and some different energy saving tips based on the monthly behavior. Also, the feedback data is visualized in a very user-friendly way. Nest collects data from the user, and interprets it back, which is a feedback of the energy saving service.
In addition, feedback is evidence of intangible services. The Energy Report is just one part of the energy saving service. According to Nest, the energy saving service is accomplished by a lot of small features, such as the Nest Leaf and Auto Away. They help users reduce the electric bill without them even realizing. But how does the user know all the features work effectively? They need evidence to reveal the effect of energy saving technology, which is the report. What is more, they need to know what else Nest can do for them, which is the energy saving tips.

3.1.3 Context

Think about how two good friends have a conversation. Even though the context changes, the dialogue never stops. Wherever and whenever they are, they will have something to say. This is the same in the relationship between the user and the product; no matter what situation the user deals with, the product will provide a service to solve the problem. In other words, the services can cover almost every context of using the product and make it work for people better. The way Nest does is to consider what the user needs on the timeline of using a thermostat. After the user buys a Nest, the first thing to do is to install it, and it is always an annoying task. With the trim kit, online video, and built-in air level which is described in Chapter 2, the user just needs twenty minutes to get the system working. After a week, Nest will remember the users’ life pattern and set the temperature for them. After a month, according to the usage data, Nest will generate an energy report to give energy usage feedback. When the users are on vacation, they can remote control it and make a comfortable temperature awaiting you back home. Nest not only gives the user a good first impression, but also impresses the user while moving to a new usage context, which keeps a strong emotional connection with the user all the time.
Although services are intangible, they are provided by physical products and interfaces, interacting with users in many scenarios in their lives. Hundreds of users will use it in thousands of contexts, which no one can expect. From the holistic standpoint, to cover every single aspect of a service is impossible. “However, the intention should always be to see the wider context in which a service process takes place.” (Stickdorn, & Jakob et al., 2011, P44)

3.1.4 The Product Service Ideation Tool

<table>
<thead>
<tr>
<th></th>
<th>Awareness</th>
<th>Feedback</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>What does it do?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3.1

Figure 3.1 is the first iteration of the Product Service Ideation Tool. This tool is designed for ideating service features for a product in the early stage of service product development. It will guide people who are involved in this process as they come up with valuable ideas. Also it is a benchmarking tool to analyze competitors.

3.2 The Product Service Ideation Tool evaluation process

3.2.1 Description

The goal of the study was to investigate what the difference is before and after people use this tool for ideation in the early service product process and to develop this tool in iterations.
The hypothesis is that using this tool for ideation is more effective than ideating randomly in the service product development front end. Finding out if the tool is helpful for ideation can help designers have more options to come up with and organize ideas, and analyze competitor products as a guiding benchmark.

Before this test began, I did another two tests to evaluate the tool (see Appendix A&B). But the results of those two tests did not contribute to the argument of this thesis. So based on what I learned from them, I developed a new test method.

3.2.2 Method

The overall method was a combination of quantitative and qualitative approaches. Interviews were conducted as the data collecting method. There were seven steps in this test.

Step 1. Introduce the Nest Learning Thermostat.

Inform participants the Nest Learning Thermostat is a good example of service product design and give them an overview of Nest’s function (Contemporary interpretation of temperature and energy management at home).
**Step 2. Explain what services Nest provides.**

Introduce Nest with the description in Chapter two, which is the standpoint from the marketing strategy. The description included installation and setup, energy saving and web system features. The reason was that the marketing strategy was on the official website which everyone can access. It was an object way for the participants to know about Nest and to reduce the influence of the service features from Nest on the ideation for another product.
2. What services does Nest provide?

A. Install & Setup

![Installation Trim Kit](image)

![Online Instruction Video](image)

![Connector and Air Level](image)

Figure 3.3

B. Energy Saving

![Energy Saving Features](image)

![Energy Report](image)

![Energy Partners](image)

Figure 3.4
Step 3. Pick a scenario to design a service refrigerator.

A refrigerator was selected because it is an everyday product. Each participant has interaction with it several times on a daily basis, so that they had rich experience, which can be used as insights from the fundamental research stage. That means participants can skip the research of learning about the product and the user and enter the ideation stage immediately.

Four scenarios were set for participants to choose and start a concept. They were:

- College students: Two college students share an apartment. They have different eating habits. They share some food, sometimes.
- Young couple: Both of them have fixed working times. They like to go out for fun on weekends. They like to travel.
- Big family: Mom, Dad and children live in a house. Dad works, children go to school and Mom stays at home. They like to travel on holidays.
- Old couple: They (65+) live in a house. They have trouble with dexterity. Their children and grandchildren visit them on weekends or holidays.

Scenarios were adapted; because they simulated the real design context, and helped participants focus on only one group of user. Accordingly, participants can choose one scenario they are interested in or familiar with to design the service for the refrigerator. Four scenarios were chosen in different stages in life span in order to fit for different ages of participants.

Figure 3.6

Step 4. List service features for the refrigerator.

Ask participants to think of the services this refrigerator can provide to help the users they picked in step 3. live a better life. The concept can be a product, interaction, packaging, graphic, etc. or a combination. In this step, the goal is to let them brainstorm without any limitation.
Figure 3.7

**Step 5. Use the Product Service Ideation Tool.**

Ask participants questions according to the framework to lead them to think of the services again. The questions are:

- What does it learn from you? (Awareness)
- How does it communicate with you? (Feedback)
- How does it live with you? (Context)

The Nest case study was an option in this step. If the participants don’t understand the question, the Nest case study of how Nest provides services can be an example to demonstrate. In this step, the goal is to let them ideate with the tool.
5. Introduce the Framework: How does Nest design the services?

A. How does it learn from you?

The product knows you, understands you, learn about you and be aware of you.

What does it do?  
Learns your lifestyle to adjust the home temperature automatically.

How does the fridge learn from you?

Figure 3.8

5. Introduce the Framework: How does Nest design the services?

B. How does it communicate with you?

The product collects information and gives back to users.

Give feedback to you

What does it do?  
Give you feedback about how does Nest work during the day, and how much energy you saved and why.

How does the fridge communicate with you?

Figure 3.9
Step 6. Wrap-up questions.

After the test, ask participants some questions to know about what they think of this tool and how this tool works for them. The questions are:

- What is the difference between ideating randomly and guided?
- Among awareness, feedback and context, which element of the tool do you think is the hardest to think of? Is it because of the tool or the refrigerator? Why?
- Among awareness, feedback and context, which element of the tool do you think is the easiest and why?
Step 7. Analyze results

In this test, steps 4 and 5 are the most important. Comparing the results from steps 4 and 5 will show the differences before and after participants use this tool for ideation in the early service product development stage.

3.2.3 Results

Eight people participated in this interview. Seven participants were designers and one was an engineer. The age distribution was 22 to 55, with seven people in the 22-30 year-old range. All four scenarios were chosen, three people chose College Students, two people chose Young Couple, one person chose Big Family and two people chose Old Couple.

Figure 3.11 is a diagram that includes all the insights to design services for a refrigerator. The insights were divided by scenarios. Overall, there are more insights by using the Product Service Ideation Tool than generating ideas randomly.
<table>
<thead>
<tr>
<th>Scenario 1: College Students</th>
<th>WITHOUT</th>
<th>WITH PRODUCT SERVICE IDEATION TOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two college students share an apartment.</td>
<td>- Keep record of sharing food</td>
<td>- Learn what I like and remind me to buy</td>
</tr>
<tr>
<td>They have different eating habits.</td>
<td>- Budapting</td>
<td>- Tells me when the food expires.</td>
</tr>
<tr>
<td>They share some food, sometimes.</td>
<td>- Cook instruction</td>
<td>- Health condition awareness and food suggestion</td>
</tr>
<tr>
<td></td>
<td>- Unfreeze in advance</td>
<td>- Turn it off and clean it when people are away for vacation</td>
</tr>
<tr>
<td></td>
<td>- Tells me when the food expires.</td>
<td>- Unfreeze and ready to be cooked before I get home</td>
</tr>
<tr>
<td></td>
<td>- Odor detection</td>
<td>- Catalog activity</td>
</tr>
<tr>
<td></td>
<td>- Inventory</td>
<td>- Tells me that’s a nut for vegetarian</td>
</tr>
<tr>
<td></td>
<td>- A database linked with calendar</td>
<td>- Tell just me my food is dead</td>
</tr>
<tr>
<td></td>
<td>- Automatic spaces divide</td>
<td>- Inventory</td>
</tr>
<tr>
<td></td>
<td>- Nutrition facts</td>
<td>- Nutrition facts</td>
</tr>
<tr>
<td></td>
<td>- Learn what I like and remind me to buy</td>
<td>- For particular lifestyle (lose weight), it can inform how to use the space to maximize it</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Can find cheaper prices at local grocery store</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Tells me where the food is on the bacteria activity spectrum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Know what it looks inside when the door is close</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Nutrient detection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario 2: Young Couple</th>
<th>WITHOUT</th>
<th>WITH PRODUCT SERVICE IDEATION TOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both of them have fixed working time.</td>
<td>- Bacteria detection</td>
<td>- Cooking suggestion for dying food</td>
</tr>
<tr>
<td>They like to go out for fun on weekends.</td>
<td>- Food remaining monitor</td>
<td>- Knows about the user’s health condition and offer the food to be healthier</td>
</tr>
<tr>
<td>They like to travel.</td>
<td>- Shopping recommendations</td>
<td>- Be aware of the expire date and reminds me before it</td>
</tr>
<tr>
<td></td>
<td>- A database linked with calendar</td>
<td>- Count how much calorie/vitamin etc. I take for this meal</td>
</tr>
<tr>
<td></td>
<td>- Remote control temperature</td>
<td>- Gives me the information of season food, when it is ready</td>
</tr>
<tr>
<td></td>
<td>- Tells me when the food expires.</td>
<td>- Cooking suggestion.</td>
</tr>
<tr>
<td></td>
<td>- Prepare ingredient</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Tells me the nutrition facts of the food</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Travel mode, remote control</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Tells me when the food is out of food</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Gives me suggestions for what meal to make based on what’s in there</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Want to eat something that has 100 calories, gives me suggestions based on what’s in there</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Light up the suggestion food</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Tells me I should close the door</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Teach me to be healthier</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Learn the buying habits and tell me when I can re-stock</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- A chart to show how healthy we are as a family</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Know about how much I waste when I throw it away</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Don’t have what I need to make cookies right now? Tell me yes or no</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Suggesting of recipe</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario 3: Big Family</th>
<th>WITHOUT</th>
<th>WITH PRODUCT SERVICE IDEATION TOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mom, Dad and children live in a house.</td>
<td>- Nutrition suggestion</td>
<td>- Know their lifestyle: times of opening the fridge door</td>
</tr>
<tr>
<td>Dad works, children go to school and Mom stays at home.</td>
<td>- Highlight difference spaces to store food</td>
<td>- Automatically adjust the temperature based on what’s in there</td>
</tr>
<tr>
<td>They like to travel on holidays.</td>
<td>- Tell you when things get expired or mold</td>
<td>- Collect the shopping list information</td>
</tr>
<tr>
<td></td>
<td>- Adjust the temperature according to the amount of food</td>
<td>- Make a reminder before generating the shopping list</td>
</tr>
<tr>
<td></td>
<td>- Label shelves</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Door close signal indicator</td>
<td>- Energy saving</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario 4: Old Couple</th>
<th>WITHOUT</th>
<th>WITH PRODUCT SERVICE IDEATION TOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>They live in a house.</td>
<td>- Remote control: old people forget things</td>
<td></td>
</tr>
<tr>
<td>They have trouble with disability.</td>
<td>- The expired food</td>
<td>- Let the users know the storage for grocery shopping</td>
</tr>
<tr>
<td>Their children and grandchildren visit them on weekends or holidays.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3.11

32
3.2.4 Discussion

The differences of ideation between with and without Product Service Ideation Tool

According to the results from the interview, I found that there are four differences. First, random ideation is a traditional way of brainstorming individually. Ideas were generated spontaneously and bounced over. With the tool categorized thinking direction, however, participants felt guided and inspired. Some new ideas were generated when they were using the Product Service Ideation Tool. Figure 3.12 shows the different ideas from one participant. The highlighted parts are new ideas.

![Table](Image)

<table>
<thead>
<tr>
<th>WITHOUT</th>
<th>WITH PRODUCT SERVICE IDEATION TOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Awareness</strong></td>
<td>- Turn it off and clean it when people are away for vacation</td>
</tr>
<tr>
<td></td>
<td>- Unfreeze and ready to be cooked before I get home</td>
</tr>
<tr>
<td></td>
<td>- Catalog activity</td>
</tr>
<tr>
<td></td>
<td>- Inventory</td>
</tr>
<tr>
<td><strong>Feedback</strong></td>
<td>- Nutrition facts</td>
</tr>
<tr>
<td></td>
<td>- For particular lifestyle lose weight; I can inform how to use the</td>
</tr>
<tr>
<td></td>
<td>space to maximize it</td>
</tr>
<tr>
<td></td>
<td>- Can find cheaper prices at local grocery store</td>
</tr>
<tr>
<td><strong>Context</strong></td>
<td>- A task for my food</td>
</tr>
<tr>
<td></td>
<td>- Text to fridge to know the food I need to buy when I'm shopping</td>
</tr>
<tr>
<td></td>
<td>- Use my account to login different fridges and get data back</td>
</tr>
<tr>
<td></td>
<td>- Create your own profile to customize what I like</td>
</tr>
</tbody>
</table>

Second, the ideas generated by using the Product Service Ideation Tool were more detailed. One reason is that using the tool is the second round of ideation; participants had a chance to rethink the same problem using the guided elements. For example, in figure 3.13, the participant expanded the original idea in the WITHOUT column and developed more detailed ideas in the WITH column. One participant used a metaphor to describe the other reason: “The three elements were like lenses. Once people think of solutions from one element, they put on the pair of glasses and look at the refrigerator from that perspective.” That meant participants thought deeper about the same problem.
Third, without knowing about how I developed the tool, participants responded saying the tool was more streamlined with the relationship between the user and the refrigerator. Participants ideated randomly based on their own past or current dissatisfied experience of using a refrigerator. When they are using the tool, questions such as “How do I use a refrigerator?” and “What is the refrigerator supposed to do for me?” were brought up. Meanwhile, this response confirmed the three attributes: Awareness, Feedback and Context set up the relationship between the user and the product.

**Awareness or Feedback?**

When participants were thinking under Awareness, two questions were addressed: 1. What can the refrigerator learn about my food and me? 2. What can it do for me after learning about my food and me? Figure 3.14 shows the participants’ answers to these two questions. We can see that not every one of the answers to questions 1 can have a solution for question 2. For example, in scenario 4: Old Couple, one idea was to know about how many times they open the refrigerator’s door. In this participant’s opinion, this could be useful information to know about their lifestyle, but he could not find a way to utilize it. What is more, question 2’s answers
overlapped with the Feedback. The idea about food expiration appeared in both Awareness and Feedback. It was because participants hoped the refrigerator could detect bacteria activity, but they were not sure that informing the users of the dying food was doing something for the user or giving the user feedback. From my perspective, both Awareness and Feedback collect users’ data; the difference depends on how the product processes the data. If the product just informs the user of the data, the feature belongs to the Feedback. If the product takes action based on the collected data, the feature fits in the Awareness. In the refrigerator’s case, it depends on how the refrigerator processes the data of bacteria activity. If it sends the user a notification or shows the user a graph of the food status, it is a Feedback feature. If it throws the bad food away, it is an Awareness feature. This issue helped the distinction between the definition of the Awareness and the Feedback.

Figure 3.14

**Feedback – over service**
Two participants had trouble finding service features in feedback. “Leave me alone” was their first reaction when they heard the word feedback. They said, “I have had a lot of notifications on my phone, if I have more from each of the appliances, I will be overwhelmed.” Also, “I know it was there, if I need it I will check it, but there is no need to remind me all the time that the product has this function.” In a word, they wanted a “silent service,” but it does not mean the feedback should not exist. Instead of accepting all the information, the user should take the initiative. For the service refrigerator, it gives the user the option to use the feedback service or not. The users will not be disturbed, but they can check the information whenever they want.

**Context – contribute to service levels**

In chapter 2, the level of service was discussed. There are three levels of service: one-way interaction of the product and the user, two-way interaction within the service system and the third point of engagement involving stakeholders of the service. Most of the concepts were in the range of the second level. However, some of the concepts in the Context touched the third level. Figure 3.15 is a service timeline the last participants generated. They associated with the local grocery store and community to provide better service. As the several iterations of the research method and the Product Service Ideation Tool, this participant came up with a product service system with the thinking from the first interaction to being part of the lifestyle. The system also contained the Awareness and Feedback features. Even though it was an initial idea, it expanded the context by touching the third level to provide a comprehensive service solution.
How to use the Product Service Ideation Tool in ideation

The study showed the Product Service Ideation Tool is an effective way to generate a greater number of service concepts for a product. But it cannot replace the random ideation approach. Random ideation as a warm-up focuses on touching every aspect of possible solutions. Following with random ideation, the tool can stimulate idea generation by service thinking. The tool helped participants extend and add to ideas from the relationship between the product and the user. Several rounds of both ideations can be conducted to maximize both the quantity and the quality of ideas.
4 Conclusion

Great products and services are the foundation of success at Nest. With the application of ubiquitous computing, the intangible factors of interactive products like the Nest Learning Thermostat have the opportunity to involve the product and the user in a system to deliver better service. The service connects small pieces together into a comprehensive offering. The service system can be associated with the user, the product, the company and even the third parties like retailers and suppliers.

By probing into the interconnection between the product and the user, three service attributes: Awareness, Feedback and Context were found from several current successful interactive products. Like a dialogue, the product and the user are aware of each other and exchange information in a cohesive context. Based on that, the Product Service Ideation Tool gives participants a basic understanding of service, and guides them through the attributes of the relationship between the product and the user to generate a higher number of more sophisticated solutions. During the evaluation process, there were four iterations of the tool (Figure 4.1). Explaining the three attributes was the biggest challenge and the methods used evolved from words, to statements and finally to questions. Through the interactions and tests, it was concluded that posing questions was the most effective means to communicate and inspire the participants.
Furthermore, the participants can be any stakeholders within the same service system. With the Product Service Ideation Tool, each of the stakeholders will consider how the system serves them and the user from their perspective i.e., gathering creative ideas from different angles on the same service level has the opportunity to provide a comprehensive service system.

**Further study**

Nest has been in the market for only two years. An interesting issue to keep focusing on is to study the impact of Nest’s products and services. Will it empower the user, trigger the “leave-them-alone” feedback, fulfill or frustrate the user?
Also this thesis topic is happening in real time. During the one-year research, some more products are integrating different services. Continuing to use the example of thermostats, after Nest had a big impact on the thermostat market, Honeywell developed a new round thermostat (Figure 4.2) based on the classic one (Figure 4.3: The Round T86 thermostat designed by Henry Dreyfuss). This new thermostat has more service features trying to move to the Upper Right quadrant as well. Understanding the current situation of service levels, mapping out the emerging products and services will be helpful for finding new value opportunity spaces.

Figure 4.2

Figure 4.3
Bibliography:


- Stickdorn, M., Jakob, S & the co-authors (2011). This is Service Design Thinking. Hoboken, N.J.: John Wiley
Appendices

Appendix A  Product Service Ideation Tool Evaluation Process 1.0 - Part One

*Hypothesis*

An air purifier could be designed to product service by integrating a system that develops an interactive dialogue between the product and users.

*Description*

Why did I select an air purifier?

• Keep consistency of Nest: air product

![Thermostat](image1.png) ![Air purifier](image2.png)

Warm / Cool Clean / Dirty

Figure A-1

• Consumer trends: health care
• Add value: lack of Intelligent and competitive service product in the market
Methods

1. Design services (Figure A-7 - A-14) for an air purifier using the Product Service Ideation Tool.

<table>
<thead>
<tr>
<th></th>
<th>Awareness</th>
<th>Feedback</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>What does it do?</td>
<td>DEF</td>
<td>BCG</td>
<td>AH</td>
</tr>
</tbody>
</table>

2. Introduce all service features to participants.

A. Remote control
   - Connect with smart phone or tablet by Internet.
   - Remote control the air purifier whenever and wherever the users are.

B. Indoor air quality
   - Know about the air quality visually.
   - Know about the working efficiency of the air purifier.
   - Automatically start working when the air is very bad.

C. Outdoor air quality
• Work with the weather station and know about the air quality in the city.

• Provide a trend to show what the air is in a few hours.

D. Communicate with the user about the window

• Set by zip code and know about the air quality around the house.

• Not only purify the indoor air quality, but also bring in natural air.

E. Light aware

• Turn to quiet mode when sensing the dark by the light sensor on the top of the product.

F. Learn about you

• Customized service

• Set up for what the users need.

• Alert the user or start working automatically when detecting allergens.

G. Filter status

• Show the users each filter’s status, and give the user a real feedback of which one need to change or clean.

H. Interactive manual

• Show the user how to use the air purifier with online videos

3. Ask participants to select and rank the service features they like.

4. Compare the differences between the service features selected by Chinese and American participants.
Figure A-6

Figure A-7
B  Indoor air quality

Figure A-8

C  Outdoor air quality

Figure A-9
D  Communicate with the window

Time to open the window!

Don't open the window!

set by zip code

Figure A-10

E  Light aware

Figure A-11
Figure A-12

Figure A-13
**Results**

Twenty samples, ten for American market and ten for Chinese market.
Appendix B  Product Service Ideation Tool Evaluation Process 1.0 - Part Two

**Hypothesis**

Using the Product Service Ideation Tool to integrate services into a product is more efficient than not using it.

**Method**

The participants who are designers would keep doing the second part of the test. After the first part of the test, participants had a general idea of the services for a product. Then ask the participants to pick one product based on their design experience or they are familiar with to integrate services without and with the Product Service Ideation Tool.

**Results**

The products participants selected: Home Dialysis Pump, Garage Door, Mobile Hard Drive, Closet, Microwave, Sound Bite 2.0, Coffee Maker, Refrigerator and Pill Box.

<table>
<thead>
<tr>
<th><strong>Home Dialysis Pump</strong></th>
<th>Awareness</th>
<th>Feedback</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>What does it do?</td>
<td>Awareness of dirty blood</td>
<td>Monitor eating habits to recognize how often or when to clean blood</td>
<td>Pump speed control Blood temperature</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Garage Door</strong></th>
<th>Awareness</th>
<th>Feedback</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>What does it do?</td>
<td>Awareness of people moving</td>
<td>The status of the door Whether need to charge</td>
<td>Become a home door with different ways of opening</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Mobile Hard Drive</strong></th>
<th>Awareness</th>
<th>Feedback</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>What does it do?</td>
<td>Sync to the Cloud</td>
<td>Projector and touch control</td>
<td>Wireless sharing the files</td>
</tr>
<tr>
<td><strong>Closet</strong></td>
<td>Awareness</td>
<td>Feedback</td>
<td>Context</td>
</tr>
<tr>
<td>------------</td>
<td>-----------</td>
<td>----------</td>
<td>---------</td>
</tr>
<tr>
<td>What does it do?</td>
<td>Awareness of the number of clothes, buying date and the tag information</td>
<td>Where the clothes are</td>
<td>Automatically fold, compress and pass the clothes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Microwave</strong></th>
<th>Awareness</th>
<th>Feedback</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>What does it do?</td>
<td>Adjust heating time based on the weight of the food</td>
<td>If there is something dangerous inside</td>
<td>Cooking suggestions</td>
</tr>
<tr>
<td></td>
<td>Temperature test</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Sound Bite 2.0</strong></th>
<th>Awareness</th>
<th>Feedback</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>What does it do?</td>
<td>Visually display relevant data for personal/professional monitoring</td>
<td>Users can adjust and mix their own sound tracks</td>
<td>Highly personalized to fit. Almost hidden to prevent stigmatization</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Coffee Maker</strong></th>
<th>Awareness</th>
<th>Feedback</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>What does it do?</td>
<td>Start making coffee after the alarm</td>
<td>The users’ coffee drinking habits</td>
<td>Connect with smart phone</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Refrigerator</strong></th>
<th>Awareness</th>
<th>Feedback</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>What does it do?</td>
<td>Visualization of food freshness</td>
<td>Send notification of dying food</td>
<td>Tell the users about the instruction like a Siri</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Pill Box</strong></th>
<th>Awareness</th>
<th>Feedback</th>
<th>Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>What does it do?</td>
<td>Pill name, instruction and amount. Reminder of taking pills</td>
<td>Time to refill The effect of the medicine</td>
<td>Can contact with doctors Real-time update</td>
</tr>
</tbody>
</table>