

**PRODUCT REDESIGN ON THE BASIS OF FUNDAMENTAL HUMAN  
NEEDS BY APPLICATION OF CONTRARY THINKING**

by

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Design activity is a process of discovering and solving problems. From the past to the present, designers have already come up with various approaches for research, analysis, ideation development, sketches, model building and final showcasing. Behind all these design behaviors, design thinking is always guiding and supporting them. Like Herbert Simon in his book *The Sciences of the Artificial* stated:

Unlike analytical thinking, design thinking is a creative process based around the “building up” of ideas. There are no judgments early on in design thinking. Outside the box thinking is encouraged in these earlier processes since this can often lead to creative solutions. An example of a design thinking process could have seven stages: define, research, ideate, prototype, choose, implement, and learn. Within these seven steps, problems can be framed, the right questions can be asked, more ideas can be created, and the best answers can be chosen. The steps are not linear; they can occur simultaneously and can be repeated (Herbert A. Simon, 1969).

In general, why you are designing, what you are designing and how to design are three basic starting points. To clear the mind before starting, the designer needs to choose and try

different combinations based on these three points. This thesis will demonstrate one combination, which is of “Fundamental Human Needs,” “Redesign” and “Contrary thinking.” Fundamental human needs, according to *Human Scale Development*, “seen as ontological stemming from the condition of being human, are few, finite and classifiable. They are also constant through all human cultures and across historical time periods. What changes over time and between cultures are the strategies by which these needs are satisfied” (Max-Neef, 1989). To fulfill these common needs, redesign is an important design direction. The behavior of redesign reminds us that there is no perfect design but always room for improvement. There are plenty of existing product designs based on fundamental human needs, and they still need to be redesigned in order to serve users better and make people’s life more convenient and comfortable. What is the design approach? Contrary thinking is an effective approach that has been used in many other areas successfully for problem solving, but it has not been summarized and developed into a more systematic form. Thus, this thesis will demonstrate and introduce a guideline of the application of contrary thinking, to solve problems and to improve quality of concept generation for product redesign based on fundamental human needs.

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# Chapter 1

## INTRODUCTION

### 1.1 Problem Statement

Our needs are various and numerous. The responsibility of design is to create and improve our products to satisfy needs that rely on material objects to be the intermediary. To understand the relationship between human and product is important and not difficult. We want to sit while we are working in an office, so therefore we need a chair and desk, or we do not want to spend too much time while we are traveling so we need vehicle and public transportation. Thus, product design guarantees the quality of satisfaction of human needs.

When people use a product, it means they will use it to help them satisfy some kind of need. When we consider society, there are many common needs. Culture, location, or generation will not change them. Examples include those such as lovers wanting to stay together a longer time, which is based on mental needs, or not wanting to grab things with difficulty, which is based on physical needs. These needs can be summarized and classified into “Fundamental Human Needs.” Fundamental human needs do not change; however, what is changing is that numerous different products have been designed to help people fulfill these needs. From product and design side of view, these needs arise from and after when a product is being used. It is different from the situation when a person from an underdeveloped civilization does not know or need a product, which is before a product is being used. When we review all these products, we can find that some of them are useful, comfortable and safe, but some of them do not perform well or contain potential danger. Designers still have problems coming up with the right product design based on fundamental human needs.



Common needs cause a desire for redesign. “The term ‘re-design’ includes this theme of society’s commonly shared and recognized objects or issues. Establishing daily products as the project’s theme is not some novel idea but is the most natural, appropriate method for reexamining the concept of design, because design deals with our common, shared values” (Kenya Hara, 2007). Nowadays, many companies and designers focus on developing new functions of product to attract customers and occupy the high-tech product market. However, to redesign products that seem pretty “normal’ in our daily life is also essential and valuable. It will refresh our conventional way of thinking.

## 1.2 Need for Study

Contrary thinking is a way of problem-solving thinking. The difference between it and other thinking approaches is that it will lead people to think in an opposite way toward a different, creative thinking mode. People usually solve problem through forward direction, but sometimes it works, sometimes it does not. There are plenty of examples among different fields of study telling us that applying backward thinking, or reverse thinking on certain issues, can cause unexpected effects. This approach has been used in business investment and operation, scientific problem solving, and manufacturing processes. It also has been used in product design and has brought us many impressive design ideas.

Here are two examples. The first one is MUJI’s famous redesign product: toilet paper. At first look, they just redesigned the tube of toilet paper and turned it from a column to a cuboid. However the design thinking is from a conventional side of view: column tube is easier for dragging the paper out of the tube; but from a new sustainability side of view, the cuboid tube can prevent people from using too much paper, which also reminds people not to waste resources and protect the environment that humans rely on for survival.

The second one is MUJI’S signage system for a local clinic. Instead of applying conventional thought by designing dark color signage to cover the dirt and make everything look clean, the designer intended to use pure white signage to remind people to the contrary

that everyone should have self-conscious awareness to keep this public space clean, for other people. In this case, contrary thinking design changes user's behavior from passivity into initiative.

From these two instances, we can realize that contrary thinking not only helps designer jumping out of the box to build creative design thinking and achieve a refreshing design, but also leads to a design emphasis on Human- Environmental friendly circumstances. In general, contrary thinking is a good thinking approach and it is worthy for study and application in the domain of product design.

### 1.3 Objectives of Study

The objectives of this study are to demonstrate the detailed targets of this article based on the whole process of development thinking:

- To study connections between fundamental human needs and product design.
- To study the necessity of redesign for the product design field.
- To collect design product cases based on fundamental human needs.
- To study the application of contrary thinking in design area and other fields.
- To collect product redesign cases based on fundamental human needs.
- To analyze the problem in the products we already have and see how people improve them or still have problems to solve.
- To summarize a design approach of contrary thinking applied in product redesign on the basis of fundamental human needs.
- To finally use these guidelines to design two projects in order to prove this approaches.
- To collect design cases, analyze them, and summarize the way contrary thinking is applied by designers.
- To collect products designed based on fundamental human needs and analyze good design and bad design.
- Analyze problems in the products we already have and see how people improve them or still have problems to solve.
- Develop guidelines of contrary thinking approaches applied in redesign on the basis of fundamental human needs
- Finally, reinforce these guidelines to design several projects.

## **1.4 Definitions of Terms**

### **1.4.1 Product Design**

Product design is the process of creating a new product. It is a very broad concept and is effective in the generation and development of ideas through a process that leads to new products. Product design has recently become a broad term inclusive of service, software, and physical product design. Other aspects of product design include engineering design, particularly when matters of functionality or utility (e.g. problem-solving) are at issue, though such boundaries are not always clear.

### **1.4.2 Design Thinking**

As a style of thinking, design thinking is generally considered the ability to combine empathy for the context of a problem, creativity in the generation of insights and solutions, and rationality to analyze and fit solutions to the context. While design thinking has become part of the popular lexicon in contemporary design and engineering practice, as well as business and management, its broader use in describing a particular style of creative thinking-in-action is having an increasing influence on twenty-first century education across disciplines.

### **1.4.3 Creative Thinking**

Creative thinking is specific thought processes that improve the ability to be creative. These thoughts processes include being in an optimal state of mind for generating new ideas, and thinking deliberately in ways that improve the likelihood of new thoughts occurring. It is to maximize the ability of the brain to think of new ideas. It is the ability to think of original, diverse and elaborate ideas. It is a series of mental actions that produce changes and developments of thought. It is the process of exploring multiple avenues of actions or thoughts.

#### **1.4.4 Fundamental Human Needs**

Fundamental human needs are most basic needs of human. They are few, finite and classifiable (as distinct from the conventional notion of conventional economic “wants” that are infinite and insatiable). They are also constant through all human cultures and across historical time periods. What changes over time and between cultures are the strategies by which these needs are satisfied.

#### **1.4.5 Satisfiers**

Satisfiers are things that can contribute simultaneously to the satisfaction of different needs or, conversely, a need may require various satisfiers in order to be met. Not even these relations are fixed. They may vary according to time, place and circumstance. All needs satisfied can be classified into different categories of Fundamental Human Needs.

#### **1.4.6 Redesign**

Redesign is any or all stages in the design process repeated at any time before, during, or after production. Redesign as discussed in this article focus on the time period after production. It refers to a redoing of the design of ordinary objects. It is an experiment, an attempt to look at familiar things as if it were our very first encounter with them. Re-design is a means by which to correct and renew our feelings about the essence of design, hidden within the fascinating environment of an object that is so overly familiar to us that we can no longer see it.

#### **1.4.7 Contrary Thinking**

Contrary thinking, also called reverse thinking, is a creative way of thinking. It usually will break with traditional opinion or go in an opposite way of general thinking. People develop familiar ways to solve problems, but contrary thinking will teach thinking in a different way, even a opposite way.

#### **1.4.8 Exformation**

Exformation is an opposite concept of “information.” Our lives are full of wonders and the unknown; thus people need constantly to wake up their fresh feelings.

#### **1.4.9 Disadvantage Manipulation**

Designers use one or several relatively disadvantaged features in a product to achieve better design.

#### **1.4.10 Function Transfer**

In this process, the designer transfers a certain function from a part of product to another part of the same product, or between a set of products that are usually used together. During this process, parts of the product or one of set of products can be abandoned or added.

#### **1.4.11 Human Physical Needs**

Needs related to human ergonomics and completion of actions are satisfied by using a product. Usually these needs are necessary and basic ones for a functional product.

#### **1.4.12 Human Mental Needs**

Needs which are beyond needs satisfied by products’ basic functions are needed to improve product value and better serve user at a higher level.

#### **1.4.13 Human Interaction Needs**

Needs related with interaction among humans and their environments are satisfied by using products.

## 1.5 Assumptions

Assumptions are factors that this study uses to support the need for research and further investigation. This study was conducted based on the following assumptions:

- Design thinking need to be developed and strengthened. Designer always need to come up with more creative design thinking to improve their designs.
- Contrary thinking is welcome and popular. It has been applied widely in business and other fields. Designer will need this creative thinking during many phrases of design thinking or action.
- Contrary thinking has many subcategories and can be classified into a systematic approach.
- Fundamental Human Needs theory is reliable and applicable. All design activities serve and satisfy these basic needs. Some of them are directly connected to those needs, but some of them are not. Those indirect designs rely on features to enhance satisfiers that can be classified into fundamental human needs.
- The design process can be simplified by classifying certain target human needs and then creating further design approaches.
- Redesign activities happen in many phases of the design process. But focusing on redesigning products in our daily living life to make user's lives become much more comfortable and easier is meaningful and valuable.

## 1.6 Scope and Limits

### 1.6.1 Scope

This study was conducted based on the following scope:

- Contrary thinking will be systematically analyzed and reclassified into a design approach. Cases studies will be included and a detailed application of the process will be introduced specifically. This approach has been proved and applied widely into business problem solving, and several product cases also have combined this thinking into its design thinking. This thinking is valuable and it should receive more attention.
- Fundamental Human Needs theory, presented in the book *Development and Human Needs*, discusses the relationship between basic needs, satisfiers and economic products. In order to apply this theory into product design area, the needs mentioned in the book need to be reclassified to be used specifically for designers. This study phase will be combined with contrary thinking to become a more detailed design approach.
- Redesign can be redefined into a concept focusing on redesigning the products appearing in our daily lives. New functional products, or conceptual product may divert people's attention, but it is the normal and usual ones that change and improve our lives. This world is filled with creative, fresh and difference-seeking desires. It is natural, but when we transfer these desires to redesigning a product, we can find more surprises.

### 1.6.2 Limitations

The limitations imposed on developing and completing the researches are as follows:

- Contrary thinking itself has a limitation of application scope. It is not omnipotent thinking and it cannot be used successfully in every situation and circumstance. In the formal part of this article, there will be a discussion about its range of application.



- Only two approaches of the several mentioned in this study can be illustrated by the final product.

## 1.7 Procedure and Methodology

This research is intended to develop the design-thinking approach for product redesign based on fundamental human needs and contrary thinking with the following steps and methodology:

### Step 1. Research and analysis to three key words

- Collect material and information from books, articles, websites and all other resources about contrary thinking, fundamental human needs and product redesign.
- Study and analyze all the collected information.
- Develop the general idea of design approach from the aspects of function, range, benefit and disadvantage of these three key words.

### Step 2. Product design cases collection and study

- Collect product design cases relating to the three key words.
- Study cases to summarize how contrary thinking applies in product design.
- Study cases to summarize how fundamental human needs are satisfied in product design.
- Study cases to summarize how redesign works in product design.
- Summarize the connections among the cases from each key word.

### Step 3. Development of final design approach

- Reclassify necessary concepts of each key word into specific categories to support the whole approach usage process.
- Develop a flow chart to explain the detailed process of using the final design approach.

**Step 4.** Two final product designs

- Use two subcategory approaches under contrary thinking to test the design approach.

## Chapter 2

### LITERATURE REVIEW

#### 2.1 Design for Meeting Human Needs

Everyday, we are surrounded by large numbers of products. Products exist for helping users save time and resource, moving and producing faster, or getting better results. Here is a very simple question, but we always ask: why do we need products? Many reasons can be cited, but the most fundamental one is that human have needs.

##### 2.1.1 Human Needs for Product

Human needs must be satisfied in every aspect but not all by material goods. Some needs could be satisfied without material product, such as needs of family or needs of rights. Some needs rely on one or several intermediaries, like products, to be satisfied, such as needs of furniture for living or needs of signs for guiding. However, the values of products are great, essential and indispensable. Just like Roozenburg and J.Eekels said, “A product is a material system, which is made by people for its properties. Because of these properties it can fulfill one or more functions. By fulfilling functions a product satisfies needs, and this gives people the possibility to realize one or more values” (N.F.M. Roozenburg & J.Eekels, 1991)

From a macroscopic point of view, every product has been designed before manufacturing and sale. Design activities are important processes to satisfy needs of humans by which designers combine creative and practical thinking into material objects. Vello and Diefra (1984) stated through the proper combination of elements, the designer ensures performance, achieves visual appeal and provides good value. To meet people’s needs is of the utmost importance. They also stated that evidence also seems to indicate that the reasons

for designing were very much the same as they are today. Either the designer believed the solution was a necessity (survival), or he or she believed the solution would improve quality of life (Vello & Diefra, 1984). That is why product design as problem solving is one of the very necessary and important activities to human from past to present. “As more of our basic needs are met, we increasingly expect sophisticated experiences that are emotionally satisfying and meaningful” (Tim Brown, 2008).

### **2.1.2 Human Needs for Good Design**

Though every product is a result of a complex design process, not all of them are doing well at serving human needs. Having good design thinking and approaches during the whole design process can help designers be more productive and creative. Vello and Diefra (1984) stated that to design is to orient oneself to a problem. This involves gathering proper information, observing basic function and utility, considering human factors, and selecting suitable structure, form, materials and methods (p.4). Figure 2.1 shows the general flow chart of the design process. Before the designing phase, what kind of design thinking or plan decides the project is going to a successful future design direction or a bad one? In Figure 2.1 we can see that “Special Resources” and “Considerations” are these two important phases. “Special resources” are usually objective situations, such as time, money and equipment, which most of time the designer does not have much choice. Luckily, what designer can control is the “Considerations” phase, which is where design thinking features such as human factors, visual appeal, and marketing. While many similar design process prototypes have been developed to provide a basic concept for designers, a more detailed and guiding approach should be created for “Considerations” to conduct design thinking.

To further explore the “Considerations” phase, questions about what kind of features a good design product has should be offered firstly. In the book *Less and More: The Design Ethos of Dieter Rams*, authors Klaus Klemp and Keiko Ueki-Polet (2011) introduced what Dieter Rams has offered as his celebrated 10 Principles of “Good Design”:

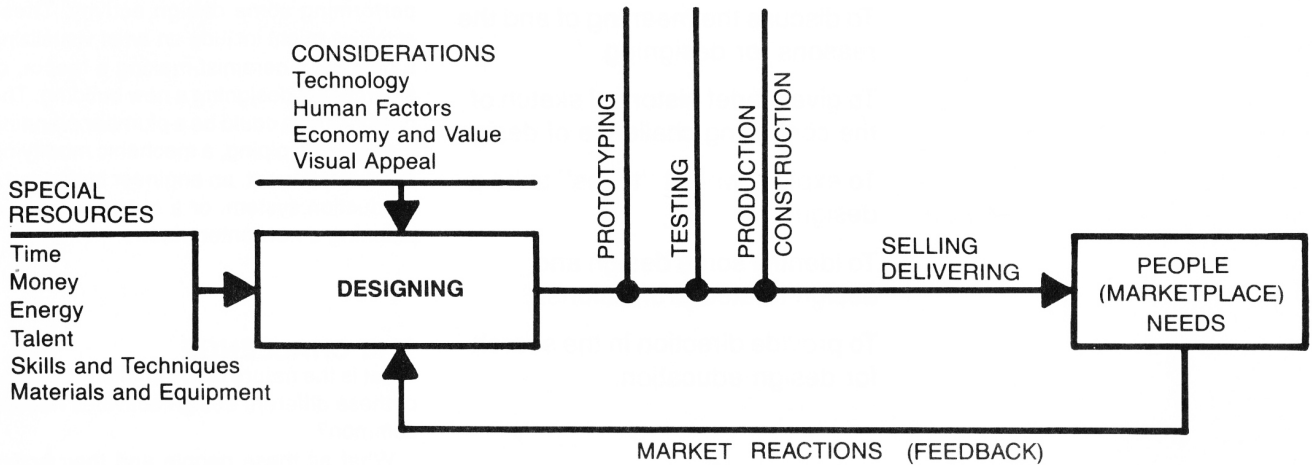


Figure 2.1: *The Design Process Serves People's Needs*. Adapted from Focus On Design (p.4), by Vello Hubel, & Diedra B. Lussow, 1984, New York, NY: McGraw Hill Ryerson Limited. Copyright 1984 by McGraw Hill Ryerson Limited.

- Good Design Is Innovative: The possibilities for innovation are not, by any means, exhausted. Technological development is always offering new opportunities for innovative design. But innovative design develops in tandem with innovative technology, and can never be an end in itself.
- Good Design Makes a Product Useful: A product is bought to be used. It has to satisfy certain criteria, not only functional but also psychological and aesthetic. Good design emphasizes the usefulness of a product while disregarding anything that could possibly detract from it.
- Good Design Is Aesthetic: The aesthetic quality of a product is integral to its usefulness because products are used every day and have an effect on people and their well-being. Only well-executed objects can be beautiful.
- Good Design Makes A Product Understandable: It clarifies the product's structure. Better still, it can make the product clearly express its function by making use of the user's intuition. At best, it is self-explanatory.

- Good Design Is Unobtrusive: Products fulfilling a purpose are like tools. They are neither decorative objects nor works of art. Their design should therefore be both neutral and restrained, to leave room for the users self-expression.
- Good Design Is Honest: It does not make a product more innovative, powerful or valuable than it really is. It does not attempt to manipulate the consumer with promises that cannot be kept.
- Good Design Is Long-lasting: It avoids being fashionable and therefore never appears antiquated. Unlike fashionable design, it lasts many years even in todays throwaway society.
- Good Design Is Thorough Down to the Last Detail: Nothing must be arbitrary or left to chance. Care and accuracy in the design process show respect towards the consumer.
- Good Design Is Environmentally Friendly: Design makes an important contribution to the preservation of the environment. It conserves resources and minimizes physical and visual pollution throughout the lifecycle of the product.
- Good Design Is as Little Design as Possible: Less, but better. Because it concentrates on the essential aspects, and the products are not burdened with non-essentials. Back to purity, back to simplicity.

These ten principles are well-known theory and summarize good design features that should be conveyed in a good product. Among those ten features, “useful” is every essential one. If a product only has a good outlook but has no useful function, it should be categorized into artwork. However when we start to think further about the other features, we still generally are staying at a concept and abstract principle level, considering them as design guiding. They can inspire and remind designers of some key points of design, but not specifically instruct the designer in how to think. In other words, behind each of those ten

features, there are thousands of sub-features that can be described into these ten. You may realize that words, such as innovation, are relative not absolute. If designers try to figure out designs utilizing these ten abstract principles directly, they will have a feeling of good design, but that feeling still can be ambiguous. Having an intuition of how to design well is very important, but deep thinking is logic and methods. “As a style of thinking, design thinking is generally considered the ability to combine empathy for the context of a problem, creativity in the generation of insights and solutions, and rationality to analyze and fit solutions to the context” (Wikipedia: Design Thinking, 2012) We need a more specific design guideline to help designers in inspiring idea generation.

Where is the point to start for that guideline? In an interview with Tim Brown, who is the CEO of the Palo Alto-based design and innovation firm IDEO, Dr. Saj-nicole Joni (2010) pointed out that significantly changed constraints create many new needs. Brown stated that designers need to “figure out what they are and how to serve them. Don’t assume that the proposition that you’ve been out in the market with before, the one that sells today, is going to be there in the future. To take this approach you need to get out into the world of those you serve and study constraints and people, looking for changes in need and behavior.” Here, we come back to the very beginning of this chapter, that the goal of all the design activities is to satisfy our human needs. “Design thinking is a different way of approaching the big challenges we face. It starts off with really trying to serve people’s needs. It connects constraints with creativity, enabling us to look at old problems with new eyes and generate new possibilities” (Saj-nicole Joni, 2010).

## **2.2 Goal: Fundamental Human Needs**

Since we are ultimately designing for human needs after all, to figure out what those are, or how to consider human needs, is quite necessary. But, it seems quite obvious that everyone knows what needs they have, from the basic ones such as the need to drink water and eat food, to varying ones depending on different persons such as the need to see a movie



and join a party. Because those needs are specific and differ depending on different people, many traditional academic studies regard human needs as infinite, changing, and various. While this idea makes sense on some level, it is not accurate.

### **2.2.1 Traditional Classification of Human Needs**

Human needs can be classified, and some basic, unchanging needs exist. From the past to present, many scholars have been trying to find a good way to demonstrate principles and theories of classifying human needs. Among them, the famous Maslow's hierarchy of needs theory (1943) classifies human needs into five hierarchical levels: Physiological, Safety, Love/Belonging, Esteem, and Self-actualization, shown in Figure 2.2.

- **Physiological**

Physiological needs are the physical requirements for human survival. If these requirements are not met, the human body cannot function properly and will ultimately fail. Physiological needs are thought to be the most important; they should be met first. Air, water, and food are metabolic requirements for survival in all animals, including humans. Clothing and shelter provide necessary protection from the elements. While maintaining an adequate birth rate shapes the intensity of the human sexual instinct, sexual competition may also shape said instinct.

- **Safety**

With physical needs relatively satisfied, the individual's safety needs take precedence and dominate behavior. In the absence of physical safety, due to war, natural disaster, family violence, childhood abuse, etc., people may (re-) experience post-traumatic stress disorder or transgenerational trauma. In the absence of economic safety due to economic crises and lack of work opportunities, these safety needs manifest themselves in ways such as a preference for job security, grievance procedures for protecting the individual from unilateral authority, savings accounts, insurance policies, reasonable

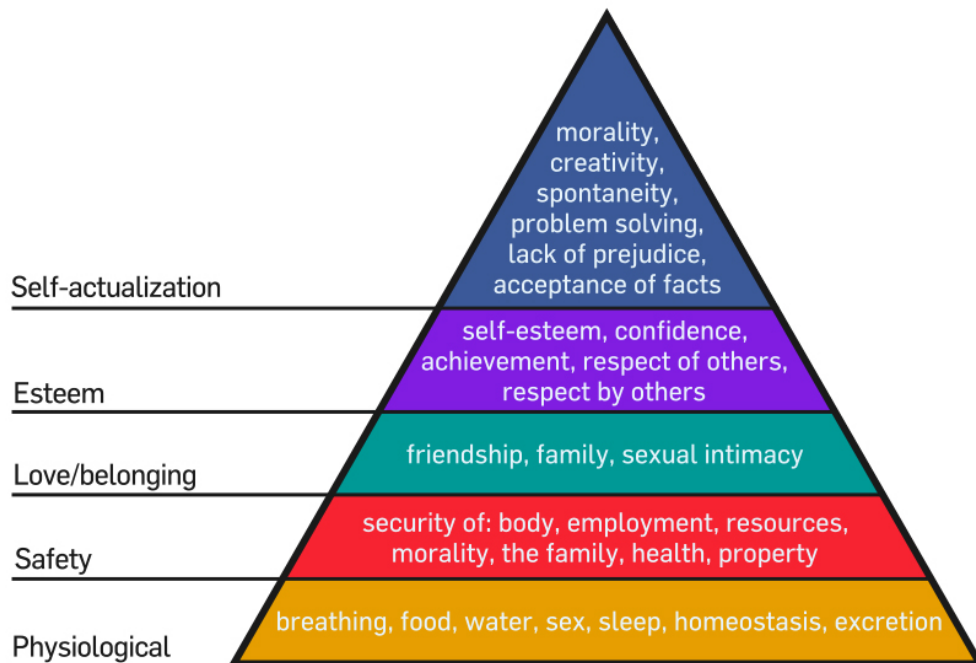


Figure 2.2: *Maslow's Hierarchy of Needs*. Adapted from Maslow's hierarchy of needs, In Wikipedia, n.d., Retrieved from [http://en.wikipedia.org/wiki/Maslow's\\_hierarchy\\_of\\_needs](http://en.wikipedia.org/wiki/Maslow's_hierarchy_of_needs).

disability accommodations, etc. This level is more likely to be found in children because they generally have a greater need to feel safe. Safety and security needs include personal security, financial security, health and well-being, and safety net against accidents/illness and their adverse impacts.

- Love and belonging

After physiological and safety needs are fulfilled, the third level of human needs is interpersonal and involves feelings of belongingness. This need is especially strong in childhood and can override the need for safety as witnessed in children who cling to abusive parents. Deficiencies within this level of Maslow's hierarchy due to hospitalization, neglect, shunning, ostracism, etc. can impact the individual's ability to form and maintain emotionally significant relationships in general, such as friendship, intimacy, and family.

- Esteem

All humans have a need to feel respected; this includes the need to have self-esteem and self-respect. Esteem presents the typical human desire to be accepted and valued by others. People often engage in a profession or hobby to gain recognition. These activities give the person a sense of contribution or value. Low self-esteem or an inferiority complex may result from imbalances during this level in the hierarchy. People with low self-esteem often need respect from others; they may feel the need to seek fame or glory. However, fame or glory will not help the person build their self-esteem until they accept who they are internally. Psychological imbalances such as depression can hinder the person from obtaining a higher level of self-esteem or self-respect.

- Self-actualization

This level of need refers to what a person's full potential is and the realization of that potential. Individuals may perceive or focus on this need very specifically. For example, one individual may have the strong desire to become an ideal parent. In another, the desire may be expressed athletically. For others, it may be expressed in paintings, pictures, or inventions.

However, much criticism regarding this pyramid have been offered. In what follows are some negative arguments towards this hierarchy of needs theory.

In their extensive review of research based on Maslow's theory, Wahba and Bridwell found little evidence for the ranking of needs that Maslow described or for the existence of a definite hierarchy at all (Wahba & Bridwell, 1976).

The order in which the hierarchy is arranged (with self-actualization described as the highest need) has been criticized as being ethnocentric by Geert Hofstede (1984). Maslow's hierarchy of needs fails to illustrate and expand upon the difference between the social and intellectual needs of those raised in individualistic societies and

those raised in collectivist societies. The needs and drives of those in individualistic societies tend to be more self-centered than those in collectivist societies, focusing on improvement of the self, with self-actualization being the apex of self-improvement. In collectivist societies, the needs of acceptance and community will outweigh the needs for freedom and individuality (Cianci & Gambrel, 2003). The term "Self-actualization" may not universally convey Maslow's observations; this motivation refers to focusing on becoming the best person that one can possibly strive for in the service of both the self and others. Maslow's term of self-actualization might not properly portray the full extent of this level; quite often, when a person is at the level of self-actualization, much of what they accomplish in general may benefit others or, "the greater self" (as cited in Wikipedia: Maslow's hierarchy of needs, 2013).

Thus, although Maslow's hierarchy of needs theory reigns as a very popular framework in sociology research and secondary and postsecondary psychology instruction, it has largely been supplanted by attachment theory in graduate and clinical psychology and psychiatry (Van Ijzendoorn MH & Sagi-Schwartz A, 2008). In addition, many uncertain factors can make Maslow's hierarchy of needs theory unreliable.

For instance, "security of body" in figure 2.2, classified into "Safety," is not convincing. If we consider "Safety" from the perspective of every people, we can summarize that there are three general categorizes: Physical Safety, Mental Safety, and Property Safety. Leaving aside the last two, if people cannot prevent physical damage, there is a significant chance of losing life, and that should belong to basic human needs. It is the same reason that makes "health" belong to "Safety" category. Also, "problem solving," which belongs in the last hierarchy of needs in figure 2.2, is not convincing neither. Problem solving ability is a big and abstract concept. You can say people need to figure out how to play a game, which is not very urgent or a basic need. But if people need to solve a problem when they are facing danger that can threaten their lives, is "problem solving" ability not a basic need for humans? The answer is obviously not.

In general, due to the way that Maslow's hierarchy of needs lacks universality and accuracy at several points, it cannot be a reliable theory to support a guideline utilizing design thinking to develop products.

### **2.2.2 Fundamental Needs and Satisfier**

Another way of classifying human needs has been created by Artur Manfred Max Neef, who is a Chilean economist and environmentalist known mainly for his human development model based on fundamental human needs. In his article "Human Scale Development," author Max-Neef (1989) points out that some needs of human which can be classified are very basic and constant with regardless of culture, age, time and other elements, and these needs can be called Fundamental Human Needs.

"Traditional ways to see needs of human are not quite accurate. For example, some theory points out that differences between culture, ages, gender, history period, location should be considered into human needs satisfy process because of that needs of human are different and changing" (Max-Neef, 1989). Compared to the traditional point of view, Max-Neef (1989) states that Fundamental Human needs (FHN) are constant and classifiable. "They are the same in all cultures and in all historical periods. What changes, both over time and through cultures, is the way or the means by which the needs are satisfied." The reason that it is easy to become confused about this concept is because we lack the ability to notice the difference between needs and satisfiers of those needs. Max-Neef points out that "A prevalent shortcoming in the existing literature and discussions about human needs is that the fundamental difference between needs and satisfiers of those needs is either not made explicit or is overlooked" (1989). Max-Neef brings up the important term "satisfier," which will be discussed later in the text. For example, "From the classification proposed, it follows that, food and shelter, for example, must not be seen as needs but as satisfiers of the fundamental need for Subsistence" (1989). Figure 2.3 shows nine categories of fundamental human needs according to Max-Neef.



Figure 2.3: *Fundamental Human Needs* by Max-Neef. Adapted from So, what do you do?, by Jay Tompt, 2012. Retrieved from <https://www.transitionnetwork.org/stories/jay-tompt/2012-11/so-what-do-you-do>. Copyright 2013 by Transition Network.

Further in figure 2.4, human needs have been classified according to axiological categories and existential categories, which are two ways to describe fundamental human needs. Max-Neef believes that traditionally people think that human needs tend to be infinite and changing all the time, and that they are also influenced by different cultural, environmental and historical times; however, human needs have special basic natural properties. There are ways to summarize fundamental human needs without concerning any other features of outside influence.

Furthermore, Max-Neef also gives a term to all the sub-level needs, which are the needs we discuss in further detail, called “Satisfier.” Our needs all can be classified into fundamental needs, and our needs can be satisfied in order to fulfill the very basic needs. The relation between satisfier and fundamental human needs are interactive, without a one-to-one correspondence. “For example, a mother breastfeeding her baby is simultaneously satisfying the infant’s needs for Subsistence, Protection, Affection and Identity.” (Max-Neef, 1989)

Needs according to existential categories Needs according to axiological categories	BEING	HAVING	DOING	INTERACTING
SUBSISTENCE	physical and mental health	food, shelter, work	feed, clothe, rest, work	living environment, social setting
PROTECTION	care, adaptability, autonomy	social security, health systems,	cooperate, plan, take care of, help	social environment, dwelling
AFFECTION	respect, sense of humour, generosity, sensuality	friendships, family, relationships with nature	share, take care of, make love, express emotions	privacy, intimate spaces of togetherness
UNDERSTANDING	critical capacity, curiosity, intuition	literature, teachers, policies, educational	analyse, study, meditate, investigate,	schools, families, universities, communities,
PARTICIPATION	receptiveness, dedication, sense of humour	responsibilities, duties, work, rights	cooperate, dissent, express opinions	associations, parties, churches, neighborhoods
IDLENESS	imagination, tranquility, spontaneity	games, parties, peace of mind	day-dream, remember, relax, have fun	landscapes, intimate spaces, places to be alone
CREATION	imagination, boldness, inventiveness, curiosity	abilities, skills, work, techniques	invent, build, design, work, compose, interpret	spaces for expression, workshops, audiences
IDENTITY	sense of belonging, self-esteem, consistency	language, religions, work, customs, values, norms	get to know oneself, grow, commit oneself	places one belongs to, everyday settings
FREEDOM	autonomy, passion, self-esteem, open-mindedness	equal rights	dissent, choose, run risks, develop awareness	temporal spatial

Figure 2.4: *Max-Neef's Matrix of Needs and Satisfiers*, (p. 32). Adapted from Human Scale Development, by Max-Neef, 1989. Copyright 1989 by Max-Neef.

But it should be clarified that satisfiers are abstract, such as privacy, physical health and work. They are intermediaries between Fundamental Human Needs and Products. “Economic goods are objects or artifacts which affect the efficiency of a satisfier, thus altering the threshold of actualization of a need, either in a positive or negative sense.” (Max-Neef, 1989) In other words, we develop our creative thoughts and ideas into products in order to fulfill one or several satisfiers for Fundamental Human Needs. “It is the satisfiers which define the prevailing mode that a culture or a society ascribes to needs. Satisfiers are not the available economic goods. They are related instead to everything which, by virtue of representing forms of Being, Having, Doing and Interacting, contributes to the actualization of human needs” (Max-Neef, 1989).

Thus, from the definition of fundamental human needs, it can be concluded that it is a useful approach and set of categories to understand and summarize human’s sub-needs (satisfiers) into the very basic level, which is valuable and helpful in assisting other fields to complete further research.

### **2.2.3 Needs, Satisfier and Product**

Products, which also can be called economic goods, are independent from satisfier and needs, according to Max-Neef’s statement that Satisfiers are not the available economic goods. “They are related instead to everything which, by virtue of representing forms of Being, Having, Doing and Interacting, contributes to the actualization of human needs” (1989). Then, what should products be considered as? Max-Neef also points out that the way in which needs are expressed through satisfiers varies according to historical periods and cultures. Social and economic relations, defined by historical and cultural circumstances, are concerned both with the subjective and the objective. Hence, satisfiers are what render needs into historical and cultural, and economic goods that are their material manifestation.

“On this basis, we can think of viable ways to organize and distribute the satisfiers and goods so that they nurture the process of actualizing needs and reduce the possibilities of



frustration” (Max-Neef, 1989). From an opposite way, different products can convey features that enhance all the necessary satisfiers to meet certain human needs. And it is not a one-to-one correspondence between products and satisfiers; the same is true of needs and satisfiers. One product can enhance several satisfiers, and the same satisfier can appear in different products or features in a product, which is an interrelated relationship. So certain special resources and considerations in figure 2.1 are the ones which can determine what kind of satisfiers will be needed in a certain design project. “A satisfier is in an ultimate sense the way in which a need is expressed, goods are in a strict sense the means by which individuals will empower the satisfiers to meet their needs” (Max-Neef, 1989).



Figure 2.5: Connections Between Need, Satisfier and Product

Thus, the importance of how a product performs at completing this whole satisfying process is obvious. “Considered that economic goods are objects or artifacts which affect

the efficiency of a satisfier, thus altering the threshold of actualization of a need, either in a positive or negative sense” (Max-Neef, 1989). Nobody needs negative actualizations, so that Max also said “in a critical theory of society, it is not sufficient to specify the predominant satisfiers and economic goods produced within that society. They must be understood as products which are the result of historical factors and, consequently, liable to change. Thus, it is necessary to retrace the process of reflection and creation that conditions the interaction between needs, satisfiers and economic goods” (1989).

To develop a direct relation between needs and products will allow development of a discipline of product design thinking that better enhances any required satisfier in design projects.

## **2.3 Target: Redesign of Everyday Products**

### **2.3.1 “Exformation” and “Normal”**

Now we understand that design exists for human needs. But what kind of products should we focus on? Or what kind of design can better benefit human’s daily life?

The term “Exformation” was offered by Kenya Hara who is a famous a Japanese graphic designer and curator in his lecture at CAFA ART INFO, and he has worked as art director of Muji since 2001. As introduced by Kenya Hara (2012), Ex-formation, opposite to the familiar information, means exploration of the unknown. Kenya also points out that actually, our lives are full of wonders and the unknown; thus people need to constantly awake their novel feelings. “Known, Understood” is a horrible concept which means your works has nothing new. To succeed, one has to look for the unknown consciously (as cited in Sue Wang, 2011).

Also, the book *Super Normal: Sensation of The Ordinary* by Naoto Fukasawa and Jasper Morrison (2008), proposes a new term called “normal,” which is very similar to “exformation” theory. They all encourage designers to rethink products around and appearing in our lives, just as Naoto (2008) said: “I believe it’s re-realizing something that you already knew, re-acknowledging what you naturally thought was good in something.” In their “Super Normal”

exhibition, Naoto and Jasper collected many daily objects recognized as super normal that “becomes evidence, testifying to thoughtful and deliberate design beyond pathos and the modernistic masquerade” (2008).

### 2.3.2 Redesign

If saying “exformation” and “normal” can allow people to notice products around them, then “redesign” is the process to discover hidden creative design points in each product.

Based on exformation theory, “Redesign” can be a good tool to excavate surprises in “normal product.” Hara (2007) stated:

Redesign refers to a redoing of the design of ordinary objects. You could call it an experiment, an attempt to look at familiar things as if it were our very first encounter with them. Redesign is a means by which to correct and renew our feelings about the essence of design, hidden within the fascinating environment of an object that is so overly familiar to us that we can no longer see it.

Redesign itself requires improvement and creativity. In order to better satisfy our fundamental needs, redesign can give designers a good perspective way to observing design targets, to think differently.

Also, common needs require redesign. The book *Designing Design* (Hara, 2007) points out “The term ‘re-design’ includes this theme of society’s commonly shared and recognized objects or issues. Establishing daily products as the projects theme is not some novel idea but is the most natural, appropriate method for reexamining the concept of design, because design deals with our common, shared values.” In this book, Hara introduces an exhibition he produced named “RE-DESIGN: Daily Products of the 21st Century.” Many famous redesigned product, as will be shown later in a formal context, such as toilet paper, exit/entry stamps, and matches were exhibited to people in that show. These designs can give people different experiences of ordinary things and demonstrate how creative and fresh feelings are obtained from ordinary product redesigns.

Redesign conveys a message that our product always can do better to serve people. Good expected quality of redesign results all depend on good design approaches and design thinking. They can make problems easier to solve and lead our design to be more convincing, reliable and creative.

## **2.4 Approach: Contrary Thinking**

### **2.4.1 Intro to Contrary Thinking: Simplification**

Before we dig into design thinking to explore a good design approach, we should ask why design sometimes is difficult.

In the book *Design Methods*, author Christopher Jones discussed three points about problem solving:

1. There are often long periods when the person who is about to make an original work appears to do nothing but take in information, work rather fruitlessly at seemingly trivial aspects of the problem, or give his attention to unrelated matters. This is known as ‘incubation.’

2. The solution to a difficult problem, or the occurrence of an original idea, will often come all of a sudden (the leap of insight) and will take the form of a dramatic change in the way in which the problem is perceived (a change of set). The effect of this transformation is often to turn a complicated problem into a simple one.

3. The enemies of originality are mental rigidity (Broadbent 1966b) and wishful thinking. These are evident when a person acts either in a far more regular way than the situation demands or else is incapable of perceiving the external realities that make his ideas unfeasible (J.Christopher Jones, 1992).

First of all, he pointed out an initial fact at the beginning of solving problems: there is too much information the designer is required to consume, and too long a time the designer is required to spend to do so. Secondly, he believed that turning complicated problems into simple ones could be a key approach to redirect the whole process a positive direction.

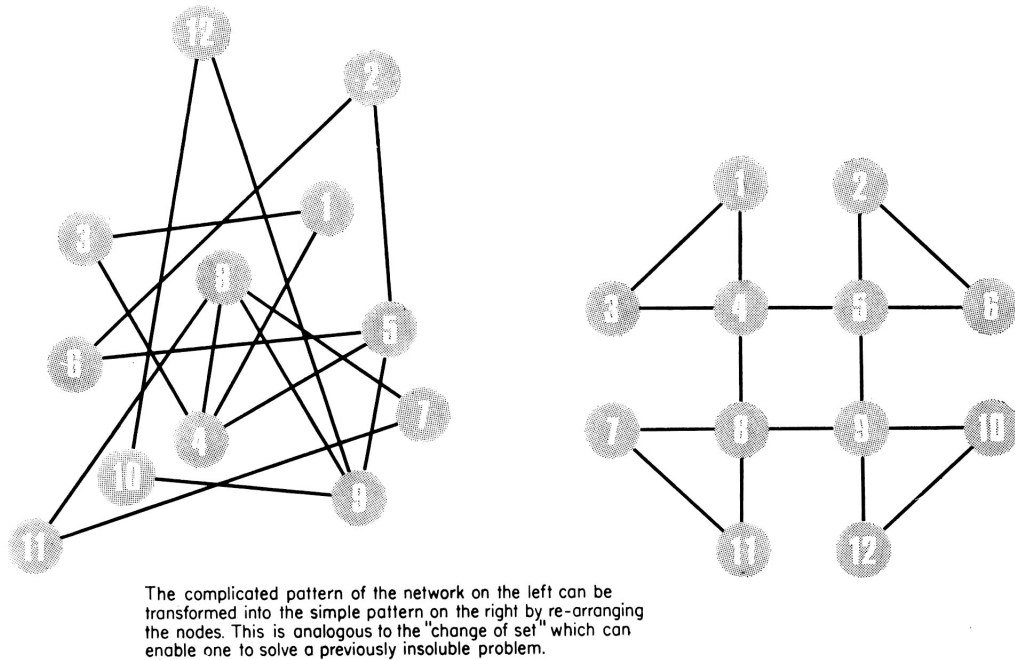


Figure 2.6: *Thoughts Simplification*, (p. 29). Adapted from *Design Methods*, by J. Christopher Jones, 1922. New York, NY: Van Nostrand Reinhold. Copyright 1970 by John Chris Jones.

Lastly, he makes us realize that our mind will easily be rigid or hold more expectations than realistic without fully understanding realities, which may result in unfeasible ideas. And these properties will limit our creativity.

The process of simplicity will inspire the designer to think differently, to be creative. "This recoding, or restructuring, process depends upon the use of a pattern which brings crucial aspects to the fore. Transformation of this pattern, in order to overcome difficulties and to resolve conflicts, depends, in this turn, upon two things: firstly, extensive and immediate knowledge of the sensitivity of the problem situation to major changes in design and secondly, freedom from either personal or social constraints upon unconventional thought and action" (Jones, 1992).

In general, before any design activities start, the designer should be very clear on three main problems: What is being designed, what the goal is, and what approach should be used. From the previous discussion, "Fundamental Human Needs" is an ultimate objective

for designer to work better an order to achieve them. “Redesign” is premium design’s target in order to satisfy our needs. Thus, we need a good design approach to support the entire design process. To conquer problems and conflicts, the designer always needs to have an innovative thinking approach to simplify problems.

Just like Wason and Johnson (1968) said, “A problem arises when a living creature has a goal but does not know how this goal is to be reached. Whenever one cannot go from the given situation to the desired situation simply by action, then there has to be resource to thinking.” But luckily, we know that “From these conclusions about creative thinking, we can infer that the main principle in dealing with complicated problems is to transform them into simple ones” (J.Christopher Jones, 1992), as can figure 2.6.

#### **2.4.2 Contrary Thinking in Different Area**

Contrary thinking, also called reverse thinking, has been proven to be an effective and creative thinking approach. People are used to thinking and acting in habitual ways when thinking and searching for answers. But sometimes if we change our target or analyze problems in a different way, backward conclusions, or thinking backwards and back from the known conditions to the solution, might simplify the problem. And the final product we design can be impressive and clever.

Contrary thinking operates through and gains powerful value from this thought process. “Contrary thinking is a deliberate shaking of the mind back and forth, reversing and reaffirming plausible views to separate out the non-essential much as the gold panner shakes out unwanted pebbles. It is worth the effort because it frees the mind of at least certain kinds of misconceptions that show their inconsistencies under dialectic analysis” (Bradbury, 2007).

Contrary thinking has been used in many different fields. For example, an article named “Contrary Thinking (Action)” on the website *Recovery Today Online*, states that “an interesting phrase that is used in recovery circles is contrary thinking or contrary action. What it usually means is when the alcoholic is thinking or wanting to do a certain thing, that person

should pause and then go in the opposite direction” (Reverend Leo Booth, 2011). This is a usage of contrary thinking in alcoholism control.

Another example shows contrary thinking has been used in business. In the book “Rediscovering the Wheel: Contrary Thinking and Investment Strategy, which writes about the formulation of a contrary thinking strategy. “The most primitive formulation of a contrary thinking stock-market strategy would be to keep tabs on what the small investor is thinking and doing and then study to think and do the opposite. If that were all there was to it this book could end right here, and this may be the most convincing explanation of why no one to my knowledge has yet written any kind of detailed study dealing with contrary thinking approaches: In earlier times, when the stock market was primarily influenced by emotional and uninformed small investors, every professional worth his salt knew enough to take the opposite side of the little fellow who was obviously acting foolishly. No one would bother to write much less to read a book telling one nothing more than that” (Bradbury, 2007).

A business story mentioned in the book *Contrary Thinking In Marketing*, people also successfully use contrary thinking to be winners in Sales Competition. “United States has a tomato sauce which compared with similar products; its concentration is too high. It is so thick that many housewives always feel inconvenient when they use it. The market outlook of this kind of sauce is not promising. Initially, the company would like to redevelop recipe to reduce the concentration and reproduce, but then they find it very difficult and the risk is big. However, they believe that the shortness of the product is in fact its advantages. Because high concentrations indicate the tomato sauce has more ingredients, less water, the nutrient is richer, and it has more pure taste. So, they took efforts to make this view separate among market. Soon this sauce arrives at the top of market comparing to other similar products” (Hu, 2007).

The examples mentioned above give us a good vision about the potential power of contrary thinking. It also has been used in product design. However there is no detailed

study about contrary thinking in the design area. Does this approach have value to be applied in product design?

There are some existing cases showing contrary thinking has been used in design field, for example, in MUJI's redesigned product: toilet paper. They redesigned the tube of toilet paper and turned it from column to cuboid. The thinking behind this design is that a column tube is easier for dragging the paper out of the tube, which is conventional. But from a new sustainability side of view, the cuboid tube can prevent people from using too much paper, which will further remind us not to waste of resources and protect the environment.

During the process of product design thinking, the designer needs to adopt unconventional opinion to create better solutions. In this way, different structures, functions, materials and other attitudes can be combined into products. For the designer, contrary thinking can result in with many unexpected creative inspiration. "Contrary thinking and action is suggesting that we don't follow the old pattern, we move away from the old tapes that have been playing in our heads for years...and go in a contrary direction" (Reverend Leo Booth, 2011). Also like Bradbury(2007) said, "Contrary thinking, by itself, is neither a synthesis nor a strategy, but it is both synthetic and strategic in its problem-solving approach. As an exercise in disciplined skepticism it pushes the mind toward disbelief while restraining it this side of inactivity; the only purpose of the decision- making process, after all, is to make decisions."

### **2.4.3 Principles of Contrary Thinking**

In the article "Contrary Thinking: Letting You See Further" (2010, January 7), the author demonstrated that contrary thinking has six forms of application and two specific approaches.

Six Forms of Contrary Thinking:

- Contrary Principle: Usage of scientific principles.
- Contrary Function: Usage of function reverse.



- Contrary Structure: Usage of structure reverse.
- Contrary Attribute: Usage of material attribute in an opposite way.
- Contrary Process: Usage of an opposite way of habitual direction of process.
- Contrary Opinion: Usage of an opposite way of conventional perspective or comments.

Two Functions of Contrary Thinking:

- Intrinsic Analysis: Analyze the basic features of the problem to create a new approach from a different perspective.
- Disadvantage Manipulation: Using shortcomings of objects to create a new approach.

In order to better understand how exactly these approaches work, three examples can be provided:

First, in history Galileo Galilei was requested by a doctor to invent the thermometer. After several failed experiments, when he was teaching an experimental class he noticed that changing the temperature of water can change its volume. Suddenly he realized that by observing volume of water, people can tell the temperature of water. This is a case of the principle of contrary application.

The second example illustrates the function of contrary thinking. We all know that wind blown fires tend to become larger, especially when a fire is already burning strong, while in certain circumstances, portable pneumatic fire extinguisher will use strong winds to dilute oxygen, which also can extinguish fire.

The last example is about the application of contrary structure. In Japan, there was a housewife who always became frustrated because every time when she fried fish, it became stuck onto the pan. She started to wonder if there was any way to heat from the top instead of the bottom. After several experiments, she finally invented a pan with a heater in the lid, which became a very popular product.

More cases about the application of contrary thinking exist, but only cases related to product have been provided here for further discussion. These cases have given us a very specific understanding about what is contrary thinking and how it works in our lives. What should be noticed is that some of the products are invented, which is not the analysis target of this article, and some of them are redesigned product, which is the target and thus will be analyzed for further development of our approach.

Another way of classifying contrary thinking, which is specifically based on product design, developed in the journal *Contrary Thinking*, asserts that contrary thinking usually works in three aspects:

- Reversed Thinking

The Reversed Thinking approach is to think from the opposite direction of habitual thinking to observe things that are already known, which creates inventive thinking. It usually opposes things in ways of object's function, structure, reasoning and other aspects.

- Converted Thinking

The Converted Thinking approach encourages people to observe things at a different angles to replace the source of the current problem, moving attention to another target, when the normal approach does not work.

- Disadvantage Manipulation

Disadvantage Manipulation is using flaws and shortcomings to recreate them to be an advantage and benefit in problem solving.

Commonalities can be found in the following ways of classification:

- Both classifications mention “Disadvantage Manipulation”.
- “Converted Thinking” in the second classification is similar to “intrinsic analysis” in the first classification, which are both explain by thinking back to the basic level

to re-analyze the problem and create a new approach. But the description of those approaches are both too abstract. It is still ambiguous how this thinking exactly works. Further definition or description of this approach should be developed.

A very important difference exists in these two classifications: both classifications mentioned the feature reversing application, but the first one regards it as the form of approach, and the second one regard it as an independent approach.

Which approach is more accurate? In the above redesigned product example about the Japanese housewife moving the heat function from bottom to top of the pan. In form, “contrary structure” feature is fully shown in this design change. But this thinking process also belongs to the application of “converted thinking” because the housewife actually thinks back to the question of which direction of heat will not cause fish to stick to pan.

Following the brief analysis, many product redesign cases to support “disadvantage manipulation” and “converted thinking” will be analyzed detail in chapter four. Many of these cases have been redesigned to a reversed form, such as dark color to white color, stable to unstable, and not like to like. However very few product redesign cases have been found to only support “reversed thinking” as an approach.

Thus, according to these two classification examples, the contrary thinking approach applied to product design basically will contain “disadvantage manipulation” and “converted thinking,” although further definitions of these two are necessary. And “reversed thinking” will be regarded as a form of contrary thinking but not an approach of contrary thinking applied in product redesign.

#### **2.4.4 The Value of Contrary Thinking**

To apply contrary thinking into product design idea generation process can inspire designers to come up with more design features and make their design more creative and interesting. There is no need to worried that this kind of contrary design will go out of tolerance of product basic function without a leash, because all design by contrary thinking will

be guided under fundamental human needs. So that this combination of contrary thinking and fundamental human needs will create a innovative idea generation approach within a guiding, and they will lead designer to brainstorm a little bit more logically, but still have the same creative effect on idea generation.

#### **2.4.5 Limitations of Contrary Thinking**

Bradbury, in his book *Rediscovering The Wheel: Contrary thinking and Investment Strategy* (2007) mentioned that “contrary thinking does not solve the information problem by enabling us to cope with more variables, but it does, by allowing us to examine the problems and the approaches to them in different lights, help us to avoid waste motion and to concentrate our efforts in the areas we pick out for ourselves as being most profitable to study. Our judgment will still be faulty, but if we continue to identify and criticize the theses we are using, we should, in the slow learning process, come to eliminate some, improve others, and discover new ones more suitable to work with” (Bradbury, 2007).

At the same time when we realize contrary thinking conveys great creative thinking, we should also notice that none of these approaches are omnipotent. “The contrary theory is a way of thinking, but let’s not overweigh it. It is more of an antidote to general forecasting than a system for forecasting. It is a thinking tool, not a crystal ball” (Hu, 2007). This is important to warn us that contrary thinking, or any kind of approaches, should be applied under a certain range of situations. Chapter 6 will provide the scope and limitations of the final guideline specifically.

### **2.5 Conclusion: Studying Goal of Thesis**

In summary, although contrary thinking has been used in product design, and several principles of contrary thinking have been created; there are no extensive research and systematic guidelines supporting this valuable approach. There is not a clear connection from what is missing to how designers apply this. Thus, based on the theory of fundamental

human needs and satisfiers, contrary thinking can be used to lead designer to figure out how to trade-off one or several satisfiers in the simplified process of product design for the basic needs.

Many articles and books have mentioned research about human needs in psychology and anthropology, about contrary thinking in business market or investment, and about innovation thinking in product design approaches. But very few of them have researched very deeply into the application of contrary thinking based on fundamental needs in product redesign. In other words, by combining contrary thinking, fundamental human needs and redesign, these three key words, this article will demonstrate a design guideline with certain limitations, worthwhile to research more deeply, detailed, and systematically in this wide product design world.

## Chapter 3

### DESIGN APPROACH DEVELOPMENT BASE ON FUNDAMENTAL HUMAN NEEDS AND PRODUCT DESIGN

Designers may or may not notice that during the beginning research phase of the very classic design process, we are trying to figure out why we are designing, either for an existing product with flaws or for a problem, which needs a product to solve it. And that question will further lead us to a more basic one, which is what specific needs of users can be satisfied by this product. During this whole thinking process, some designers will perform a deep analysis before they get involved into further design, but some of them will only have a superficial idea and keep on doing their next step of design. Just like Albert Einstein said, “the world as we have created it is a process of our thinking. It cannot be changed without changing our thinking.” Product is a combination of art and science, which is actually as complex as other scientific study outcome. To make a good product requires product designers to adjust their thinking and provide the right direction to guide their creative decision in any phase of design. Thus, at the beginning of all phases, knowing what needs we are designing for is very basic and essential. “The challenge to all of us is to internalize an approach to development based on human needs which, once understood, will guide our actions and expectations” (Max-Neef, 1989).

#### **3.1 Fundamental Human Needs Reclassification for Product Design**

Economic goods as tools enhance various types of satisfiers to fulfill our fundamental needs. “While a satisfier is in an ultimate sense the way in which a need is expressed, goods are in a strict sense the means by which individuals will empower the satisfiers to meet their needs” (Max-Neef, 1989). During the real design process, there is no real necessity to figure

out how product, satisfier and fundamental human needs interact with each other. However, learning to utilize this whole theory to clear our design thinking at the beginning design phase in order to simplify problems is very important. Like this article mentioned before, how we arrange our design activities and focus our design thinking will influence and lead our design result into very different ways.

While the matrix of needs and satisfiers has done a good job in describing the whole fundamental human needs theory, we still need to reclassify a specific and direct matrix for reference of product designer's design activity. In figure 2.4, according to axiological categories, Max-Neef classified fundamental human needs into nine basic needs, which are subsistence, protection, affection, understanding, participation, idleness, creation, identity and freedom. But how do products enhance satisfiers to meet all these basic needs? By the following explanations, each fundamental need can be understood in a way related to specific types of product features.

- Subsistence: Basic features of usability and usefulness which guarantee the main function of products.
- Protection: Features that prevent user from physical or property damage.
- Affection: Features that bring the user pleasure, joy, and comfort.
- Understanding: Features that help the user understand product function and how to use the product properly.
- Idleness: Features that help the user save time, resource and efforts.
- Creation: Features that allow the user to design or self-define.
- Identity: Features that have a branding and united feeling for the user such as company worker, or team member.

Needs According to Axiological Categories	Personal Needs		Interaction Needs
	Physical	Mental	
SUBSISTENCE	Functionality, Main Function Usability	Able to do, Solving Problem	Sharing, Maintenance, Cooperation, Reflection
PROTECTION	Ergonomics, Stable Status, Smooth edge, Child-resistant, Clean, Soft touching	Prevent Physical Damage, Prevent Property Damage	Privacy, Prevent Physical Damage, Respectability, Property, Prevent of Wasting Resources
AFFECTION	Soft touching Smooth edge, Good smell, Colorful	Comfortable, Love, Pleasing, Amusing	Space Sharing, Function Sharing
UNDERSTANDING	Ergonomics, Signal Interaction, Instant Reflection, Habitual Behavior	Understandability, Predictable, Fitness	Understandable, Predictability, Signal Interaction, Usual Behavior
IDLENESS	Portability, Multi-function, Easy Operating	Enjoyable, Fast, Easy, Light	Space Redistribution Optimization, Multi-tasking, Resource Redistribution Optimization
CREATION	DIY, Multi-combination,	Designable, Enjoyable, Funny	(e.g. Personal Website) DIY, Flexible Form
IDENTITY	Color, Form, Structure, Material	Branding, Fashion, Standing out, Unify	Logo, Color, Discrimination Feature, Unified Feature

Figure 3.1: FHN Reclassification Based On Needs of Product



By using these seven redefined fundamental needs, product user-friendly features can be classified as satisfier enhancers meeting certain basic needs. And based on user-center design theory, which is “user-centered design tries to optimize the product around how users can, want, or need to use the product, rather than forcing the users to change their behavior to accommodate the product,” user needs can be seen as essentials from the surrounding physical, mental, and environment, which is also a process of interaction, another category.

The definition of these three categories follows:

- Physical needs:

Needs related to human ergonomics and completion of action are satisfied by using a product.

Usually these needs are necessary and basic for a functional product.

- Mental needs:

Needs which are beyond needs satisfied by products’ basic function are needed for improving product value and better serving users at a higher level.

Usually these needs are not have-to-be-satisfied ones considering a functional product, but their existence are necessary for fundamental human needs, such as “affection, “idleness” and “protection.”

- Interaction needs:

Needs related to interaction between human-human and human-environment are satisfied by using a product.

Figure 3.1 is the chart of Fundamental Human Needs based on needs of product. The purpose of making this reclassification is to better guide the designer to simplify and clear their design thinking at the beginning of the design process. Due to the attributes of product, “freedom” cannot really be satisfied directly by a product, so it has been moved out of

the reclassification category. Also, “participation” is combined with interaction needs for minimum duplication.

Like the relationship between fundamental human needs and satisfiers, which is not one-to-one correspondence, the design features in this chart can also appear in different needs at the same time. For instance, the feature “soft edge” can protect user from physical damage such as cutting the hand, but it also can bring user a visually comfortable feeling, which belongs to the affection category.

And to prevent misunderstanding when designers use this chart, it has to be clear that all the features should be seen and considered from the user’s side of view, not from the designer’s. And considering a better understanding of interaction needs, all the features in the chart also should be seen from user’s side of view. In other words, under public space, all these features satisfy each individual person, not a group.

### **3.2 FHN Analysis Approach Development Based On Fundamental Human Needs**

It is not enough to only have Figure 3.1, the chart of FHN reclassification. If we say the designer will start to think about product features in that way, which means categories as a thinking clearing process, there are still ambiguous approaches behind all these when they face real design action. Thus, an approach which we can call “FHN Analysis Approach” can be developed according to the FHN reclassification. The following studies will firstly show how “FHN Analysis Approach” works for an existing specific product.

- **Material Product**

Cup is a general name of all different types of cups. By the material category classification, we have paper, plastic, glass, porcelain, wood, metal, and rubber cup. By usage differences classification, we have teacup, coffee cup, wine glass, mug, etc. We cannot know which one is better without giving certain design circumstances, but we can know a cup, just as a product, can satisfy basic needs of humans and how each feature in this

product does that. In other words, in order to simplify this “cup” design, we consider it from an angle that all the different features exist for serving human needs. Here, for cup design, we generally can classify the features into two big categories, which are “user physical needs” and “user mental needs.”

All cups, which should also be designed well, have the same basic functions for user physical needs: containing liquid, holding with the hand and using for drink. And for basic mental needs, features such as comfort and preventing physical damage should also be considered in the design process. Other additional features, such as tea filter, handle, color and even branding logo all vary according to certain design targets. But we still realize no matter what the situation is, what special features are needed in this design, they still can be classified into Fundamental Human Needs, which is demonstrated in Figure 3.2. The features collected here are just examples. According to different situations, different features will be added to this chart.

“Subsistence” is a very special and most basic feature. If a product fails to fulfill this category, we cannot regard it as a usable product. Thus, all the features belonging in this category should be firstly considered and satisfied during concept development. Also, when designers write down these kind of features, they should put them on the top of the list and try to avoid describing duplicate feature.

No matter what kind of problems designers are dealing with, they can summarize all the necessary features into this chart to have a clear understanding and judgment. By creating this chart, we can not only easily tell how a product with features satisfies each basic need, but also know which needs are specifically more important than others.

Products like cups, chairs, desks and tableware have a tendency to have the demand of needs in “Protection” and “Affection” beside the very basic needs “Subsistence”. But, the same as material product, human needs can be different. Electric products with interfaces also require products to provide good interaction features, such as sound and

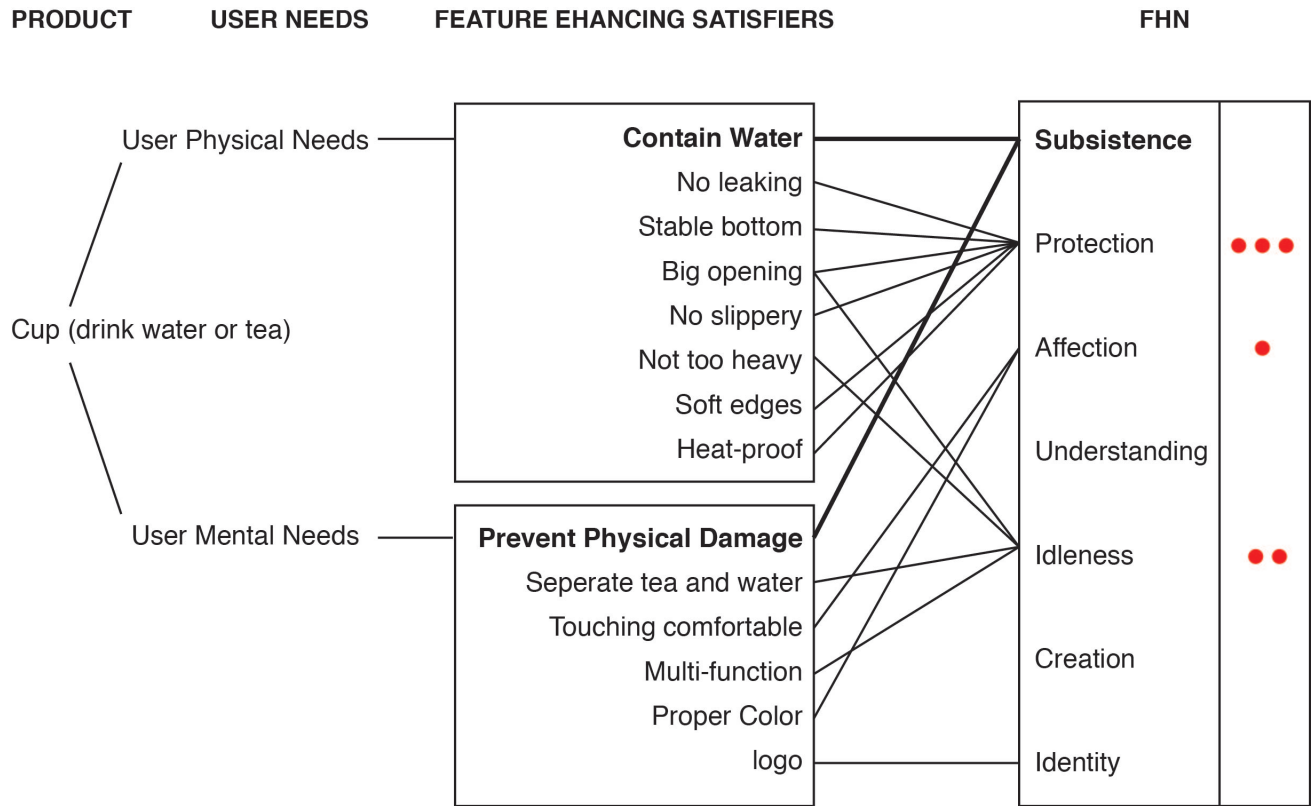


Figure 3.2: Chart of Cup and Fundamental Human Needs

light feedback, even vibrating alerts. And due to more complex functions compared to cups and chairs this kind of product with interface systems also requires higher understanding for usual human behavior and cognitive ability. Figure 3.3 demonstrate these differences compared to Figure 3.2.

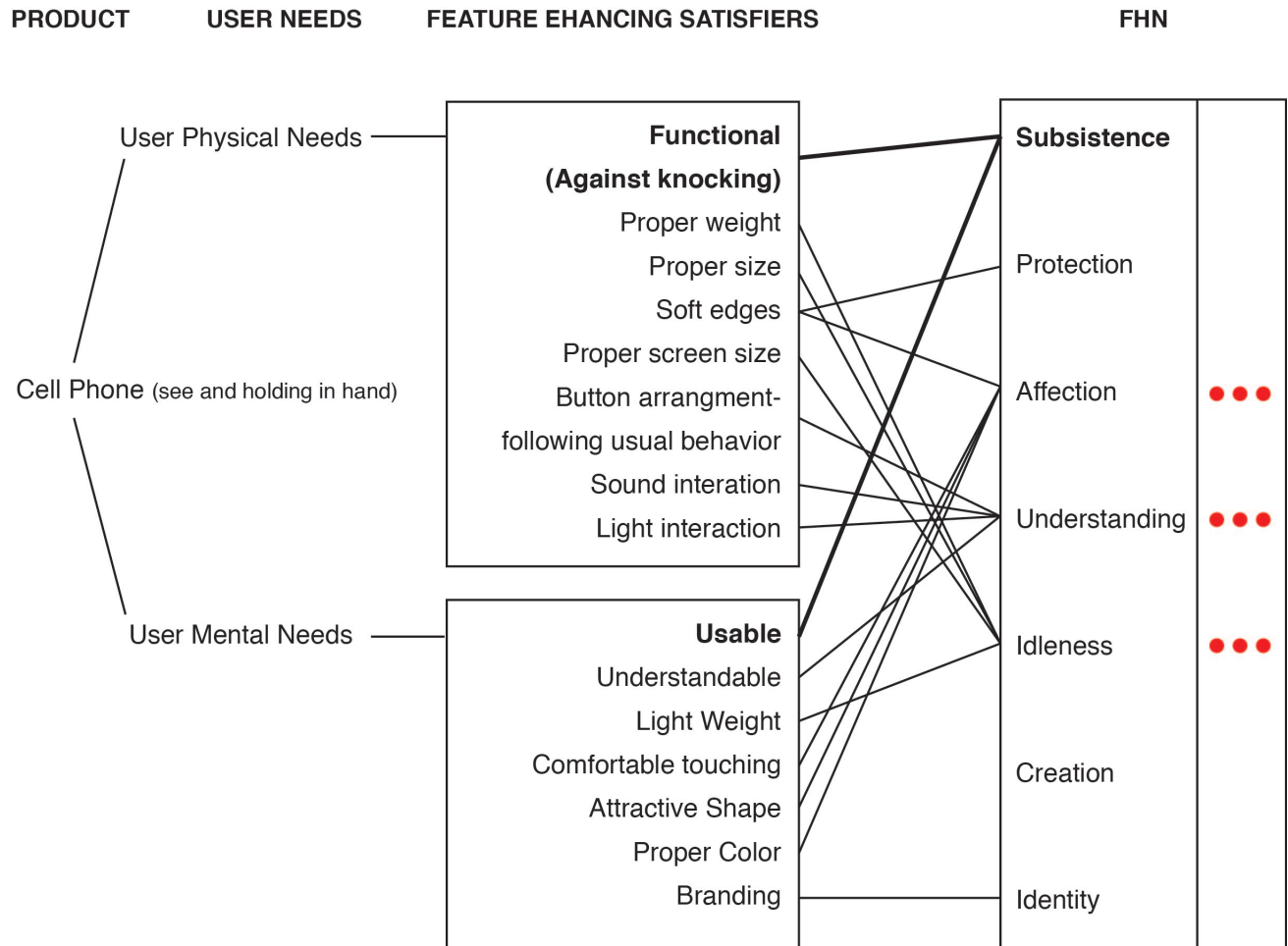


Figure 3.3: Chart of Cell Phone and Fundamental Human Needs

- Website (or App)

Website is a non-material product. Dissimilar to cups which usually will not have share features, website has another special attribute which is its interactive feature. This product not only needs to satisfy user personal physical and mental needs, but also need to complete a successful interaction process. Figure 3.4 demonstrates the thinking process with the additional “Interaction Needs” aspect through analysis of the Amazon website.

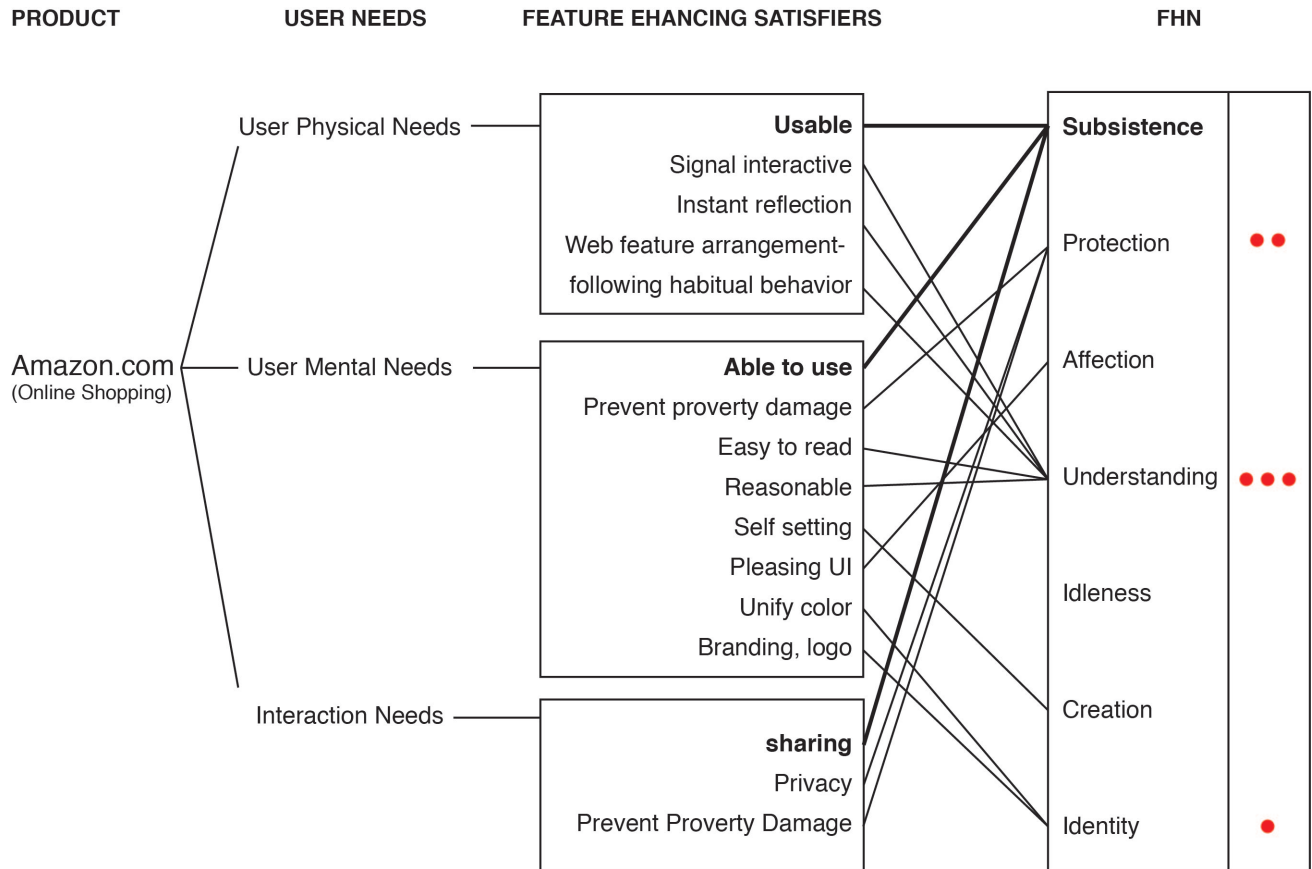


Figure 3.4: Chart of Amazon Website and Fundamental Human Needs

The main function of Amazon is online shopping and branding product evaluation so that “protection,” “understanding” and “identity” are more necessary needs for customers, and “understanding” has the highest rate. Compared to amazon.com, wix.com, an online portfolio or personal design website analyzed in 3.5, has different tendencies of demands. Figure 3.5 shows that as a self-design website, most of its function is assisting users in design and self-definition. Thus compared to Amazon, “creation” needs are greatly satisfied here. In addition, “Affection,” “Understanding,” and “Idleness” are the other three main fundamental human needs satisfied in this case. From these two charts, we also can see that “understanding” is a very essential need that should be highly satisfied in website design work.

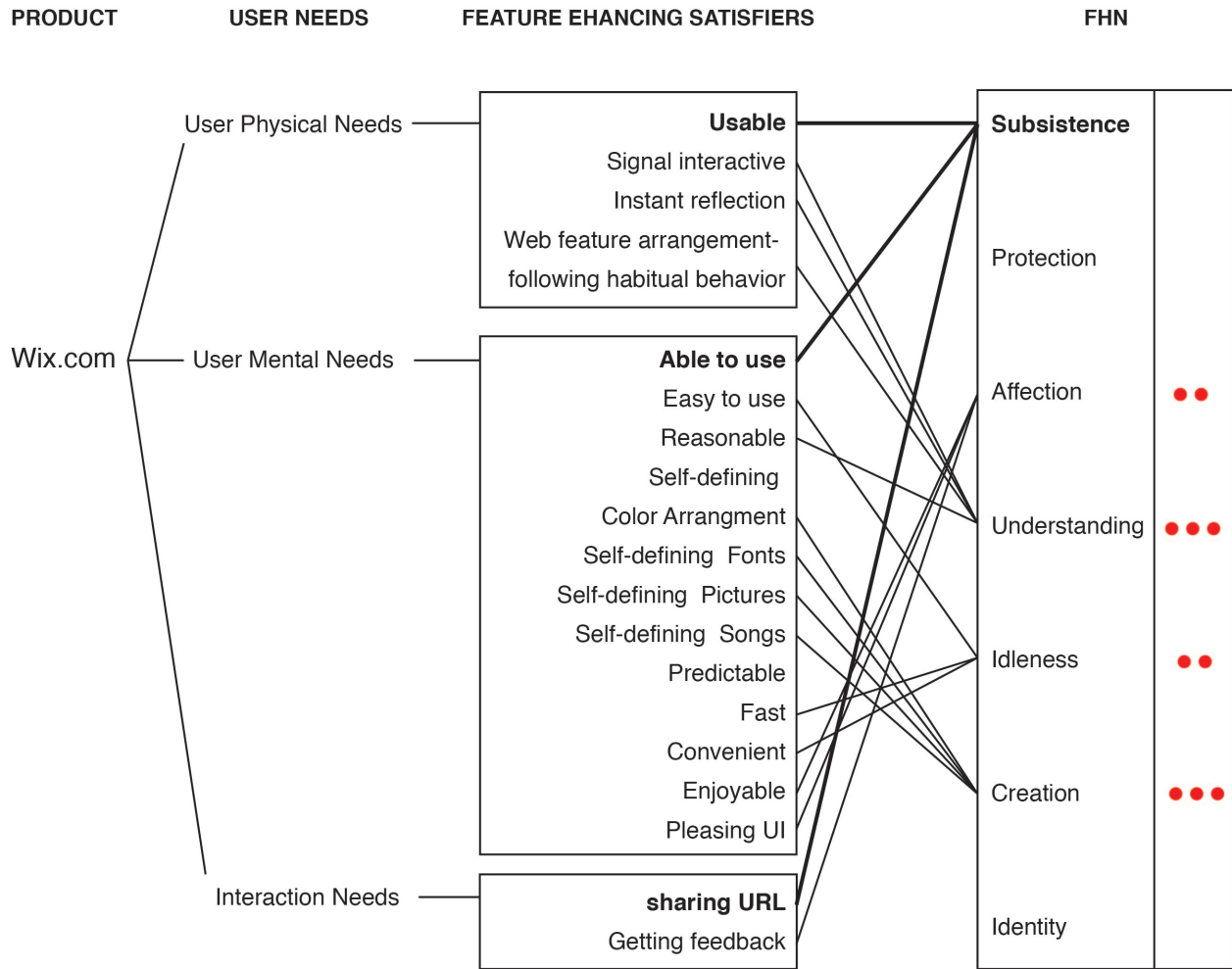


Figure 3.5: Chart of Wix Website and Fundamental Human Needs

### 3.3 Conclusion: Process of Applying FHN Analysis Approach

In general, case studies shown in the last section attempt to explain that FHN Analysis Approach is convenient and effective. Different products have different needs satisfying requirements of user. Once a designer has a target product, by analyzing using this chart they can easily know what are important and irreplaceable features, and which features can be traded-off according to certain requirements or under certain circumstances. Figure 3.6 shows a basic process of this FHN Analysis Approach.

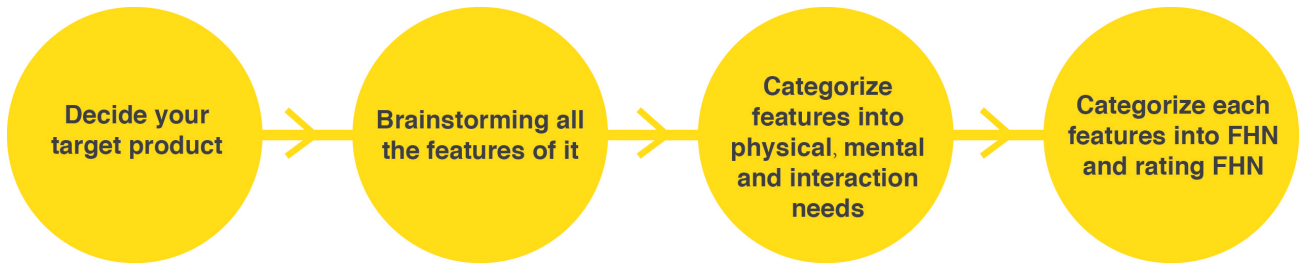


Figure 3.6: Process of FHN Analysis Approach

Furthermore, once a chart for a product has been created, it has two functions, which are idea generation assistance and evaluation:

- Idea generation Assistance:

By laying down all the features from the designer himself or herself, FHN Analysis will clearly demonstrate an existing feature's tendency distribution of a product, which can be seen as conventional perspective or habitual point of view. And by observation and further trade-off action, the designer can create many different feature combinations, which may not all be effective, but the whole process can motivate a designer's creative nerves to finally get a good idea.

- Evaluation:

This function is available when several first concepts have been created. According to the FHN analysis chart, the designer can recheck and adjust his or her ideas about which part does not satisfy necessary human needs, and which part can be weaker or stronger.

The purpose of developing FHN Analysis Approach is for better demonstration of applying contrary thinking into further creative thinking, which is discussed chapter five. It also can be used independently as a thinking tool for simplification.



## Chapter 4

### PRODUCT REDESIGN BY CONTRARY THINKING

If we say that a redesigned product is a result of sequence of actions that can be seen as adding or rearranging values of a product with original basic function, then contrary thinking is one of the approaches to creating good redesign. Adding, reducing and rearranging features of a product can be an interesting and creative redesign process.

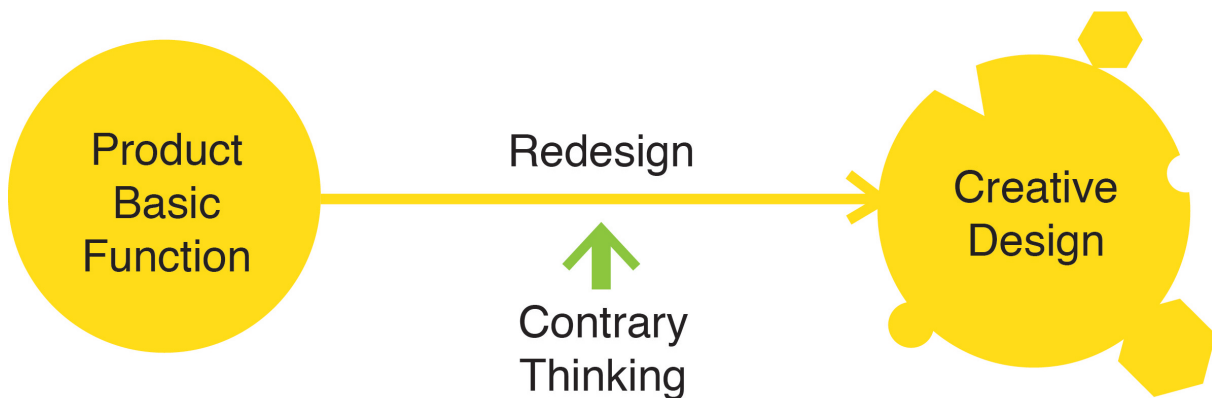


Figure 4.1: Redesign, Contrary Thinking and Product Value

#### 4.1 Two Approaches of Contrary Thinking

In chapter two, the way of classification of contrary thinking has been generally discussed according to two existing classification, which are “converted thinking” and “disadvantage manipulation.” However, the existing definition of “converted thinking” is ambiguous. The original definition is:

“Converted Thinking approach encourage people to observe things in a different angle of way to replace the current problem resource, move attention to another target, when normal approach does not work” (Zuoan Reading, 2010, January 7).

As an approach to guide designers' design thinking that sometimes can be confused and chaotic, it needs to be more simple and accurate to be understood and applied to save time and effort. Thus by observing supporting product redesign cases, which will be discussed in the following sections in detail, a more specific description of "converted thinking" is created. The redefinition of two approaches of contrary thinking is as follows:

- Disadvantage Manipulation

Designers use one or several relatively disadvantageous features in product to achieve better design.

- Function Transfer

The designer transfers a certain function from a part of product to another part of the same product, or between a set of products that are usually used together. During this process, parts of the product or one of set of products can be abandoned or added.

To better understand how specifically these approaches work in our design activities, we need to collect supporting cases to study and analyze.

## **4.2 Redesign Case Studies of Disadvantage Manipulation**

Designers usually avoid features that seem unacceptable to the public because conventional thinking usually will lead people to a fixed mindset. But many cases have proven that it can be creative if we just convert these "shortcomings" to parts of a product. The following case studies will demonstrate how disadvantage manipulation works.

Based on fundamental human needs, cases have been separated into sections divided by physical needs, mental needs, and interaction needs.

### **4.2.1 Basing on Fundamental Personal Physical Needs**

- Tea Cup Redesign



Figure 4.2: Tea Cup Redesign. Adapted from <http://www.qiqifaxian.cn>. Copyright 2007-2014 by Qiqifaxian.cn

1) Problem Solving: Separate tea and water.

2) Disadvantage Feature: Unstable bottom.

3) Design Intro:

When drinking tea, many people don't like tea leaves sticking on lips or ending up with leaves in the mouth. So many existing products show that the designer will design a filter to separate tea and water. Most existing filters are placed on the rim of the water bottle or cup, but in this case the designer wisely uses an unstable bottom to control the position of water and uses a small mesh filter to separate tea and water.

4) Analysis based on fundamental human needs:

Figure 4.3 demonstrates drinking tea this action requires product to satisfy protection, idleness and affection other than the basic subsistence.

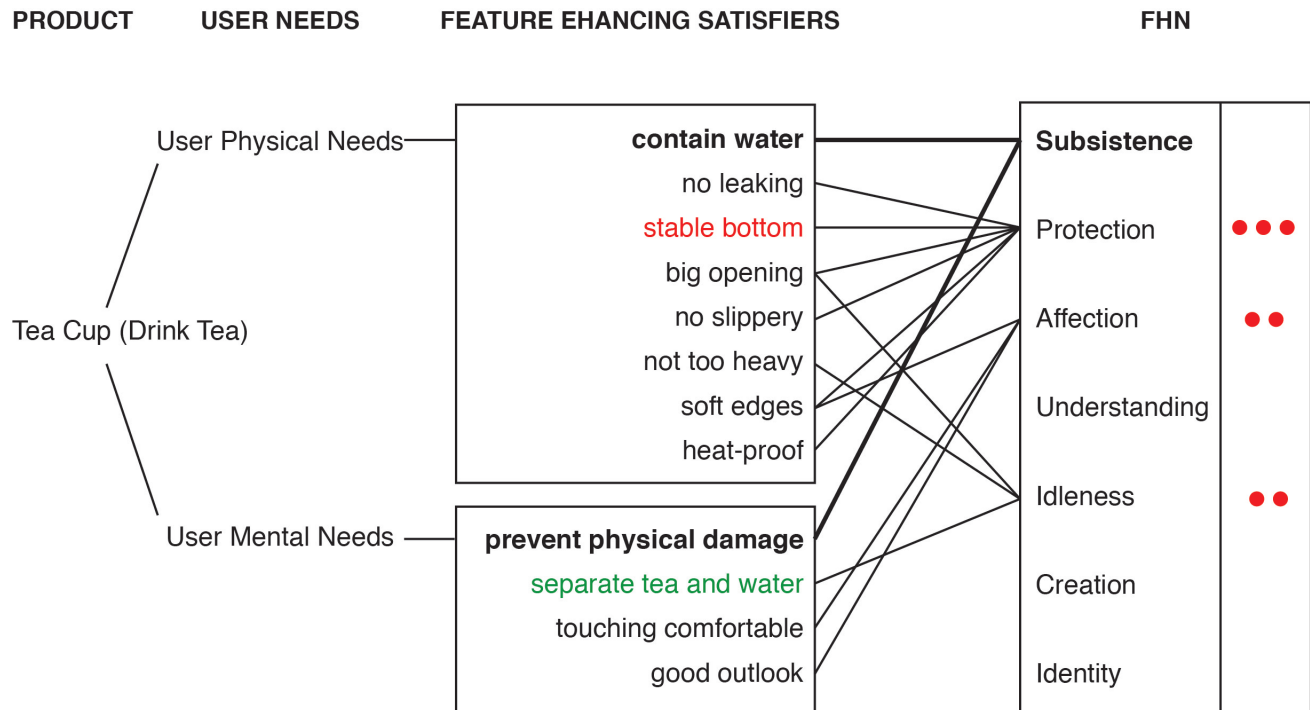


Figure 4.3: Chart of Tea Cup and Fundamental Human Needs

The designer trades off physical need “stable bottom” to fulfill mental need “separate tea and water,” and at the same time satisfy “no leaking” to prevent the unstable bottom from causing hot water to pouring out, which will threaten “protection.”

- Sugar Spoon Redesign

- 1) Problem Solving: Control sugar intake.
- 2) Disadvantage Feature: Leaking.
- 3) Design Intro:

Many people like to add much sugar to their coffee, but we also know that too much sugar intake is not healthy for our body. Designers focus on this problem and apply

“leaking,” this disadvantage feature, to sugar spoon to remind people to control the volume of their sugar intake. Also, making shape of the spoon like a skull can also remind people to care for their health.



Figure 4.4: Sugar Spoon Redesign

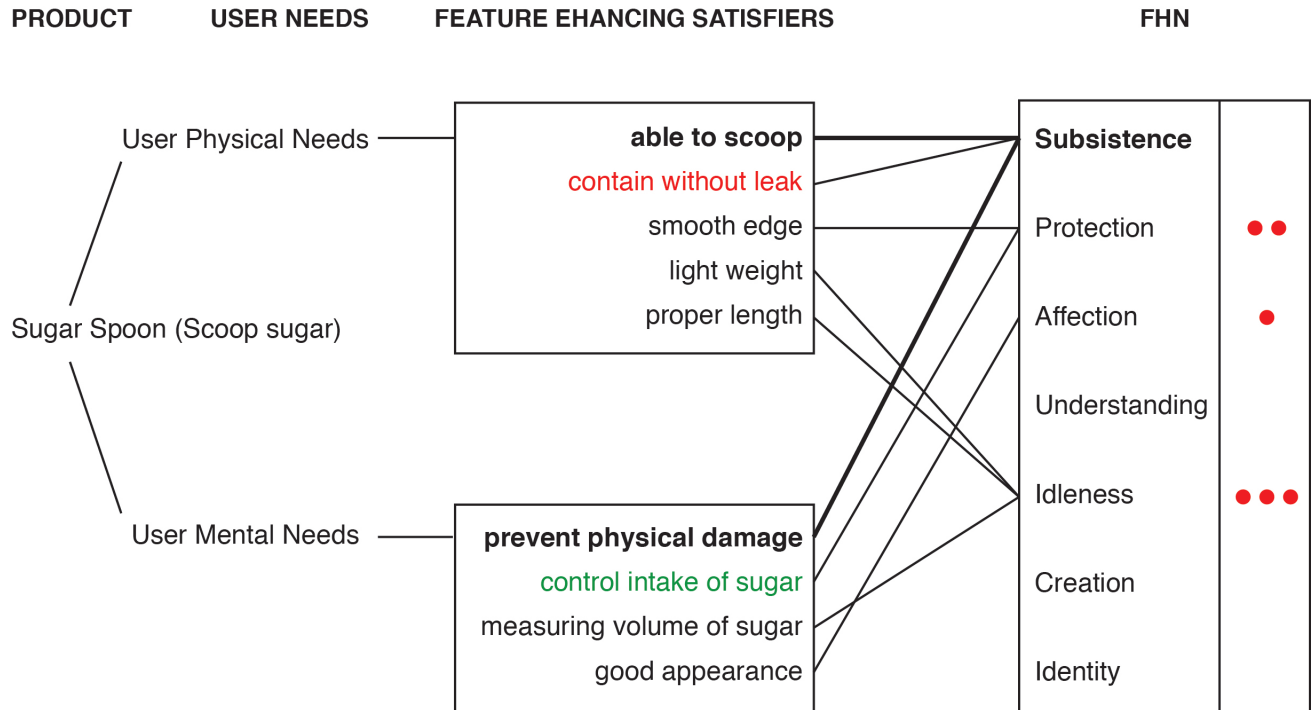


Figure 4.5: Chart of Sugar Spoon and Fundamental Human Needs

4) Analysis based on fundamental human needs:

In this design, the feature “no leaking” is traded off by mental needs feature “control volume of sugar.” But at the same time it keeps feature “scoop sugar” as the “subsistence” feature so that this redesign is accepted.

- Public Dustbin Redesign



Figure 4.6: Public Dustbin Redesign. Adapted from <http://www.qiqifaxian.cn>. Copyright 2007-2014 by Qiqifaxian.cn

1) Problem Solving: Easy pouring of trash into a dustbin and letting people put the public tool back to its position.

2) Disadvantage Feature: Inclined bottom and instability

3) Design Intro:

After the user sweeps trash and dust into a dustpan, the next action will be to pour all trash into the dustbin. But in this action, the user has to lift the dustpan higher to achieve the height of dustbin, which is not convenient. Designers noticed this problem and use an inclined bottom to lower the dustbin height. After cleaning, this inclined dustbin also implied people will think “make it straight.” This reminds people to put dustbin and broom back which will make the dustbin straight.

4) Analysis based on fundamental human needs:

Similar to the first cases, this design traded off “stable bottom” to get the feature “convenient” and “sharing”, and also kept “no leaking” to prevent trash getting out of dustbin.

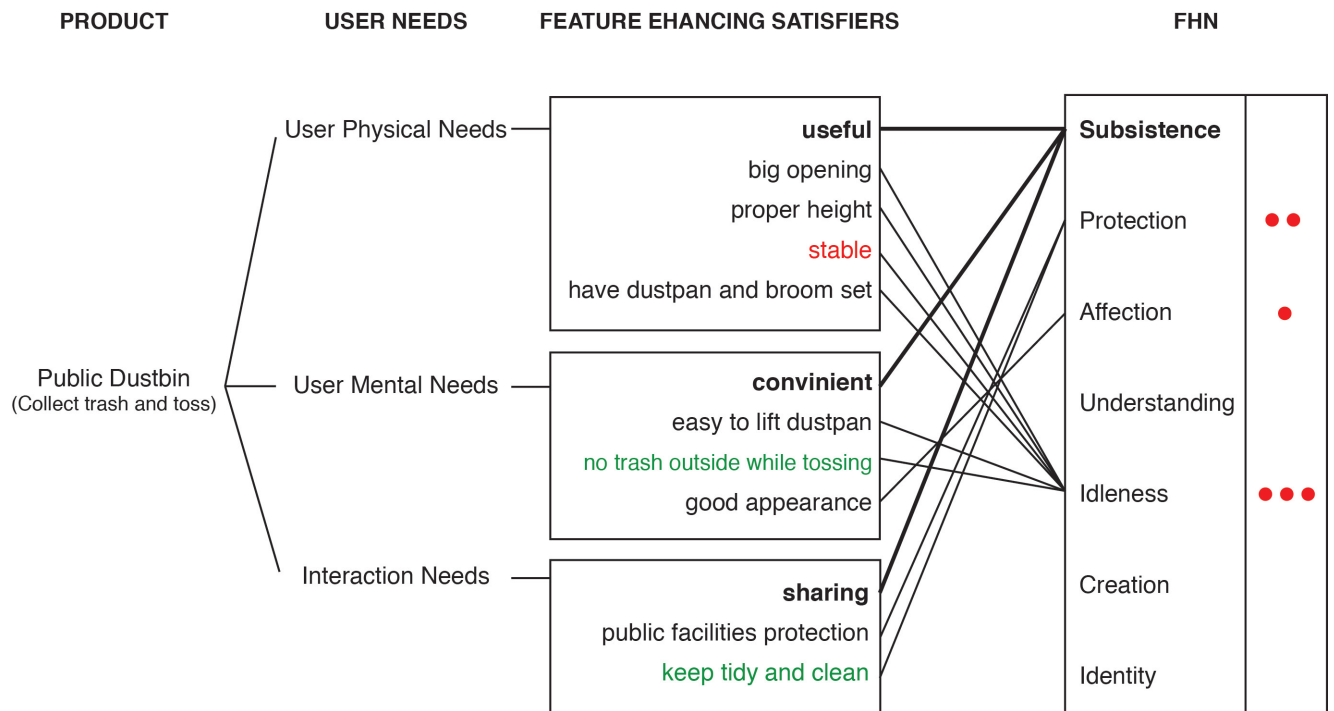


Figure 4.7: Chart of Public Dustbin and Fundamental Human Needs

#### 4.2.2 Basing on Fundamental Personal Mental Needs

- Cup Redesign

1) Problem Solving: Watermark ring is annoying.

2) Disadvantage Feature: Watermark ring

3) Design Intro:

Many people don't like watermark rings. Coaster are designed to prevent watermark and protect table. However in this case, the designer kept the watermark, this annoying feature, and make it look like a sakura flower by changing the shape of cup bottom, which change the way people see watermark ring.



Figure 4.8: Sakura Cup. Adapted from <http://www.qiqifaxian.cn>. Copyright 2007-2014 by Qiqifaxian.cn

4) Analysis based on fundamental human needs:

This design keeps “no watermark ring” feature and combine it with the feature “good outlook” by creating a sakura bottom shape. Also at the same time the designer didn't change the rim shape to sakura and kept the circle to satisfy “soft edges,” which can prevent people from hurting their lips.



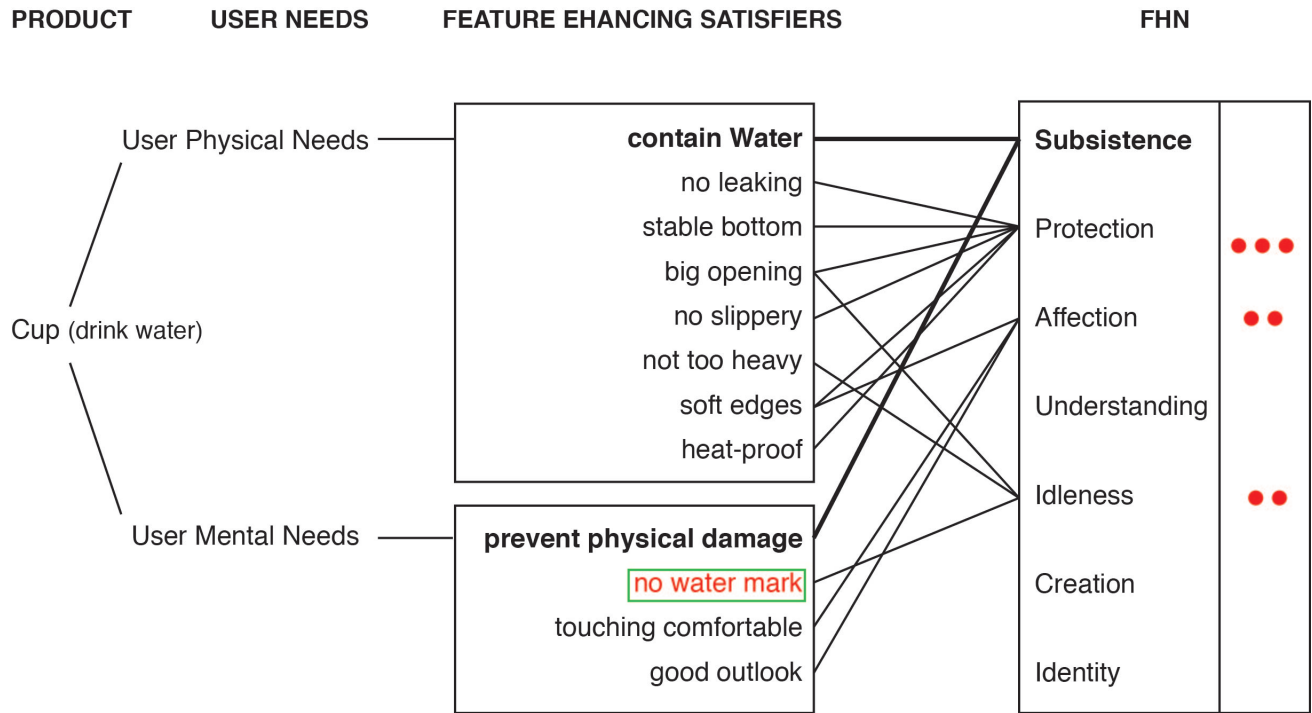


Figure 4.9: Chart of Sakura Cup and Fundamental Human Needs

- Bottle Rim Redesign



Figure 4.10: Bottle Rim Design. Adapted from <http://www.qiqufaxian.cn>. Copyright 2007-2014 by Qiqufaxian.cn

- 1) Problem Solving: Lovers want to stay longer when they are dating.
- 2) Disadvantage Feature: Small bottle rim.

3) Design Intro:

When lovers are dating, they usually will buy a beverage while they are talking. But when they finish those beverages, it will remind them to go somewhere else or just say goodbye. Designer noticed this human mental need and designed a smaller rim for beverage bottle. Although it is not easy to drink fast, this feature can make lovers spend a longer time drinking the beverage, which makes lovers stay longer.

4) Analysis based on fundamental human needs:

In this design, the feature ‘big opening’ is traded off by the mental needs “for lovers while dating,” and this does not influence the basic function of beverage bottles, which is the feature “contain beverage.” Also, this redesign still guarantees feature “drink smoothly” which makes this redesign acceptable.

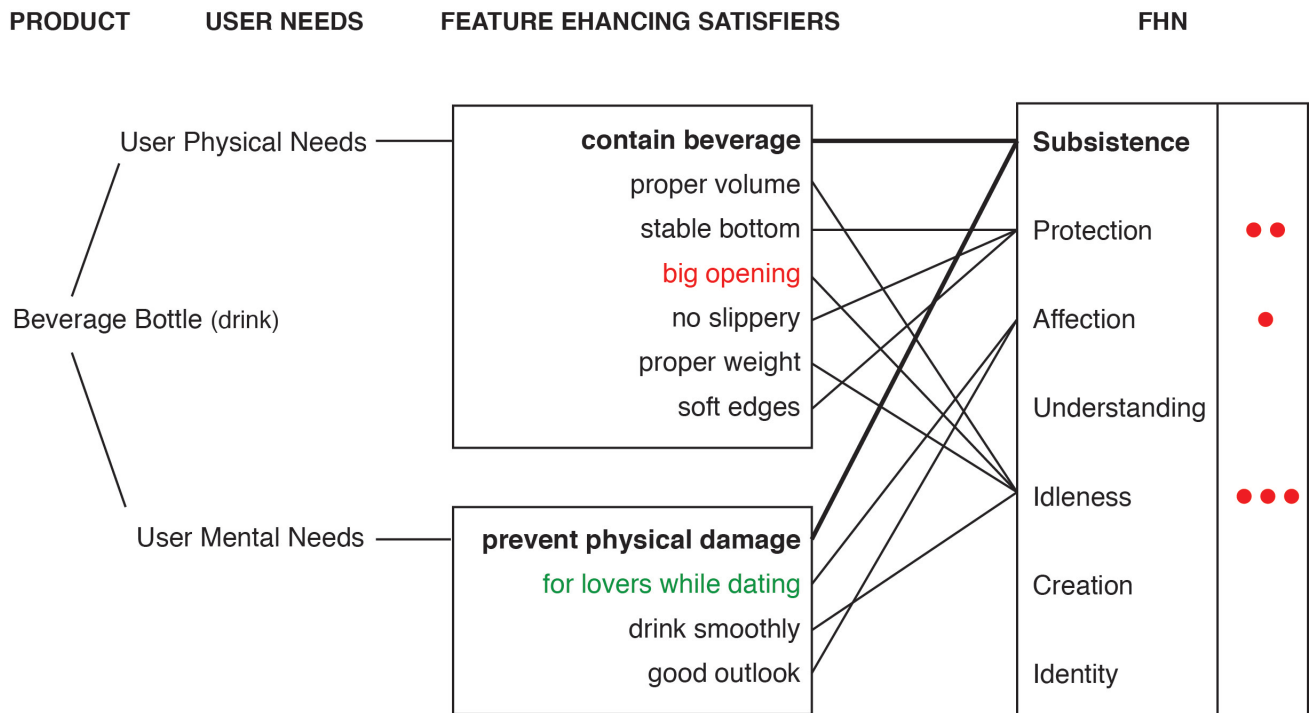


Figure 4.11: Chart of Beverage Bottle and Fundamental Human Needs

### 4.2.3 Basing on Fundamental Interaction Needs

- Toilet Paper Redesign



Figure 4.12: Toilet Paper Redesign. Adapted from Designing Design. (p.27), by Kenya Hara, (2007), Switzerland: Lars Muller Publishers

- 1) Problem Solving: Saving resources.
- 2) Disadvantage Feature: Hard to pull paper out.

3) Design Intro:

If we only consider from a user's perspective, toilet paper should be designed to be easily pulled out. But when we look at the big picture and consider limited global resources, we should realize everyone on earth has the responsibility to protect our environment and save resources. From this point of view, designers redesigned toilet paper cores and simply changed its shape from cylinder to cuboid, which will make toilet paper rolling a little bit slower and harder. But what is important is that this change does not influence the basic function of toilet paper cores. Paper still can easily to be dragged out and the design can remind people to save paper. Also, cuboid core also change the shapes of toilet paper, which is easier for stacking.

4) Analysis based on fundamental human needs:

Figure 4.13 is the chart that demonstrates the analysis of toilet paper based on FHN.

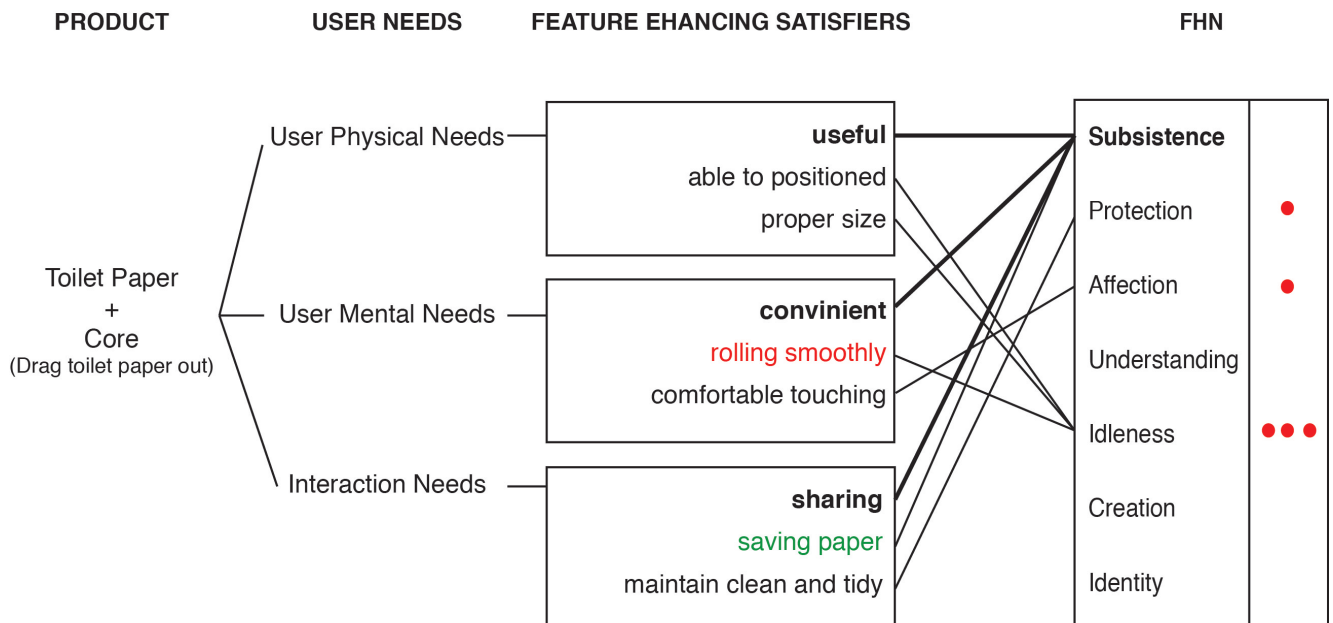


Figure 4.13: Chart of Toilet Paper and Fundamental Human Needs

In this design, the feature “saving paper” was strengthened and “cylinder shape” was traded off. But these change didn’t influence the feature of “Idleness,” which means “easy rolling” just decrease its level from smoothly rolling to rolling.

- Hospital Signage System Redesign



Figure 4.14: Hospital Signage System Redesign. Adapted from *Designing Design*. (p.165), by Kenya Hara, (2007), Switzerland: Lars Muller Publishers

- 1) Problem Solving: Maintaining public sanitation.
- 2) Disadvantage Feature: White color.

3) Design Intro:

Public spaces, especially places like hospitals and restaurants, need to keep a tidy environment. So usually in order to prevent a wall, table or signage from getting dirty, the designer usually will choose a dark material to decorate things that easily are touched and get dirty. In this case, the designer contrarily applies white and soft material to all signage. He intends to remind people to maintain public sanitation by creating a clean and tidy environment.

4) Analysis based on fundamental human needs:

In this design, the interaction feature “keep public place clean” is enhanced by using feature “easy to get dirty material” instead of the feature “dark color material.”

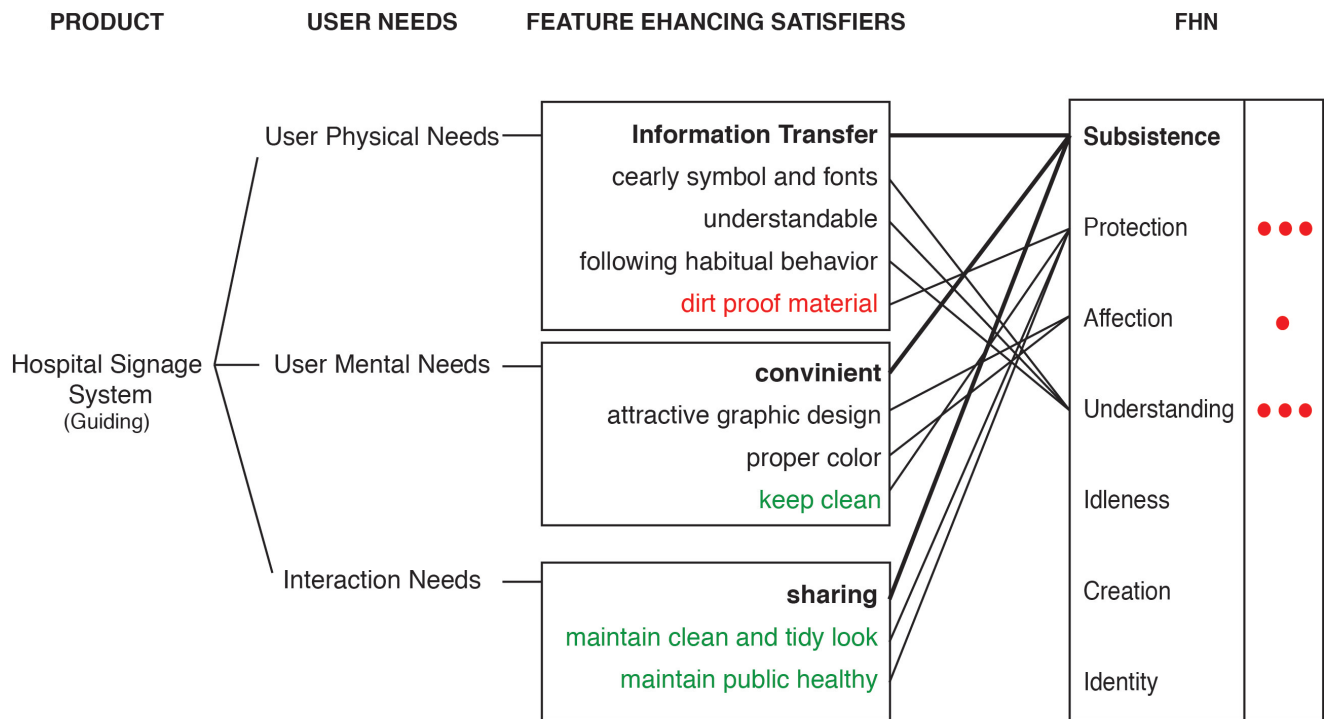


Figure 4.15: Chart of Signage System and Fundamental Human Needs

### 4.3 Redesign Case Studies of Function Transfer

Function Transfer has been used in many product design cases, but it hasn't been summarized into an approach. By moving one function from one part of product to another part of same product or between a set of products that are usually used together, design outcomes can be smart and creativity can be intrigued. The following product redesign cases show us the specific working process of this approach.

#### 4.3.1 Basing on Fundamental Personal Physical Needs

- Wall Socket Redesign

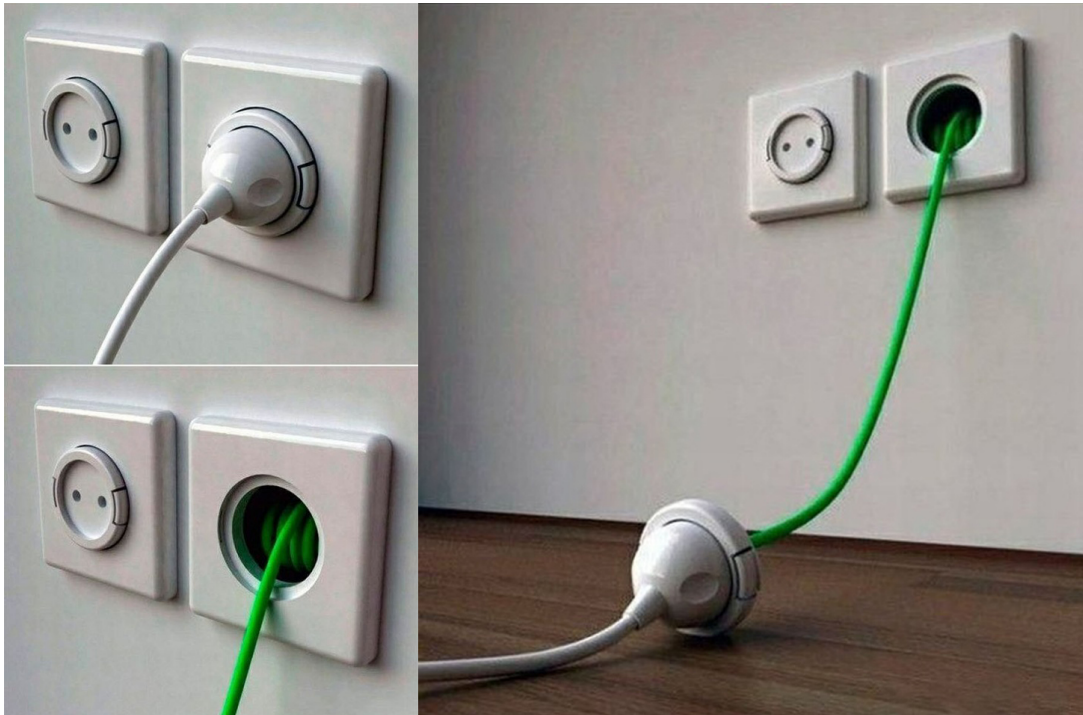


Figure 4.16: Extensible Wall Socket. Adapted from <http://www.qiqufaxian.cn>. Copyright 2007-2014 by Qiqufaxian.cn

- 1) Problem Solving: The plug wire is not long enough.
- 2) Transferred Function: Extendable wire.

### 3) Design Intro:

The conventional way to extend a wire is focusing on plug's wire. This design winsomely transfers this function to the wall socket by hiding an extendable wire into the wall and connecting with a movable socket.

### 4) Analysis based on fundamental human needs:

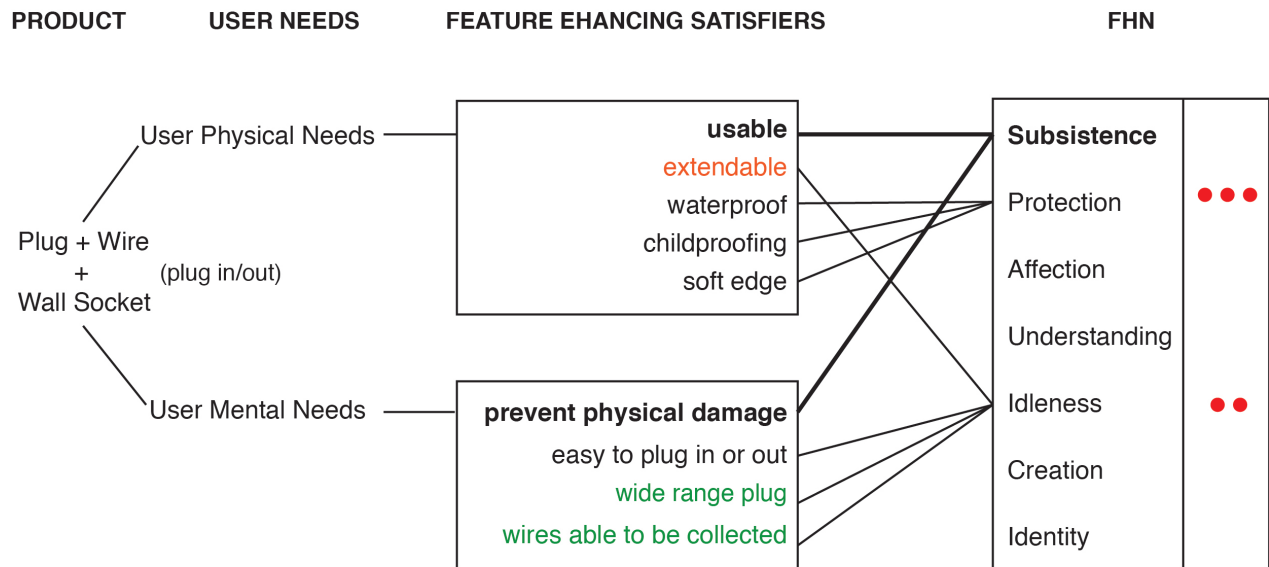


Figure 4.17: Chart of Extensible Wall Socket and Fundamental Human Needs

In this case, a plug and a wall socket are two products used together. The feature “extendable wire” is transferred from the plug wire with a conventional perspective to the wall socket in a creative point of view. In this way, it not only solves the main problem, but also hides part of the wire into the wall to make the wire look tidy.

- Umbrella Redesign

1) Problem Solving: Umbrella will flip over when blown by a strong wind.

2) Transferred Function: Folding structure.





Figure 4.18: Umbrella Redesign. Adapted from <http://www.qiqufaxian.cn>. Copyright 2007-2014 by Qiqufaxian.cn

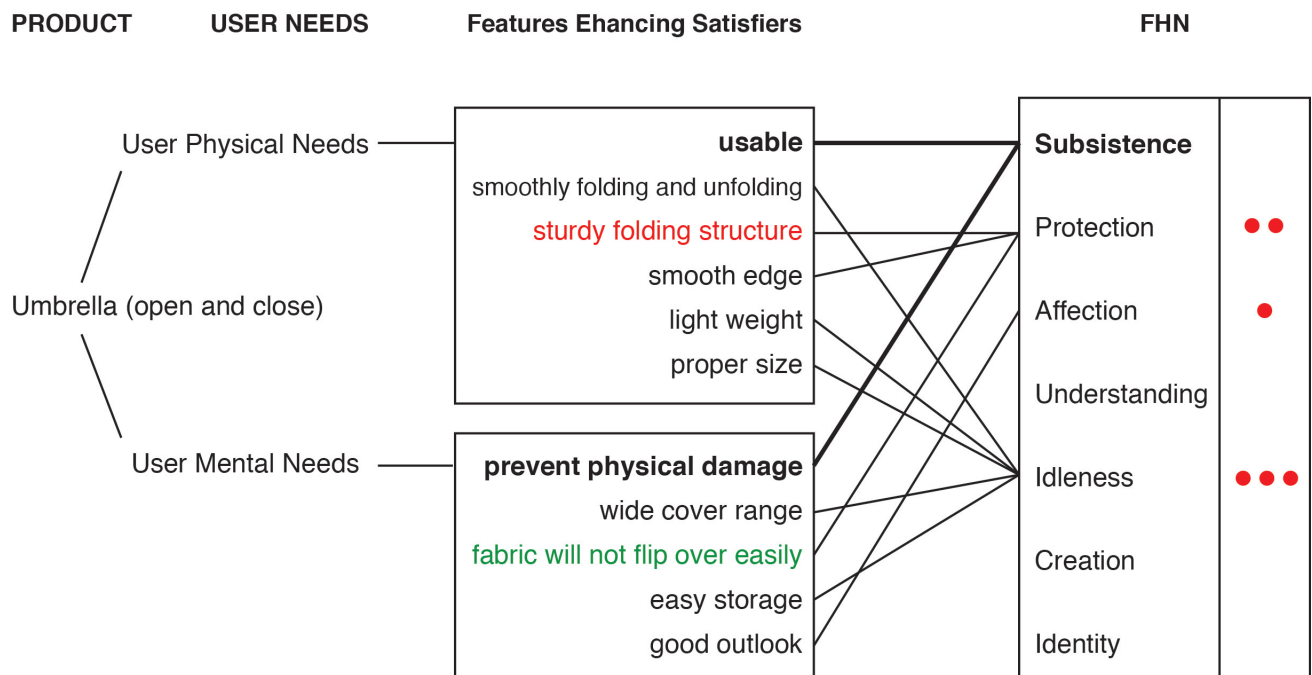


Figure 4.19: Chart of Umbrella and Fundamental Human Needs

### 3) Design Intro:

It is very common and inconvenient that our umbrella may flip over from strong winds. The designer in this case cleverly not only moved the supporting structure of umbrella from below to above the fabric, which prevents the fabric from flipping over, but also changes our conventional method of closing an umbrella from up to down.

### 4) Analysis based on fundamental human needs:

The feature “sturdy folding structure” is transferred on the same carrier umbrella, but by inspiration of structure reversing form, the designer moved the folding structure from below the fabric to the top. Also, to satisfy the subsistence function “open and close,” he or she changed the movable feature from folding structure to fabric. This design sacrifices feature “good outlook” for a trade-off.

- Broom Redesign



Figure 4.20: Broom Redesign. Adapted from <http://www.qiqifaxian.cn>. Copyright 2007-2014 by Qiqifaxian.cn

- 1) Problem Solving: Broom easily falls down
- 2) Transferred Function: Broom standing
- 3) Design Intro:

Usually an upright sweep set will provide a broom snap to hold the broom in an upright position. In this case the designer transfers this function from the dustpan to broom.

4) Analysis based on fundamental human needs:

The broom and upright dustpan snap are a set of products to perform standing broom behavior and are conventionally used together. In this case, the feature “can stand” is transferred from the dustpan to broom to fulfill mental needs “upright storage.”

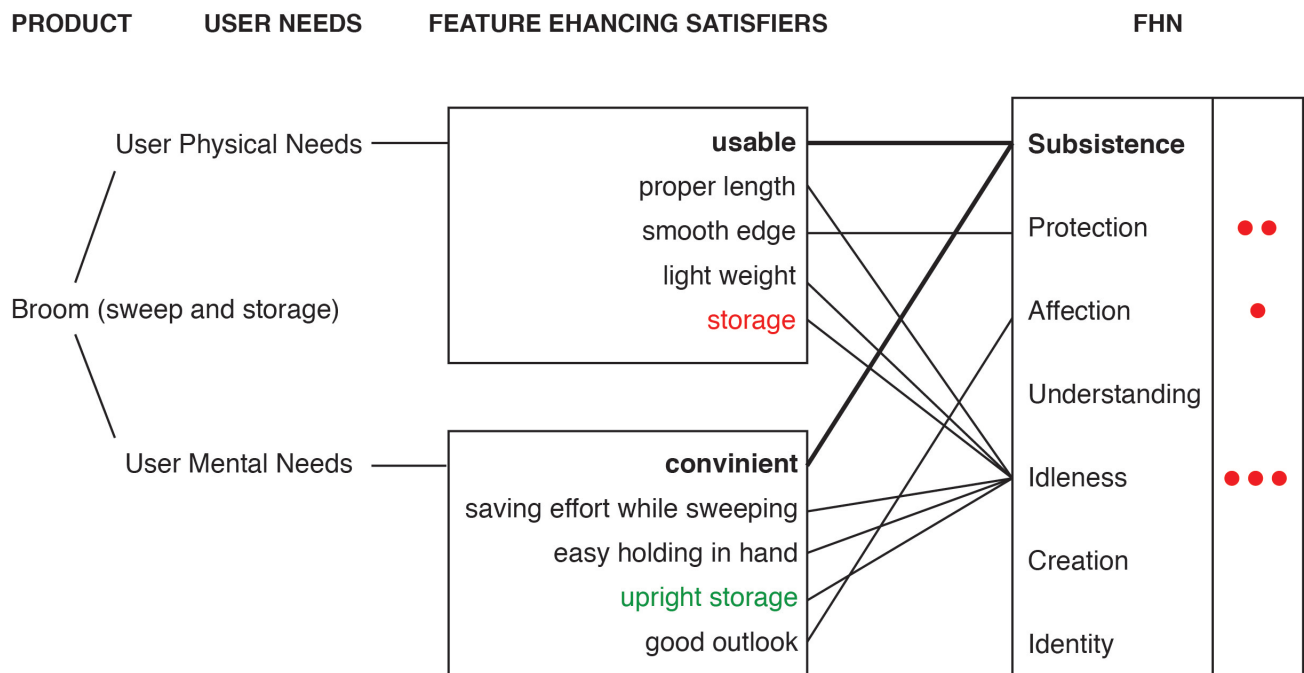


Figure 4.21: Chart of Broom and Fundamental Human Needs

### 4.3.2 Basing on Fundamental Personal Mental Needs

- Tea Cup Redesign

1) Problem Solving: Wet tea bag will drip tea water while taking it out of the cup.

2) Transferred Function: Squeezing teacup.



Figure 4.22: Tea Cup Redesign. Adapted from <http://www.qiqifaxian.cn>. Copyright 2007-2014 by Qiqifaxian.cn

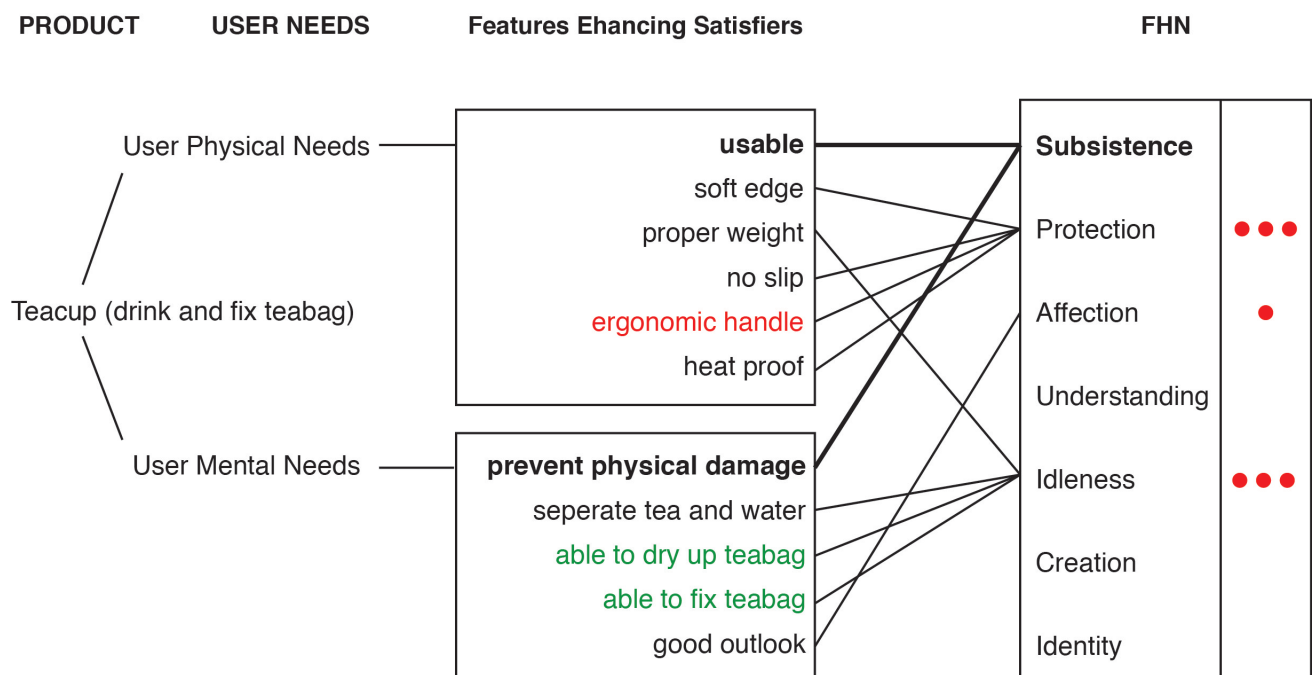


Figure 4.23: Chart of Teacup and Fundamental Human Needs

### 3) Design Intro:

It is annoying that a teabag will drip water on the floor or table when the user takes the wet teabag out of the cup. But it is also inconvenient and unhealthy if a user squeezes

the teabag by hand. The designer in this case transfers this squeezing function to the tea cup, which will not only prevent the hand from polluting the tea water, but also save the user's effort of throwing away wet teabag by storing it on.

4) Analysis based on fundamental human needs:

In this design case, in order to satisfy the needs "protection" and "idleness" by preventing teabag dripping into hot tea water, the feature "ergonomic fitting handle" carries the function "squeezing and fixing teabag" from user's hands.

- Curtain Redesign

1) Problem Solving: Bring the user a different way to change conventional behavior.

2) Transferred Function: Open the curtain and pull the curtain shut.



Figure 4.24: Curtain Redesign. Adapted from <http://www.qiqifaxian.cn>. Copyright 2007-2014 by Qiqifaxian.cn

3) Design Intro:

Pulling the curtain to the left or right side to open it is a very common and usual behavior. In order to change this conventional life habit and bring a fresh feeling to an

ordinary object, the designer created a foldable curtain with many small magnets on it. By this way, people need to push the curtain up to open it instead of pulling two parts of the curtain to the sides. When closing the curtain, the user just needs to pull the curtain down instead of dragging two sides of curtains to the middle.

4) Analysis based on fundamental human needs:

Curtain and curtain tiebacks and rings are a set of products to perform opening and shutting behavior. This design mainly satisfies human’s “affection” needs because that is the way that we open and shut curtains, which does not have any big problem from product design perspective. But changing our conventional behavior in our daily life can bring us a refreshed and innovative feeling, which can be called “affection”, by abandoning “pulling and dragging,” and also transferring the “open and shut curtain” function from curtain tiebacks and rings to the curtain itself.

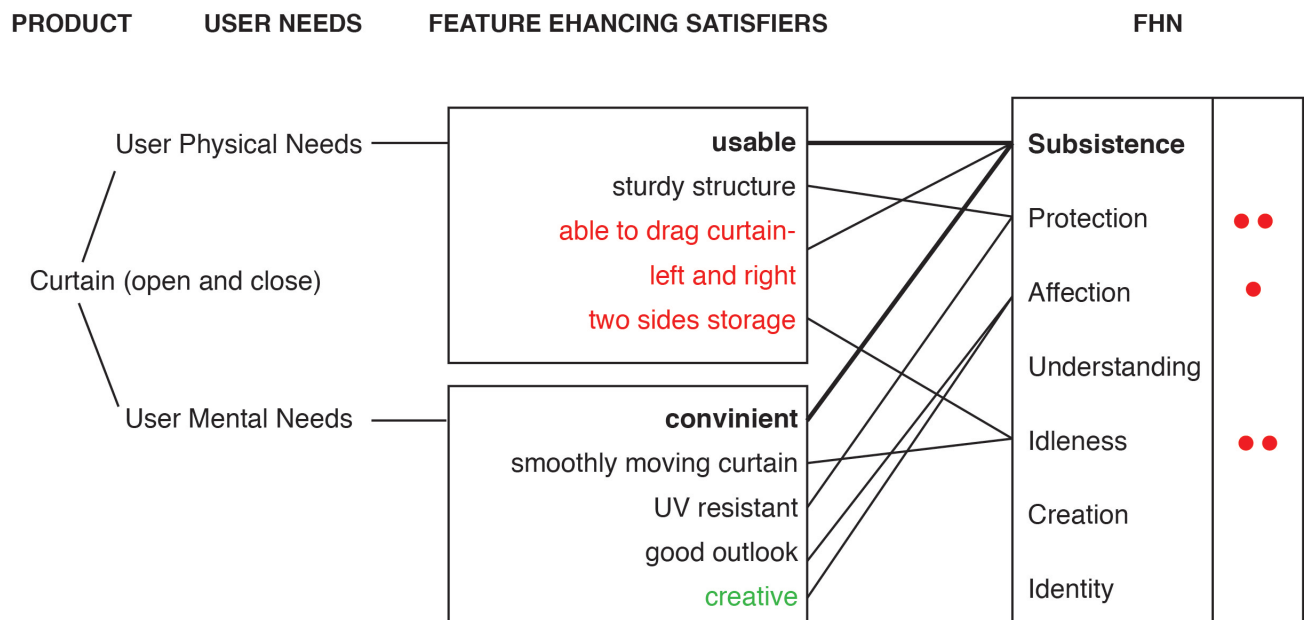


Figure 4.25: Chart of Curtain and Fundamental Human Needs

- Table Lamp Redesign



Figure 4.26: Table Lamp Redesign. Adapted from <http://www.qiqifaxian.cn>. Copyright 2007-2014 by Qiqifaxian.cn

1) Problem Solving: Bring the user a different way to change conventional behavior.

2) Transferred Function: Control the brightness of light.

3) Design Intro:

Similar to the last case, we usually will control brightness of light by turning the button on the light. But in order to create a different and innovative way to do the same thing, the designer creates a box with a window blind to control the brightness of light.

4) Analysis based on fundamental human needs:

Inside the electric structure of light is the object to perform brightness control behavior. By transferring the function “control the brightness” from the light to the outside structure, this design also mainly satisfies human’s “affection” needs. In this case, the designer is not removing part of the product or moving the whole product out; instead he or she added a part to the original product to perform the same function.

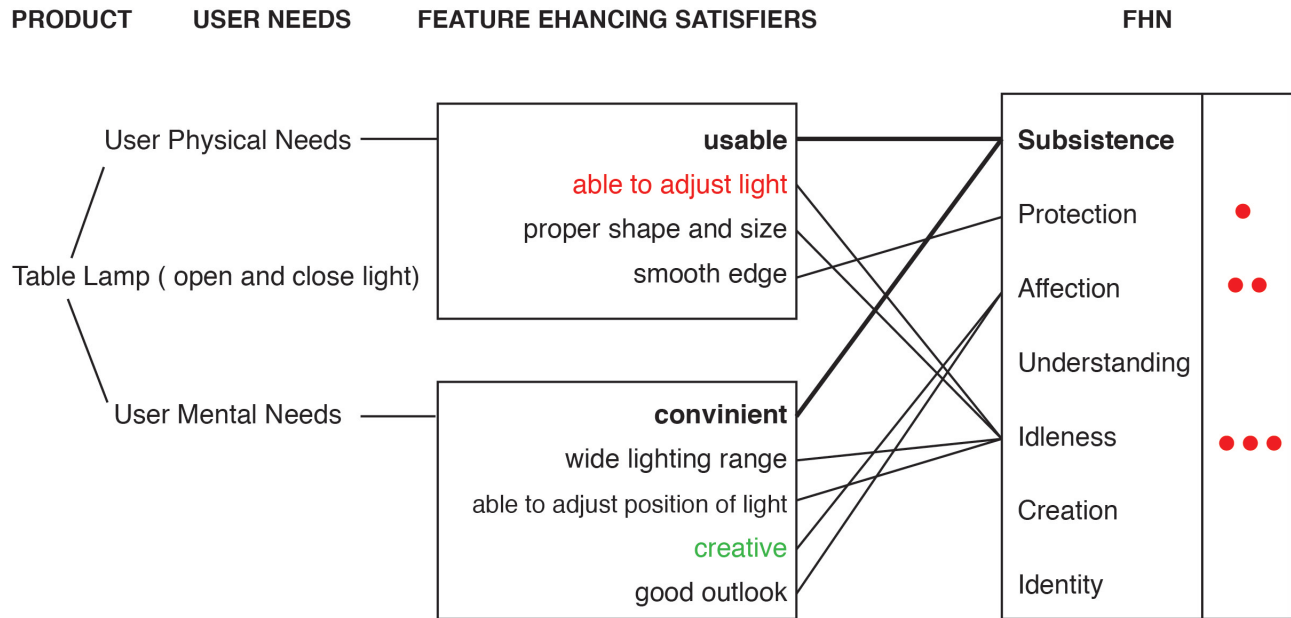


Figure 4.27: Chart of Table Lamp and Fundamental Human Needs

- Bicycle Lock Redesign

1) Problem Solving: Prevent bicycle being stolen.

2) Transferred Function: Locking Bicycle.

3) Design Intro:

Nowadays bicycle thieves are clever and they can break any kind of lock. To protect people's safety, designer designed this pedal lock, so that if this lock is broken by a thefts, there is no pedal for the thief to use to ride away.

4) Analysis based on fundamental human needs:

Bicycle and locks are a set of products that together prevent bicycle thief behavior. By transferring "sturdy locking structure" feature from the lock to the bicycle itself, this design cleverly satisfied the feature "stealing resistant" belonging to basic "protection" needs. Also, it is a good way to fulfill feature "easy storage."





Figure 4.28: Bicycle Pedal Lock. Adapted from <http://www.qiqifaxian.cn>. Copyright 2007-2014 by Qiqifaxian.cn

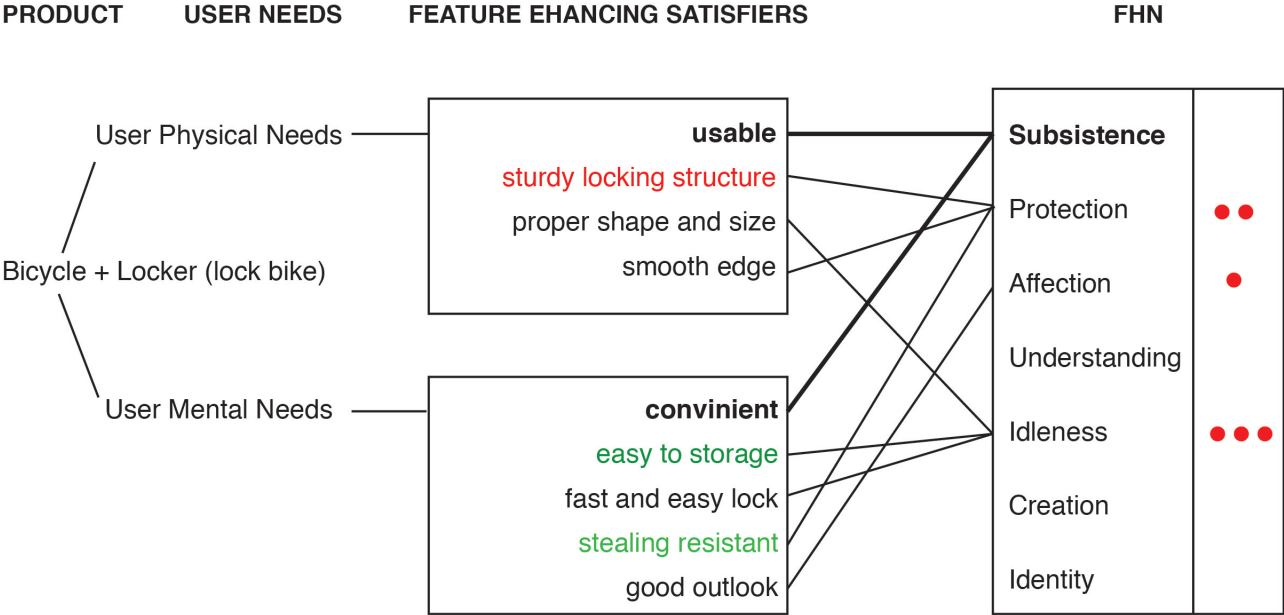


Figure 4.29: Chart of Bicycle Lock and Fundamental Human Needs

### 4.3.3 Basing on Fundamental Interaction Needs

- Potato Chips Can Redesign
  - 1) Problem Solving: Bottom potato chips are hard to remove.
  - 2) Transferred Function: Structure to easily take chips out of the can.

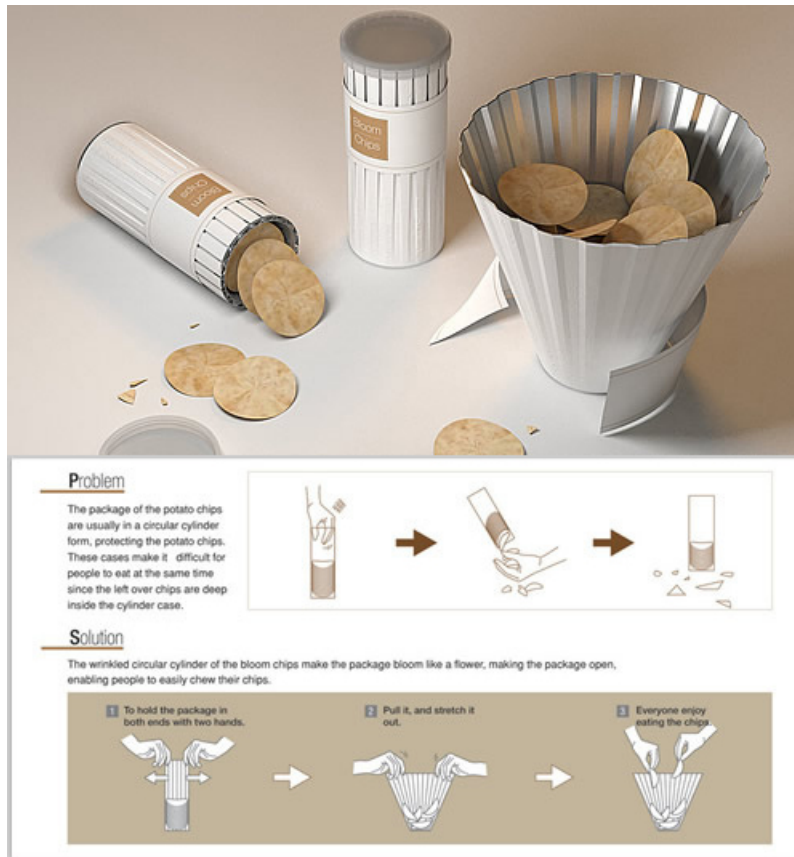


Figure 4.30: Potato Chips Can Redesign. Adapted from <http://www.qiqufaxian.cn>. Copyright 2007-2014 by Qiqufaxian.cn

#### 3) Design Intro:

When we pick potato chips out of the can we always feel inconvenienced because it is hard to get chips at the middle and bottom positions. If you hold the can upside down a little bit trying to pour the chips out, some small potato fragments will come

out and fall. Some cans of chips will have a plastic drawer to easily let chips in and out. In this case, the designer also considers that potato chips are a welcome food at a party and it is necessary to easily share them with many people. He or she transfers “taking chips out” thought to “changing the shape of bottle” and made a can which can be unfolded to become a big bowl with chips in it.

4) Analysis based on fundamental human needs:

By FHN analysis, “idleness” and “protection” are the basic needs should be mainly satisfied for a potato chips product. In this design case, the designer transfers the feature “structure to easily take chips out” from inside the structure to the can itself. In order to fulfill the feature “take chips out,” the designer abandoned “cylinder shape.” At the same time this change also fulfilled the feature “big rim of bottle.” However, this design has a shortcoming due to the feature “ability to store chips.” That means once the bottle has been unfolded, it is not easy to refold it to store chips.

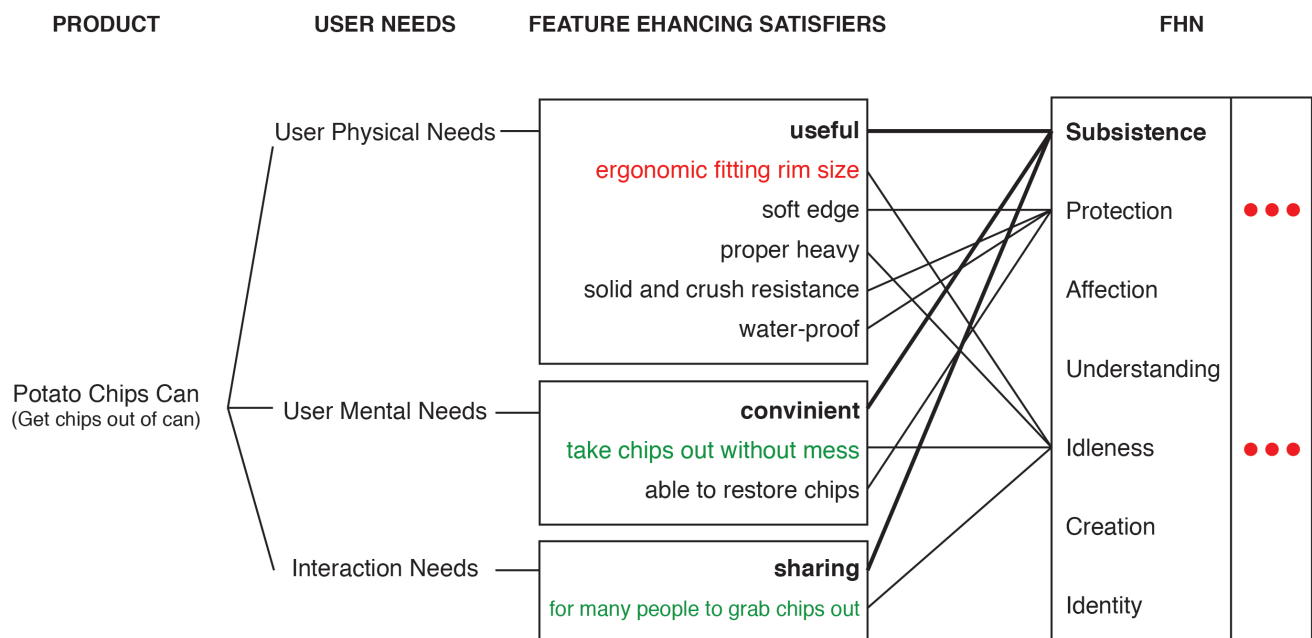


Figure 4.31: Chart of Potato Chips Can and Fundamental Human Needs

## 4.4 Approach Development of Contrary Thinking

By collecting, observing and analyzing product cases, we can gain a general idea regarding how the two approaches of contrary thinking “disadvantage manipulation” and “Function Transfer” works. Thus, more a systematic instruction of the application of these two approaches can be built as the core part of guidelines of contrary thinking.

### 4.4.1 Application of Disadvantage Manipulation

To apply disadvantage manipulation approach, the following steps are:

- Identify the key problem and target product:

The target product can be only one, two or more if they closely work together to complete an sequence of action. The identified problem is an unsolved need that needs to be written down as human mental needs in a chart of FHN analysis.

- Idea generation features.:

According to the example of the FHN analysis chart mentioned earlier, the designer brainstorms all the related features by referencing the seven fundamental human needs and categorizes them into physical, mental and (if necessary) interaction needs. The designer alone or several people can complete this process together. No duplicated or very similar features should appear in this chart.

- Observe and find features that can be changed into disadvantage feature, generating trade-off idea:

For example, in order to solve a problem, represented by feature 2 under human mental and interaction needs in figure 4.32, feature 3 under human physical needs can be turned into a disadvantage feature. However this redesign change can influence some features, becoming disadvantages too, which may influence other “fundamental human needs.” Thus, these features needs to be enhanced in a minor way or changed to

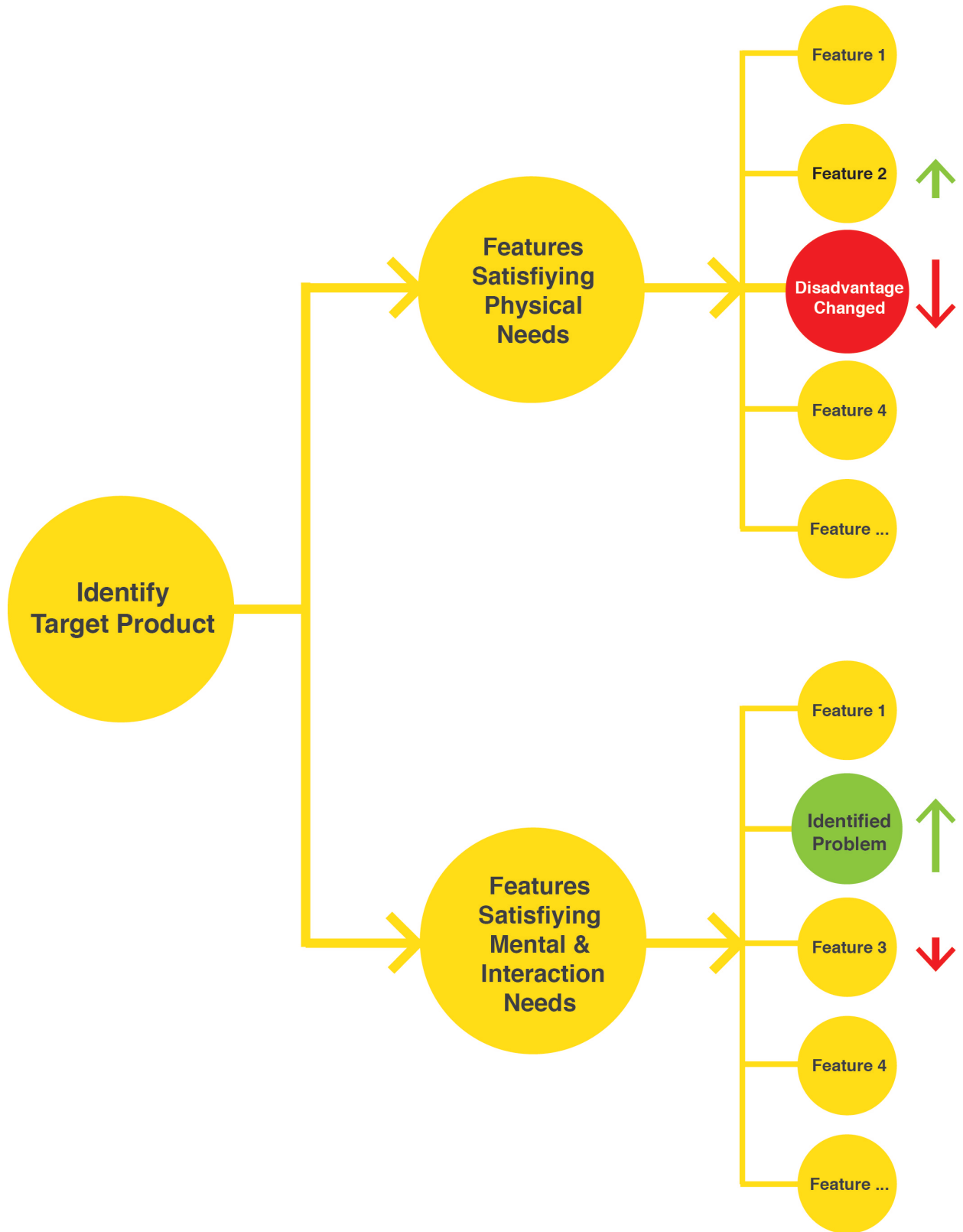


Figure 4.32: Disadvantage Manipulation Flowchart

continue satisfying related needs, such as feature 2 under physical needs in figure 4.32. But sometimes these sequence of redesign action may slightly weaken some needs, such as feature 3 under mental and interaction needs. But the designer must consider if this result is acceptable so that this feature can be sacrificed.

- Repeating step three to create several different concepts as back-up, examine them by referencing the seven fundamental human needs:

A screening process is necessary to select the best solution. By reanalyzing these ideas under a FHN analysis chart, it is easier to find out if there any change interferes with “subsistence” needs or if any change does not fitting limitations and requirements.

#### 4.4.2 Application of Function Transfer

Several steps of the function transfer approach are identical to disadvantage manipulation. To apply the disadvantage manipulation approach, the following steps are:

- Identify the key problem, target function and products:

One thing the designer needs to be aware of, when applying this approach, is that the target products need to be regarded as carriers. If there is only one product, then different parts of this product can be seen as carriers. If there are two or more products working together to complete a behavior, each product can be seen as different carriers. The reason to define “carrier” is to help the brain to separate products or parts of product to prepare for function transfer.

- Idea generation features

One or more people generate all the related features of human physical needs, mental needs and interaction needs based on the key problem, target products and related behaviors. The sequence of idea generation can reference each of seven fundamental human needs. No duplicated or very similar features appear in this chart.

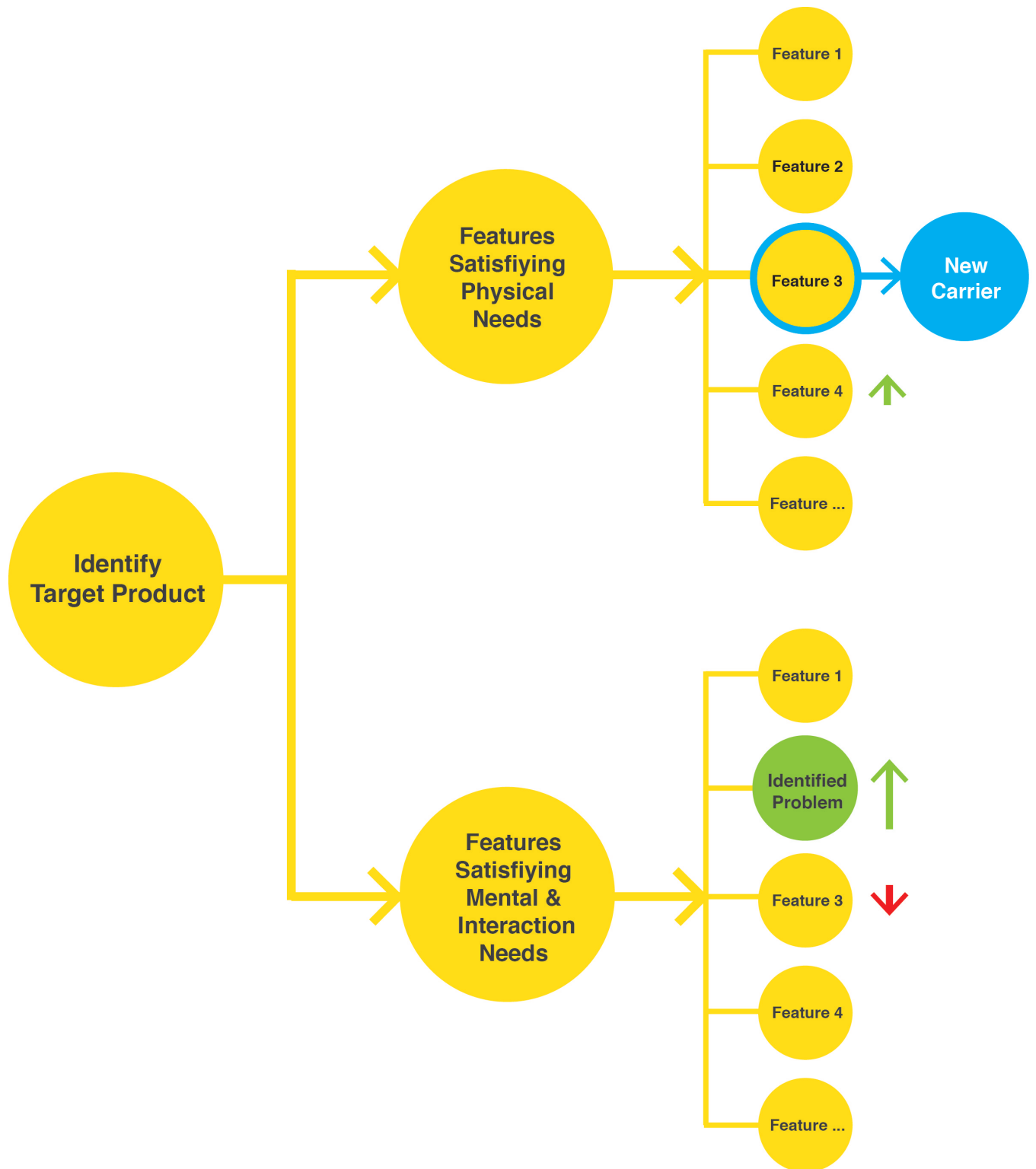


Figure 4.33: Function Transfer Flowchart

- Observe and find features that can be transferred from one carrier to another. Then, generate trade-off idea:

For example, in order to satisfy feature 2 under mental and interaction needs in figure 4.33, feature 3 under physical needs was found to be able to move from a conventional carrier to a new carrier. With this redesign change, some features will be also influenced, such as feature 4 under physical needs and feature 3 under mental and interaction needs. Feature 4 needs to be enhanced to support the transition of feature 3, but all these redesign changes cause feature 3 to not be fully satisfied. But this not a big influence compared to the main function improvement, so this design concept is acceptable.

- Repeat step three to create several different concepts as back-up, examining them by referencing the seven fundamental human needs:

Recheck ideas under FHN analysis chart, the same as with disadvantage manipulation.



## Chapter 5

# GUIDELINE OF USING CONTRARY THINKING TO REDESIGN ON THE BASIS OF FUNDAMENTAL HUMAN NEEDS

### 5.1 Scope of Application in Design Process

In Chapter three and four we have discussed the details of using contrary thinking to redesign products considered from a fundamental human needs point of view. As a guideline for designers to apply in the design process, it is necessary to demonstrate when and where is appropriate to use this approach.

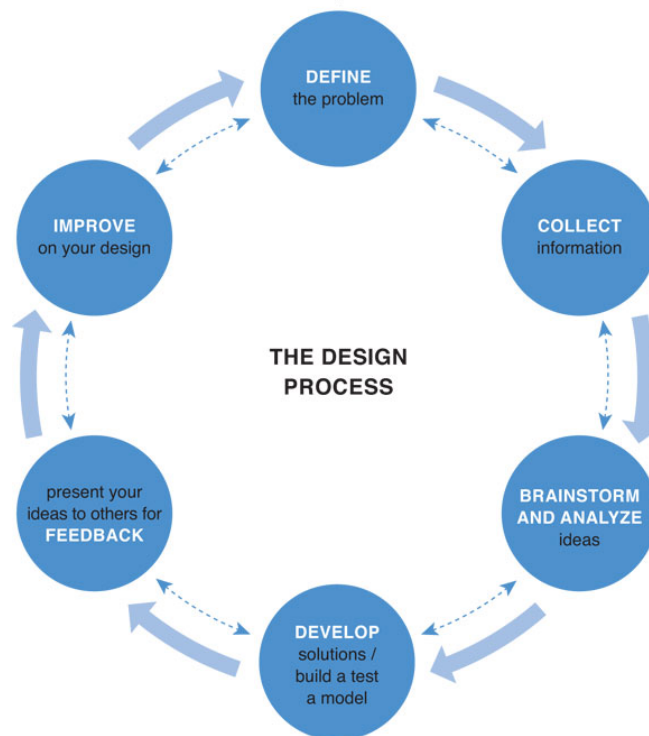


Figure 5.1: The Design Process. Adapted from Writing an Internal or External Design Brief, 2013. Retrieved from <http://showandtelldesign.com/writing-a-internal-or-external-design-brief-back-to-basics>

There are many ways of defining the product design process but most of them are very similar, such as figure 5.1, which is one of the very basic diagrams to describe the design process steps. According to the development of the approach combining contrary thinking and fundamental human needs, the goal of this guideline is to inspire designers to generate more creative ideas, evaluate all the potential ideas considering constraints and limitations, and make final several best choices for further concepts development, such as figure 5.2 demonstrates, which are all based on satisfying human needs. Thus, this guideline belongs to the step “Idea generation and analysis”.



Figure 5.2: Brainstorm Process. Adapted from 24 Weeks of Windows Phone Metro Design, Ideation and Concept, by Arturo Toledo, 2012. Retrieved from <http://ux.artu.tv/?p=206>.

## 5.2 Summary of Approach Manipulation Process

After we identify problems, understand constraints, and are ready to explore good ideas, we need to complete the two steps of the process of this “contrary thinking” brainstorm technique:

- Create the mind map by using “FHN Analysis Chart’.”

Just like we introduced in chapter three and four, in order to apply FHN Analysis approach we need to fill in three main parts to complete this chart before we brainstorm, which are “target product,” “product features” and “fundamental human needs rating.”

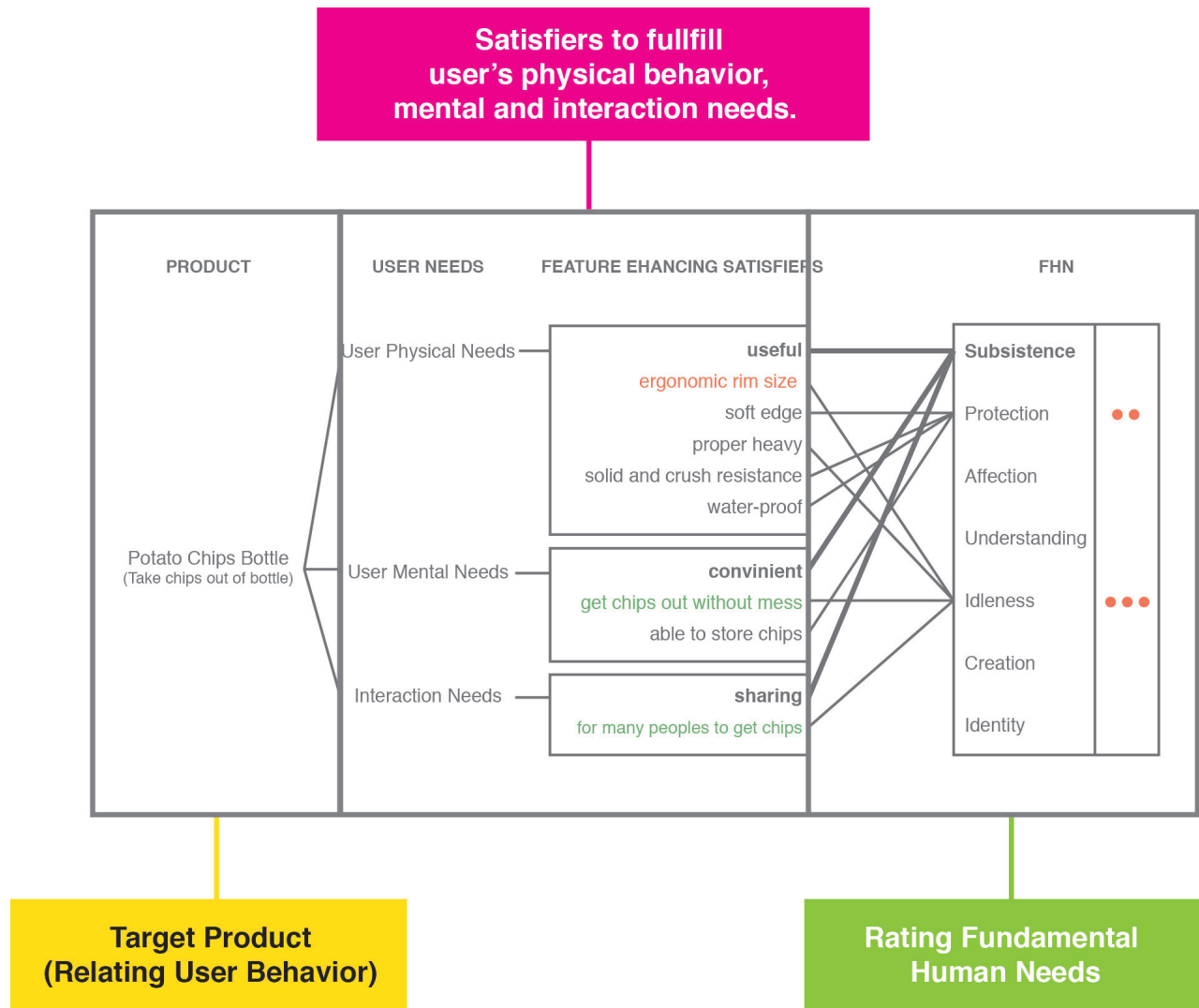


Figure 5.3: FHN Analysis Chart

1) Target Product

When we write down the target product, our mind should not just focus on a product itself; instead we should also describe the series of human actions to use this product, and write it down simply into chart under the product name for easier recall.

## 2) Product Features

Not just a random idea generation of any features, in order to help the designer to brainstorm with several guiding directions, this chart separates all the features relating to the product into three categories according to human needs, which are “user physical needs,” “user mental needs” and “interaction needs.” Some products that do not have interaction attribute can have the interaction needs section deleted, but if necessary, it also can be added.

But when we look at these three needs, a problem arises which is that different people have different understanding about these three needs. So we need definitions to guide the designer’s direction of thinking:

The definition of these three categories:

- Physical needs:

Needs related to human ergonomics and completion of actions satisfied by using a product.

Usually these needs are necessary and basic ones for a functional product.

- Mental needs:

Needs which are beyond needs satisfied by the product’s basic function are needed for improving product value and better serving users at a higher level.

Usually these needs are not have-to-be-satisfied ones considering a functional product, but their existence is necessary for fundamental human needs, such as “affection, “idleness” and “protection”.

- Interaction needs:

Needs related to interaction between human-human and human-environment are satisfied by using a product.

Just like figure 5.3, all the features in “user physical needs” are the ones that support basic completion of basic functions. But the features in “user mental needs” are the ones that are not really necessary but will provide more value to the product and better satisfy user needs. “Interaction needs” are mainly features that relate to public sharing or to environmental balance.



Figure 5.4: Features Generation by Using Different Color Notes. Retrieved from <http://interactiondesign.sva.edu>

In practice, the designer can do this brainstorm him or herself or ask a group of people, using different colors of sticky notes to separate the three human needs.

### 3) Rating Fundamental Human Needs

No matter how all the features are written down, by categorizing all the features into seven fundamental human needs we can clearly understand two points:

- What needs have to be satisfied.
- What needs are not very important, but may have potential.

Thus, the value of this rating process is that it guides the designer’s direction of thinking and discovers potential design directions.

- Generation of different features through transformation by using contrary thinking approaches.

According to the detailed development of contrary thinking approaches “disadvantage manipulation” and “function transfer” in chapter four, designer can try these two approaches by randomly combining different features notes to brainstorming, such as figure 5.5.



Figure 5.5: Idea Generation. Retrieved from <http://www.creative-constructs.com/sticky-note-ninjitsu>

The redefinitions of the two approaches are:

- Disadvantage Manipulation Designer uses one or several relatively disadvantaged features in the product to achieve better design.

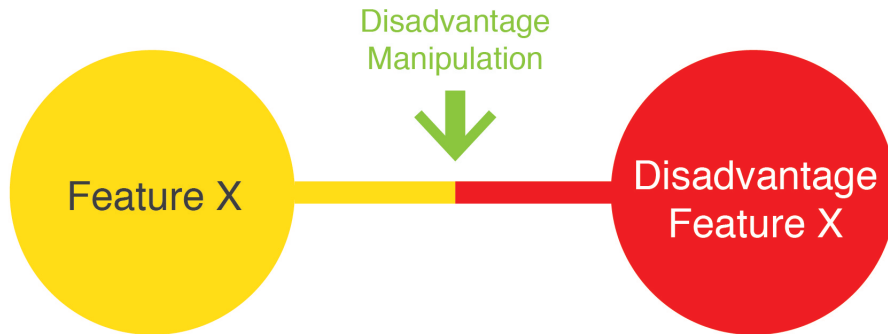


Figure 5.6: Simple Disadvantage Manipulation Diagram

- Function Transfer

The designer transfers a certain function from one part of the product to another part of the same product, or between a set of products that are usually used together. During this process, parts of the product or one of set of products can be abandoned or added.

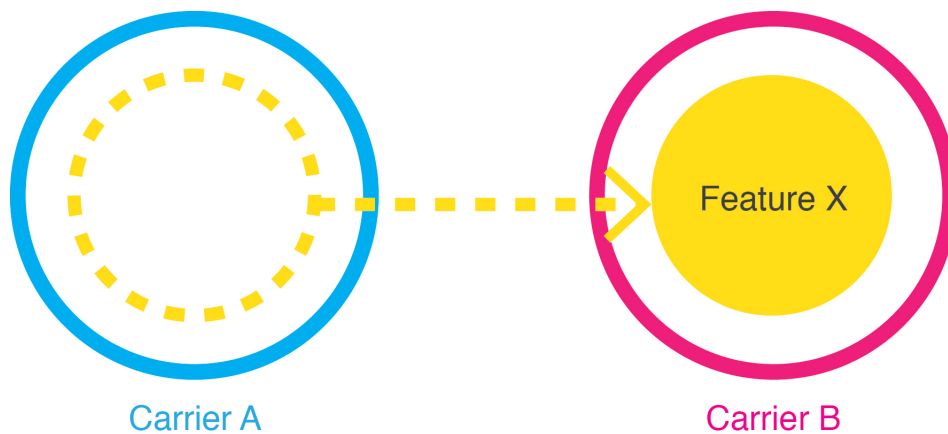


Figure 5.7: Simple Function Transfer Diagram

The specific steps of applying these two approaches are in chapter four. By all these series of actions, the designer can fully stimulate his or her creativity and imagination. Good ideas then can be generated.

### **5.3 Limitations**

In former sections, sixteen product redesign cases has been detailed analyzed to prove the design result of applying contrary thinking techniques based on FHN analysis is convincing and creative. However due to the limited time for this research, more designer testing are needed to be further set up to demonstrate the application effect on different designers with various design ability and knowledge of design. The result also need to compare to the result of same group of designers when they use other idea generation approaches and the result of same group of designer when they doesnt use any approach, although the comparison test has certain difficult to control influence of various.



## Chapter 6

### FINAL DESIGN BY APPLICATION OF GUIDELINE

#### 6.1 Coat Rack Redesign

##### 6.1.1 Design Opportunity

Coat rack is designed for users to hung their clothes when they come back home, which is convenient for temporary cloth storage. But usually people do not wear the same cloth everyday, so many of them will put on other clothes instead of the one hanging on the coat rack. After days go by, there will be more and more clothes hanging on the coat rack and people usually will forget to take them off of it. So a traditional coat rack lacks a feature that can remind people to wash or to wear the clothes on the coat rack, which can help users having a good life habit.



Figure 6.1: Coat Rack with Many Clothes on It

### 6.1.2 Design Thinking

By using approach of fundamental human needs analysis, chart 6.2 was created for creative idea generation. After writing down as many features as possible that related with design target, according to disadvantage manipulation approach, feature “stable” can be traded off. By weakening the stability at visual level of the coat rack and enhancing the stability at physical level, feature “good cloth storage habit” as the design target can be achieved and it also can refresh users’ knowledge of conventional coat rack stand.

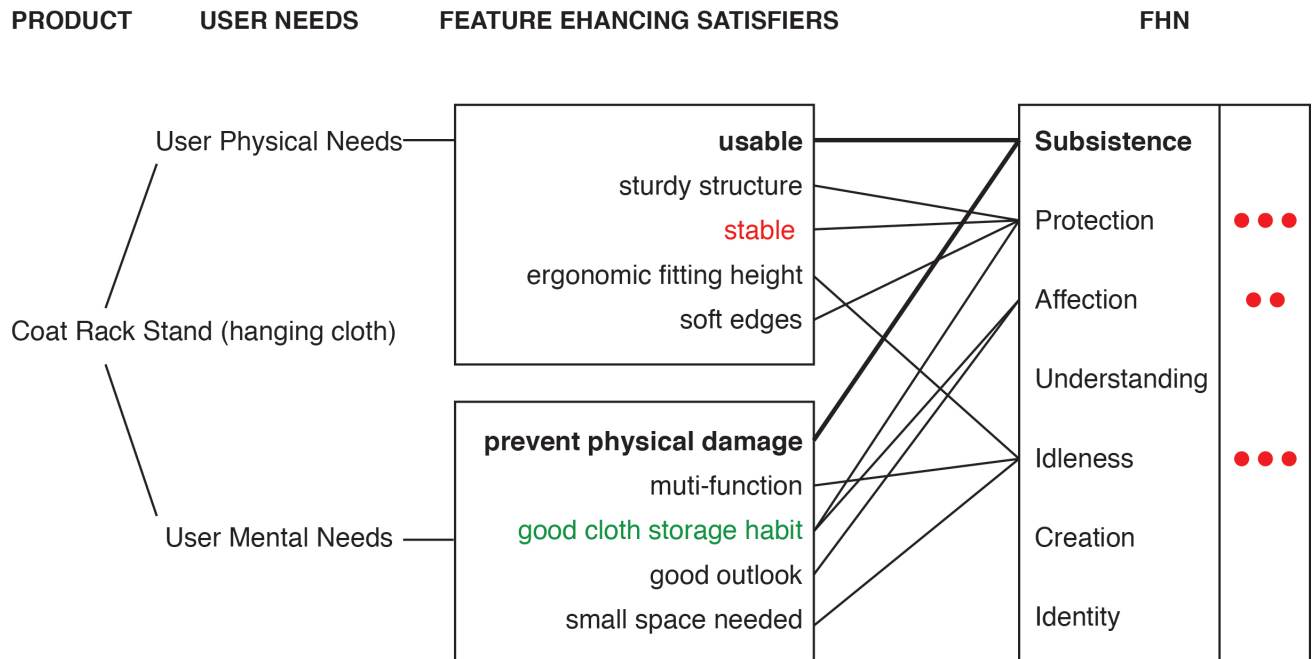


Figure 6.2: FHN Analysis of Coat Rack

Just like when people see the tree with snow on it in figure 6.3, they have a potential tendency to adjust things back to straight or stable. So a stable coat rack stand with an unstable visual look can help this redesign to achieve the design goal.



Figure 6.3: Inspiration of Coat Rack Redesign

### 6.1.3 Concepts Development and Sketches

Figure 6.4 is the sketches of idea development. The main goal is to design a “unstable” appearing coat rack stand with a stable physical structure. Figure 6.5 shows the three sketches of final concepts.

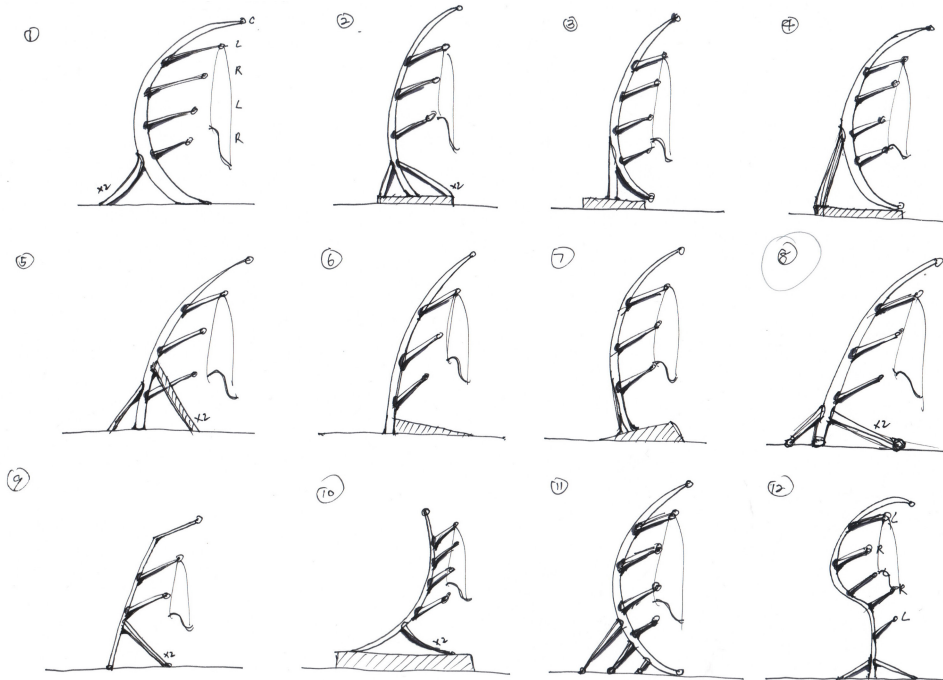


Figure 6.4: Ideas Development

### Coat Rack Stand Concept 1-3

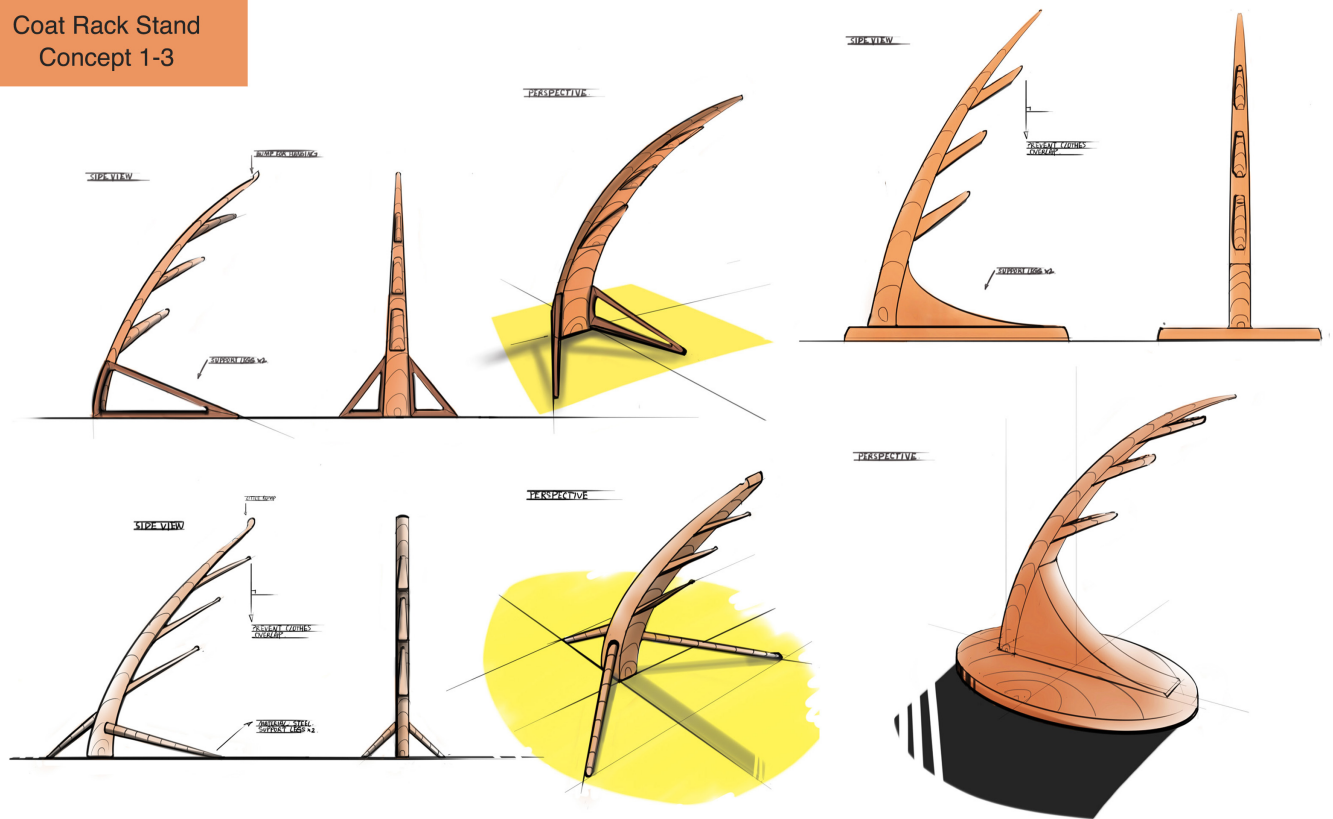


Figure 6.5: Final Concepts

The key points which has to be considered into this design are not only making it looks “unstable”, but also controlling the minimum space occupied by the coat rack, avoiding any potential danger and keeping the aesthetic appearance.

#### 6.1.4 3D Model and Final Rendering

The material of the main body of coat rack is wood and the material of the base is acrylic. Steel nails, wood glue and tongued-and-grooved joint structure are applied to make the design more stable. The reason of choosing clear acrylics as the material of base part is that in this way, user can focus their attention on the wood part, which is visually unstable. And the clear acrylics are responsible for making the whole structure stable. Figure 6.7, Figure 6.8 show how the steel nails and tongued-and-grooved joint work in this design.

### 6.1.5 Design Benefit

Comparing to other coat rack design, this redesigned coat rack has a better configuration about guiding user to have a good cloth storage habit, which better fulfill the “affection” fundamental human need. The reason why a good habit should be classified into “affection” is that a good habit will lead user to have a better living environment and a positive attitude, which will increase user’s affection feeling. Thus, we can say that this redesign has better design benefit than usual coat rack for the function of guiding user’s live habit.

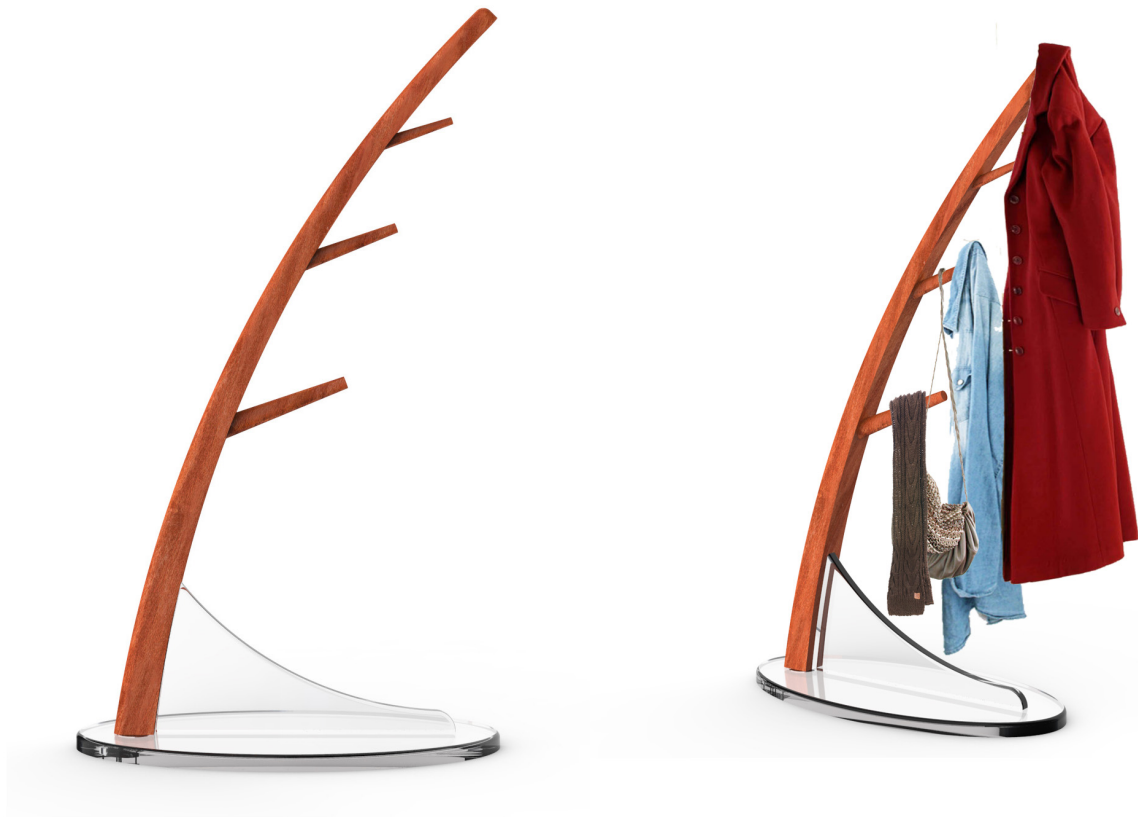


Figure 6.6: Appearance of “Falling” Coat Rack



Figure 6.7: Tongued-and-grooved Joint and Branches Structure

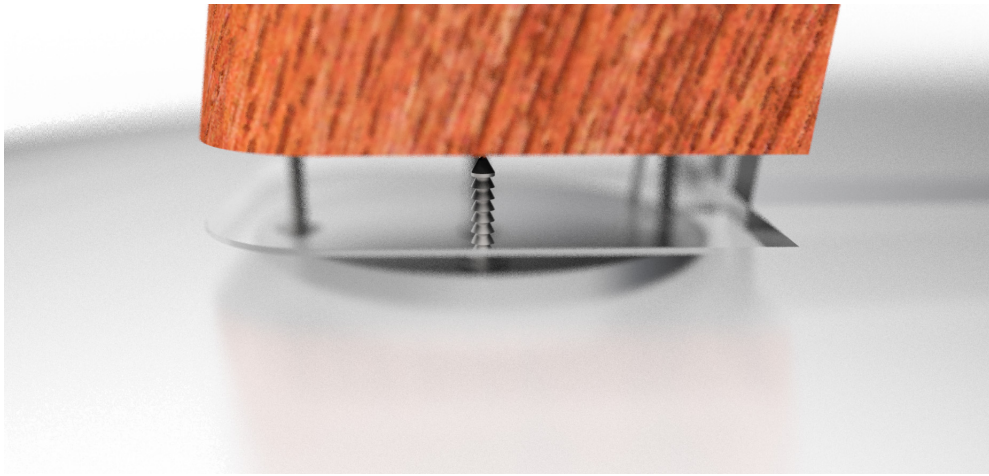


Figure 6.8: Bottom Installation

## 6.2 Floor Lamp Redesign

### 6.2.1 Design Opportunity

Usually, floor lamps are designed with an up or a down or two sides direction of light of the lampshade, which are unchangeable. And usually the way of changing light direction usually relies on steel support structure, like the lamps in figure 6.9. In order to change users' conventional behavior and provide a different way of changing light direction of a floor lamp, there is an interesting design opportunity to redesign the lampshade.



Figure 6.9: Usual Floor Lamp

### 6.2.2 Design Thinking

By using the approach of fundamental human needs analysis, chart 6.10 demonstrates the related features of lamp according to the design target “different way to change light direction.” In this chart, by applied function transfer approach, feature “adjust light direction” is transferred from support structure to lampshade, which fulfills the “proper light” that belongs to idleness of human needs.

Inspired by the Chinese product fan in figure 6.11, the lampshade can be redesigned to have a similar folding structure to create a changeable lamp shade, which can change the light direction according to user’s different needs.

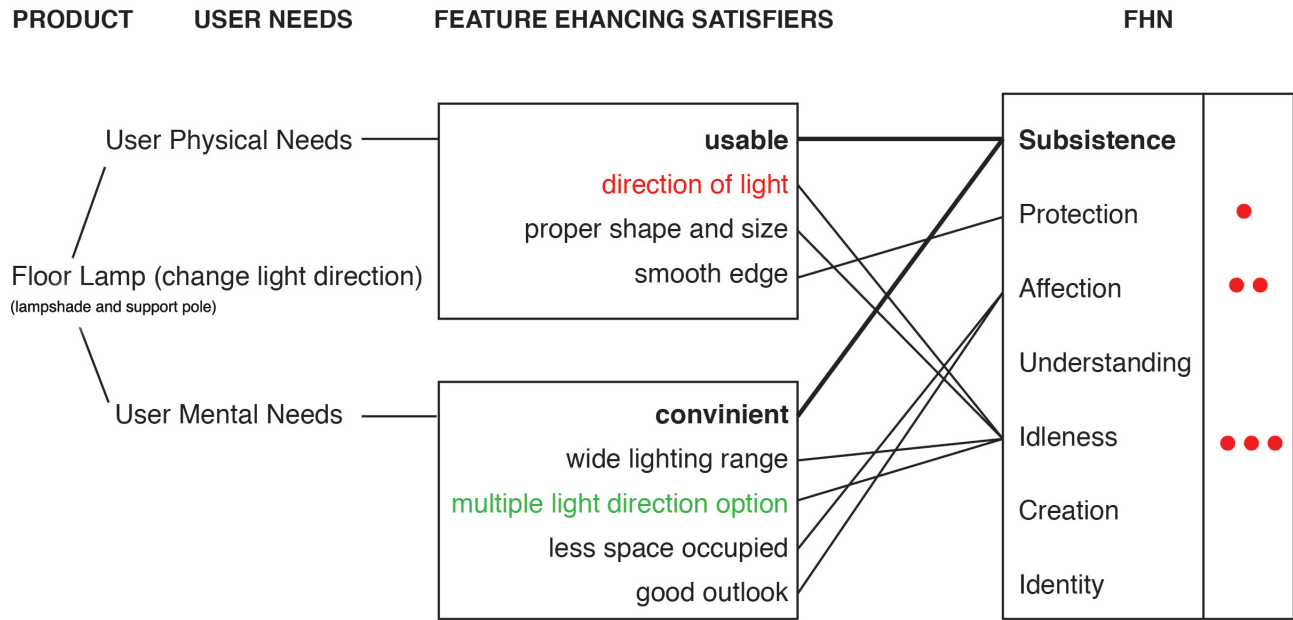


Figure 6.10: FHN Analysis of Floor Lamp



Figure 6.11: Inspiration of Floor Lamp Redesign

### 6.2.3 Concepts Development and Sketches

To achieve the design purpose, which is redesigning lamp cover to control the light direction, many assumptions and brainstorming concepts have been created.



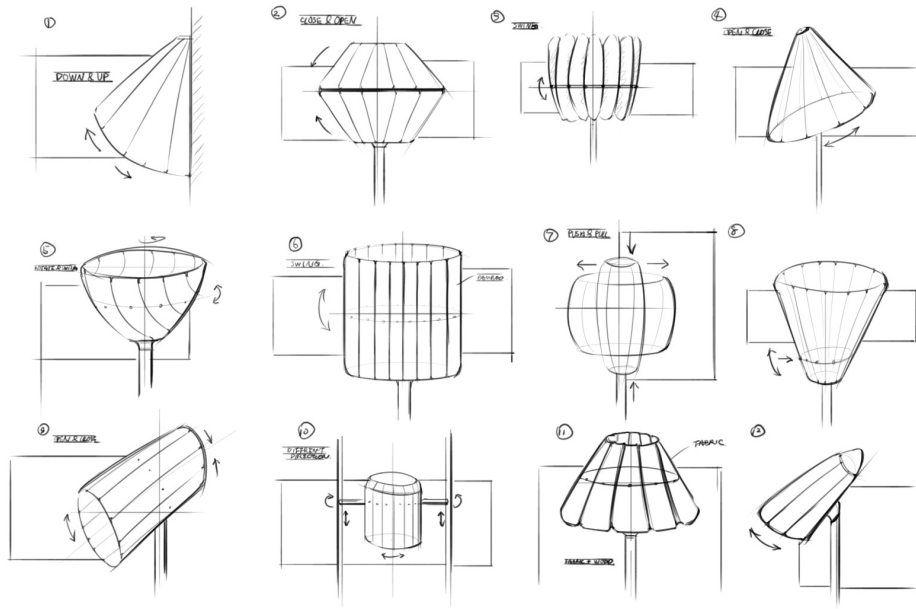


Figure 6.12: Idea Generation

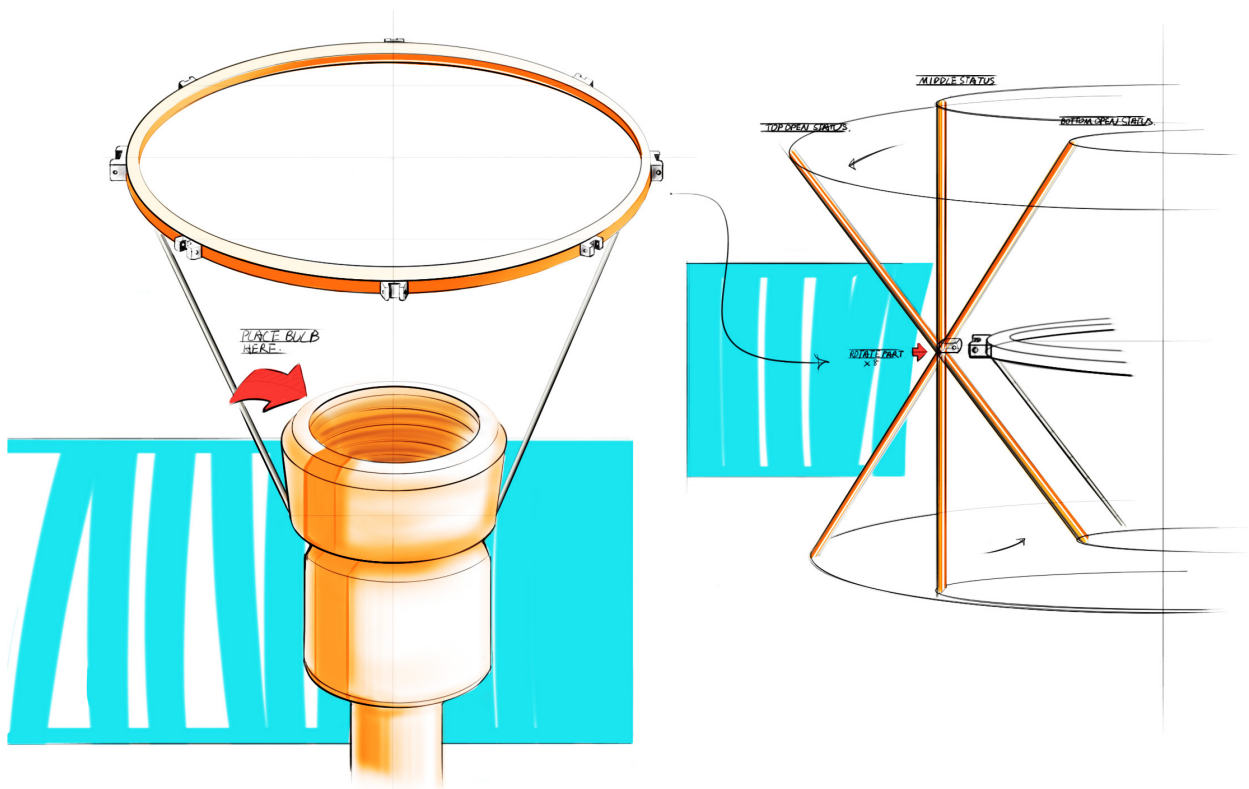


Figure 6.13: The Structure Configuration of the Final Concept

The majority of these concepts are basing on dividing a lamp cover evenly into several parts. By creating joints, these parts, made by wood, bamboo or fabric, can sway between certain degrees. Based on this thinking, more diversity designs can be created to play around controlling light direction. Considering the common sense that it is better to keep a product easy to use with delicate details, concept 11 is a good choice for final concept development.

#### 6.2.4 3D Model and Final Rendering

Figure 6.14 demonstrates three status of the lamp shade of the same lamp. All the material except the lampshade part is designed to use steel and plastic with wood color paint. The material of the lampshade is fabric with proper hardness.

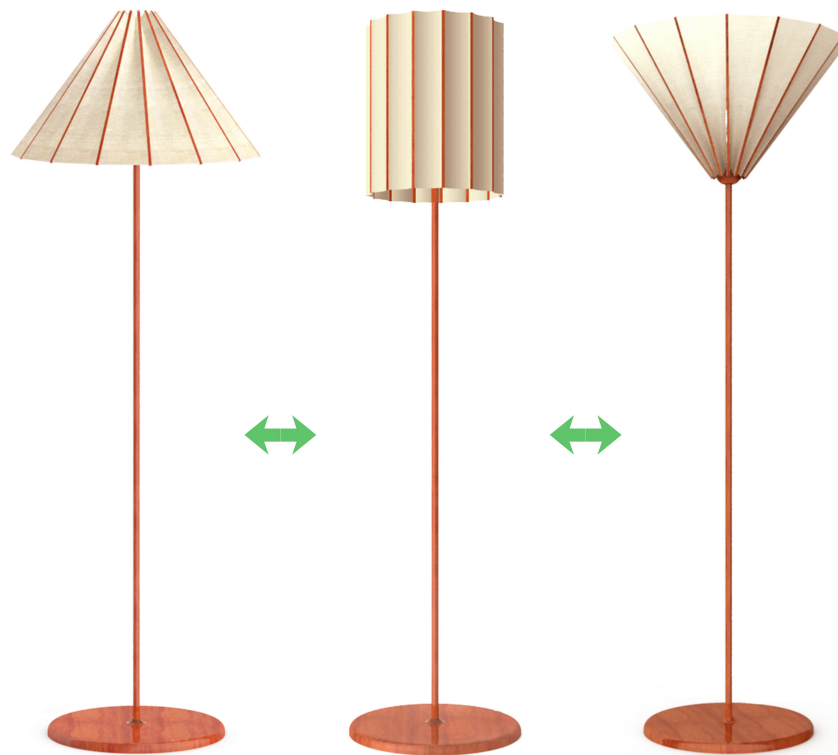


Figure 6.14: Floor Lamp with Foldable Lamp Shade

Figure 6.15 shows the detail structure of the lampshade. There are fifteen fulcrums on the plastic circle connected with fifteen plastic sticks, which are used for holding and

changing the fabric lampshade. Thus, by dragging the top or bottom area of the lampshade, a user can easily change the shape of the shade and then change the light direction.

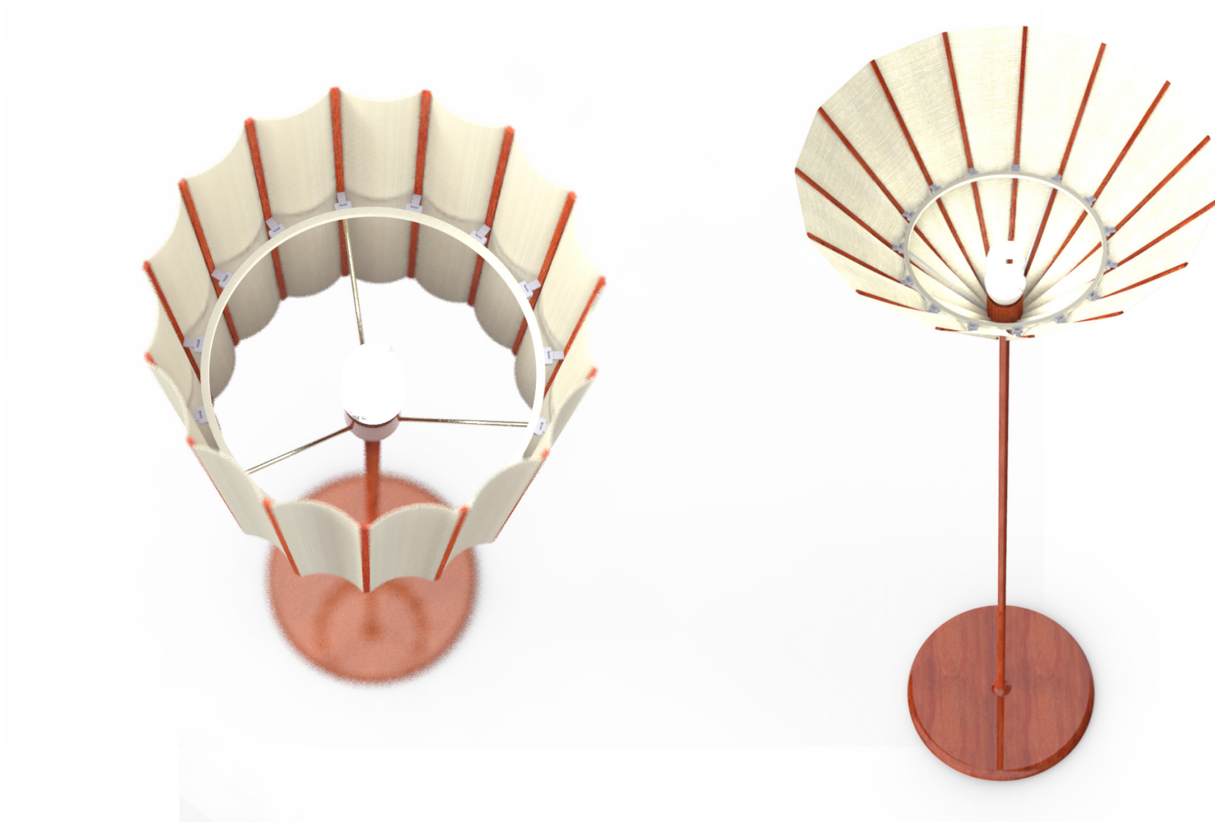


Figure 6.15: Inside Appearance of Lamp Shade

The fabric of lampshade should not be too soft or too hard. Because if the fabric is too soft, the lampshade will lose the beauty and it also will influence the effect when top or bottom area of fabric fold together. If the fabric is too hard, it may cause the top or bottom of fabric to not fold together. Folding status is shown in figure 6.16.

Figure 6.17 is a close shot of the detail of the fulcrum structure. These small fulcrum structures can be printed on a 3D printer to make a full-size model.



Figure 6.16: Fabric Folding Status



Figure 6.17: Detail of Folding Structure

### 6.2.5 Design Benefit

The design benefit of this floor lamp redesign is that it better fulfill user's need for having multiple light direction option from one lamp. It is not only provide a downward light for reading, but also a up and down kind of all way through light and a upward light. The first one has more functional meaning, and the last two have more stylish values. And all these at some level save the effort or bring user a convenient to have more design feature from one product, so that this redesign better fulfill the fundamental human needs which is "Idleness."

## 6.3 Library Table Redesign

### 6.3.1 Design Opportunity



Figure 6.18: It is not healthy to Sit for A Long Time

Everyone has experienced after a long time sitting on a chair, his or her whole body feels wrong. It is not a good habit to sit hours without standing up or walking around a little bit. But due to some reasons, such as a paper has to be finished in a day or other deadline is coming, people will choose to have waist pain rather than failing to finish their

work in time. Thus, a workspace for people standing to read book or work on computer is necessary, although it is not as comfortable as sitting on chair. But still, standing to work on a high table is a little bit tiring, so that the function “lean against something” need to be included.

### 6.3.2 Design Thinking

This design combines the two approaches of contrary thinking, which are disadvantage manipulation and function transfer. Firstly, the feature “ergonomic fitting for sitting” is traded off by “prevent long time sitting”, which create a disadvantage feature “not comfortable” for guiding users toward to a better life behavior. At the same time, in order to reduce the “not comfortable” feature, this design will transfer the function “lean against chair back” to table itself. By trading off these functions, this design can fulfill users’ protection and idleness needs.

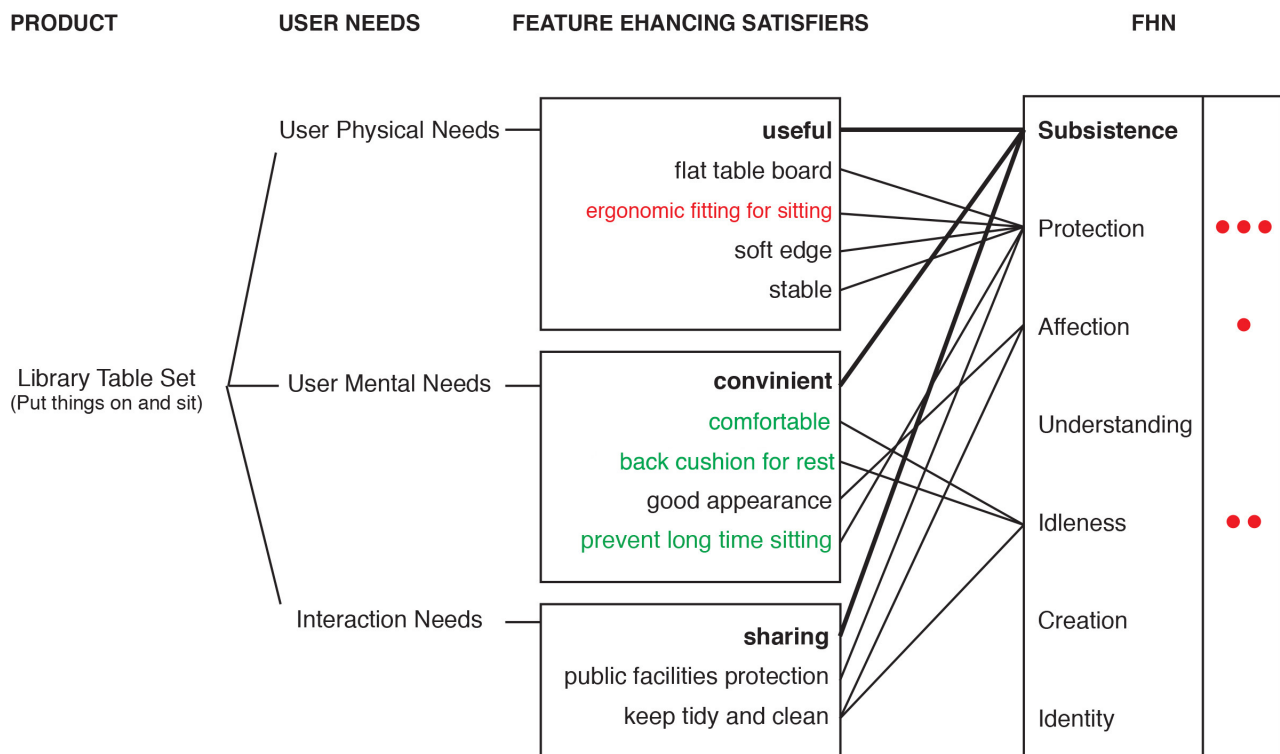


Figure 6.19: FHN Analysis of Library Table

### 6.3.3 Concepts Development and Sketches

The general shape is to design around the user so that many circle features are included. According to the waist thickness of the standing position of 95 percent of people, which are collected in book *The Measure of Man and Woman: Human Factors in Design*, it is necessary to design a movable top board to fit 95 percent of users. At the beginning, there are two thoughts to make the top board move back and forth. One is to move toward the front; the other is to move along the side of left top board. The advantage of the second one compared to the first one is that it will avoid finger injuries and any items being stuck into the slot between left board and top board.

Figure 6.21 shows the idea generation of bottom supporting structure. The two final concepts on the right corner at the bottom will be made into scale models for further testing. Figure 6.22 is the sketches which demonstrate details of the design.

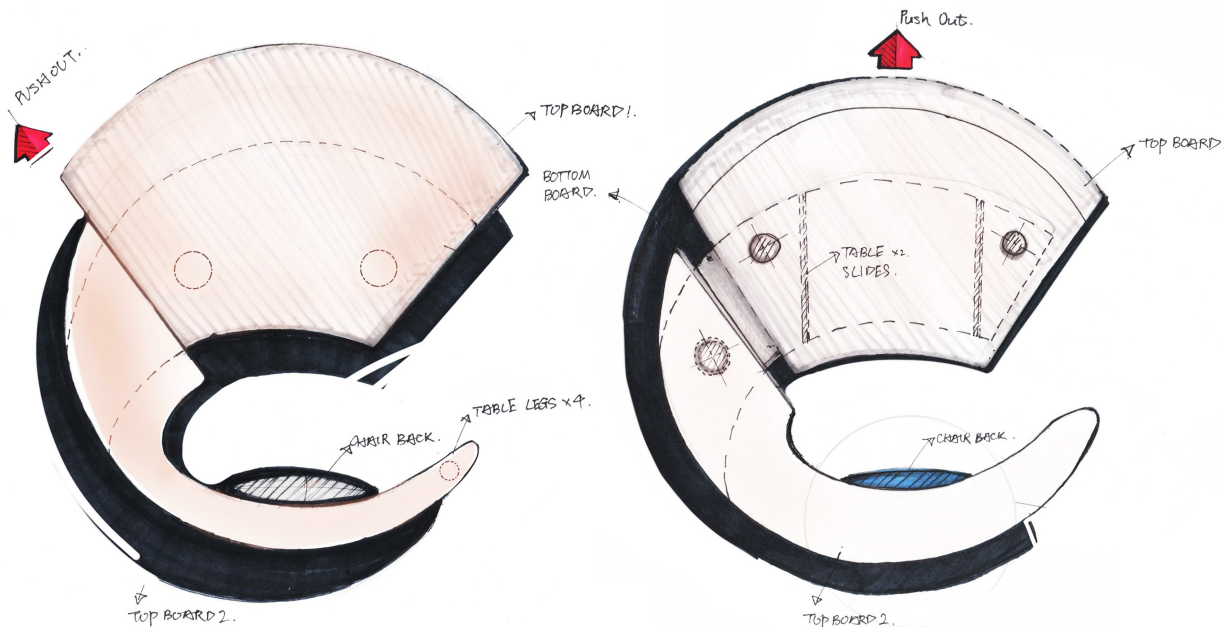


Figure 6.20: Top Boards Structure Configuration



Figure 6.21: Supporting Structure Configuration

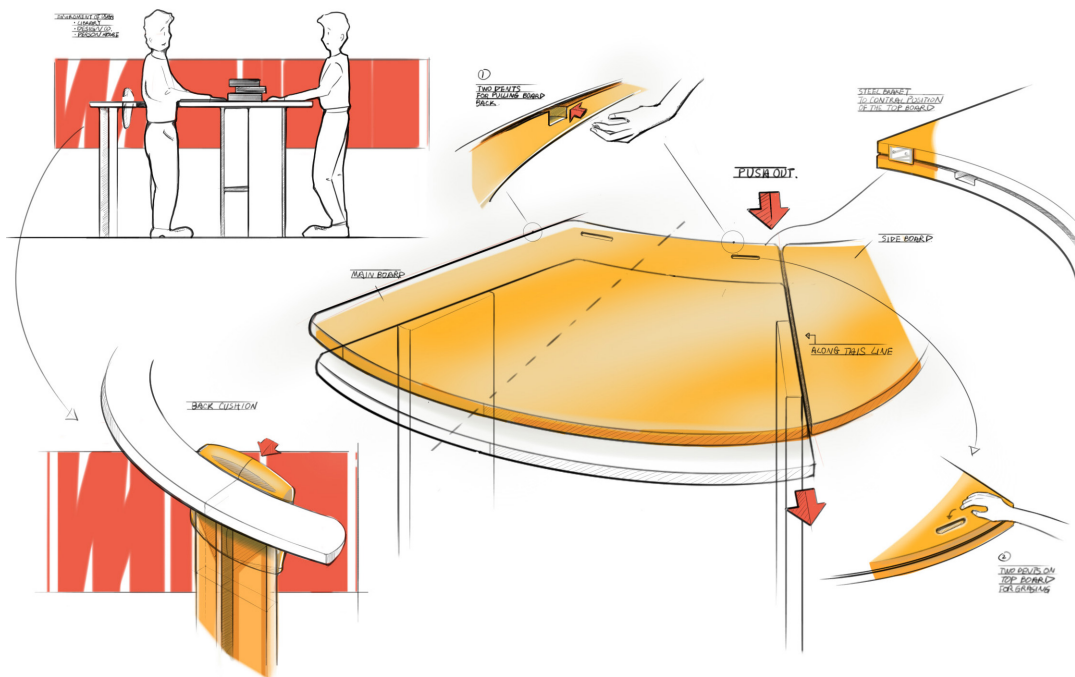


Figure 6.22: Details Structure Configuration



### 6.3.4 Final Two Concepts Scaled Model Test

There are two different supporting structure demonstrated by the scaled models. Figure 6.23 and figure 6.24 are the photos of scaled model of concept A, and figure 6.25 and figure 6.26 are the photos of scaled model of concept B.

Concept A contains many perpendicular structures at the supporting area, and the asymmetrical form provides the whole table a different sense of beauty. Concept B is more simplified than concept A. The position of two support boards under the main table board and the one support board at the pillow area creates an isosceles triangle shape, which is strong enough to hold three table boards to 43-inch height. And concept B uses less material than concept A, which can lower the price of material cost.



Figure 6.23: Scaled Model of Final Concept A



Figure 6.24: Scaled Model of Final Concept A



Figure 6.25: Scaled Model of Final Concept B



Figure 6.26: Scaled Model of Final Concept B

### 6.3.5 3D Model and Final Rendering

Figure 6.27 and 6.28 shows the two status of this library table. All the dimensions are designed reference to ergonomic book *The Measure of Man and Woman: Human Factors in Design*, the dimensions allow the majority of users to walk in and out. Figure 6.29 shows the different perspective of views of this design.

Figure 6.30 and figure 6.31 are detail rendering and exploration rendering of the table.

From the exploration figure we can see that there are three top boards; two of them are above another one that has two grooves for installing two drawer slices. And the two drawer slices connect with top right board, which will complete the movable structure. The left top board not only connects with the board with grooves, but also fixes with a wood vertical board with a soft thin leaning pillow. This part is designed for user to lean against for rest. The installation does not uses no nails. All the connections between each part rely on tongued-and-grooved joint structures, wood glue and wood sticks.



Figure 6.27: Top Board Opening and Closing Status in Perspective View



Figure 6.28: Top Board Opening and Closing Status in Top View



Figure 6.29: Top Board Opening and Closing Status in Left and Back View



Figure 6.30: Design Details around Drawer Slides Area



Figure 6.31: Exploration View

### 6.3.6 Final Full Scale Model

The full size model of the library table took about one month to finish. The following figures presents the process of working and photography of the final model.



Figure 6.32: Board Cutting by CNC Router Machine

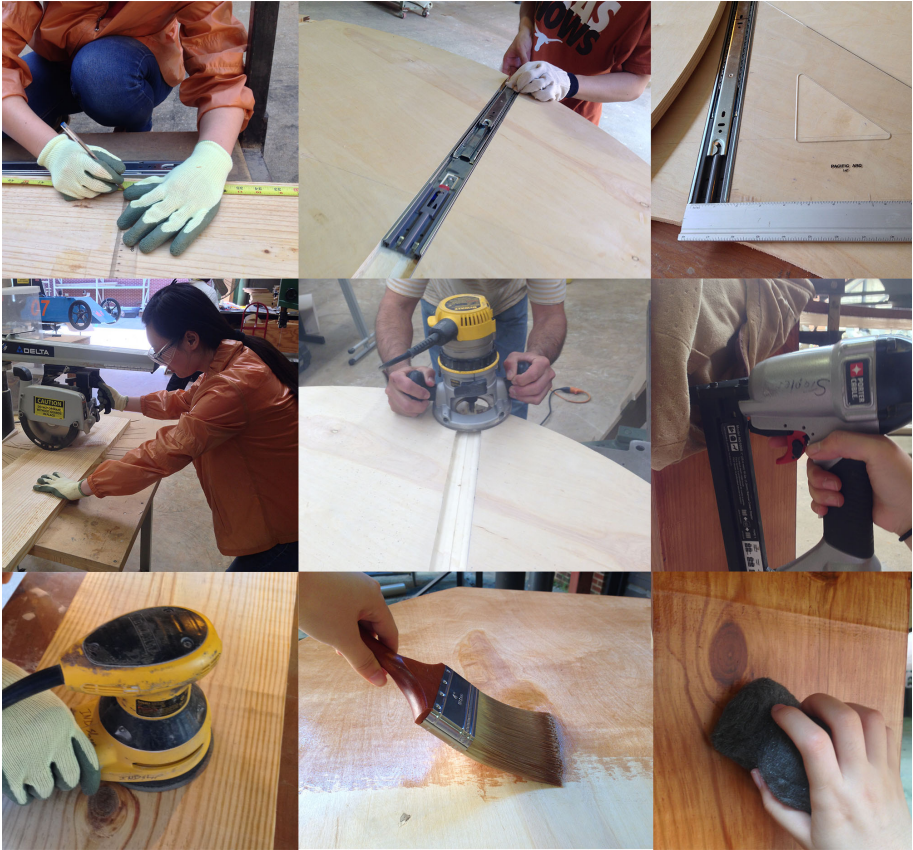


Figure 6.33: Model Making Process





Figure 6.34: Perspective View



Figure 6.35: Front View and Cushion Area View



Figure 6.36: Dents for Dragging Top Board and Steel Plate for Stopping Top Board



Figure 6.37: Table in Used

### 6.3.7 Design Benefit

Bad living habit will cause bad impact on our health. This library table redesign aims to create a standing use table that can prevent user from sitting for a long time without any body stretch, which is harmful for our blood circulation and it will cause many diseases. This design feature fulfill our “Protection” in fundamental human needs, but afterall it will be tired if we stand there for a long time. So that in order to decrease this disadvantage, feature “back cushion” is designed to fulfill user’s another fundamental human needs, which is “Idleness”. So there is a balance composed by these two needs satisfaction.

## Chapter 7

### DISCUSSION AND CONCLUSIONS

This thesis aims to develop a guideline of creative idea generation by applying contrary thinking into design process. The purpose of this guideline is to help designers have a more systematic and rational thinking for creative idea generation. Basically, there are three key words to guide and limit the whole thesis developing, which are fundamental human needs, redesign and contrary thinking.

This research begins with an in-depth discussion of the relationship between human needs and products. Basing on Max-Neef's theory of fundamental human needs around human scale development area, a reclassification of fundamental human needs for product design has been created. The reason of coming up with this reclassification is that instead of randomly brainstorming for creative ideas, the designer trades off and plays around with an amount of features systematically, which are designed into products for human needs satisfaction purpose, can create a screening process. This allows more ideas can be got and prevents from missing many good ones. Thus, first part of the guideline has been developed in chapter three, which named "FHN Analysis Approach."

Based on the FHN analysis chart, the second part of guideline can be generated. In chapters four and five, contrary thinking is redefined to fit product redesign. By using its two techniques, which are "disadvantage manipulation" and "function transfer," product features brainstormed by FHN Analysis can be strengthened or weakened for achieve a certain design purpose. A number of existing product design cases have been analyzed by contrary thinking approach to test if contrary thinking works in the way summarized in this thesis, and if the design results are creative, effective and fulfill the fundamental human needs.

Although the key word "redesign" in this thesis does not have as direct a relation with guiding functions as the other two key words, it is brought up mainly to constrain the range of types of products discussed in this thesis. Due to the fact that the existing design cases analyzed show contrary thinking usually works as a redesign approach, there is not enough evidence to prove that it can also effectively work as a new product invention approach. Further research is needed for future analysis.

The final three product designs in chapter six aim to prove the guideline of the two techniques of contrary thinking. The coat rack redesign intends to test the technique "disadvantage manipulation," the floor lamp redesign intends to test the technique "function transfer," and the library table redesign intends to test the effect of combining these two techniques. Compared to the traditional use product, all three final designs relatively solve identified problems better or bring users a different using experience.

Designers can explore more applications of FHN Analysis and two contrary thinking techniques, as following suggestions:

1. Designer can play around with the combination of the two contrary thinking approaches, such as two parts of a product are designed based on A approach, and another one part designed based on B approach.
2. Designer can try different areas of products using this guideline to evaluate the effect of creative design, such as UI design and service design.
3. Designer can be trained in use of FHN analysis chart for idea generation, such as focusing on the needs "identity," "understanding," and "affection" to redesign any product chosen.

In the future, more observation and tests of these sets of approaching are needed. Experiment can be set up as following:

1. Up to 50 designers need to be chosen randomly for further testing.
2. Choose a design topic of product. Need to set up three groups of approach application for comparison. First group, no idea generation approach allowed for designers. The

Second group, designers will apply the approach developed mentioned in this thesis into idea generation. The third group, designers will apply other kind of idea generation approach into their design process.

3. In each group, vote their design products by evaluating their creative level. Compare results of these three groups of testing and get the conclusion.

4. If needed, several more times of the same test with different design topics are going to be set up for more accurate result.

The difference between design results with and without the use of this idea generation approach, or with the use of other idea generation approach, should be fully test and compared. However we should notice that there are many variables in this experiment that influence the outcome of this experience. Three of them are explained in the following texts, but more variables are needed to be concluded in the future:

1. The order of these three groups of testing. Which approach is applied by designers first will change the judgments when designer apply another approach. So multiple tests should be set up and results be compared.

2. The different levels of design ability of designers. It is important to choose designers randomly and to control these designers design abilities to avoid test errors.

3. The knowledge of the target design product. The product chosen to be the design target should not be too complicated or too popular for certain group of designers, in which case the knowledge of the target product will differ too much among designers.

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