

**An Approach to Design Products Helping
Children Develop Habits**

by

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A thesis submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Master of Industrial Design

Auburn, Alabama
August 3, 2019

Keywords: Habits, Behavior, Children, Product Design

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Abstract

Habits are important in our life. More than 40% of human's daily behaviors are decided by their habits. Parents are always looking for ways to help their children build good habits. Therefore, products that can help children develop good habits are needed. In the thesis, what habit is and how it can be formed are studied. Children's physical and psychological development are both researched. In the end, an evaluation method is given for designers to assess how their products can possibly help children develop habits.

Acknowledgments

It has been three years since I came to Auburn University. Luckily, I have been helped by lots of people. Without their love and support, I would not have been able to make it.

I would like to thank my major professor Tin-man Lau for his support and advice during my master's study. What I have learnt from you will benefit me forever.

I would like to thank my committee members Professor Rich Britnell and Professor Christopher Arnold for their great patience and professional advice.

I would like to thank my friends at Auburn for their encouragement.

At last, I would like to thank my parents for their unconditional love and care for me.

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Chapter1 Introduction

1.1 Problem Statement

Habits are important parts of our life. A habit is a routine of behavior that is repeated regularly and tends to occur subconsciously (“Habit”, 2019). More than 40% of human’s daily behaviors are decided by their habits. The Confucian Analects say that the differences in the characters of people are chiefly owing to habits. Because of massive repetition and unconsciousness, these behaviors usually bring people unexpected effects and outcomes. Therefore, habits formed during one’s childhood can have life-long effects, which makes it important for people to develop good habits when they are young.

Based on these reasons, parents are always looking for ways to help their children build good habits. They hope young children can live up to social and cultural expectations and behave in appropriate ways, so then their children can have a better life in the future.

So as designers, we can provide a new way for parents by designing products which can help children develop good habits. Young children gain cognitive maturity by interacting with the social world and acting upon the physical world (Rodd, 1996). Products around and used by young children can affect their behaviors and their ways of thinking. Vygotsky viewed child development as a result of young children’s competence being challenged and extended with help from others, both adults and peers. The development of thinking was considered to be a shared endeavor between adults and children rather than an individual process for each child (as

cited in Smith,1993). When adults provide guidance and interactional support in “the zone of proximal development”, young children exhibit greater competence in their thinking. The “zone of proximal development” refers to the gap between the actual level of development which is determined by individual problem solving and the level of potential development which is determined by problem solving shared between the adult and child, under adult guidance and support and in collaboration with peers. Vygotsky believed that what children learn and can do today with assistance and guidance, they can do it tomorrow alone, unaided and independently.

The most important thing for early childhood professionals to understand about young children’s cognitive development is that it cannot be formally taught, rushed or hurried. Young children gain cognitive maturity by interacting with the social world and acting upon the physical world (Rodd, 1996).

Also, nowadays, most products which are designed for children focus on how to satisfy children’s needs. However, parents are also customers when it comes to children’s products. Helping parents should also become an important part when designing products for children. Therefore, designers need guidelines that satisfy children’s needs and satisfy parents’ desires to help their children build good habits.

1.2 Need for study

To develop a new habit or change old habits, the study of habit itself is needed. Firstly, the reasons why a habit can be formed need to be found. Then process of how a habit can be formed needs to be examined. After studying principles of habits, evidence and support for how to change habits needs to be researched. Because children are different from adults in many

ways, children's development needs to be focused on. It's necessary to research children's development stages and convert child factors to design thinking.

Also, for further research to understand how some products help children develop good habits, some remarkable cases and products which are related to this thesis need to be studied.

1.3 Objective of Study

This thesis presents an approach for helping companies and designers to design products which can help children to develop or change habits. The following are the objectives of this thesis.

- Study the relevant knowledge of habits
- Study the relevant knowledge of how to change habits
- Study the relevant knowledge of children psychology
- Study the relevant knowledge of children's physical development
- Study the cases which can help people change habits
- Develop an approach to design products help children change or develop a habit
- Apply the approach to product design

1.4 Assumptions of Study

It is assumed that all the research, approach, method and data I found are correct.

It is assumed that habits have a long-term effect.

It is assumed that habits can be changed

It is assumed that a new habit can be developed on purpose

It is assumed that parents are willing to help their children develop habits that are good for them physically or psychologically.

1.5 Scope and limitations

Scope of study: This study focuses on the methodology to design a product which can help children to change or develop a habit. The aim of this guideline is to be universal so that it can be applied in all categories in today's market.

Limits of study: This thesis focuses on how to design a product which can help children develop good habits. However, we cannot have an accurate definition of the term "good habit". Whether a habit is good or bad is highly related to one's own experience and very subjective. It can be different in different cultural contexts, but some universal elements are true across cultures and experiences. For these reasons in this thesis, habits developed by children can be defined as those that help them in self-improvement and give them a sense of satisfaction without hurting themselves and fellow human beings.

Also, habit formation can be a long-term process. Products designed by using the approach provided in this thesis will highly improve the possibility that children change or form a habit. However, there's no guarantee that products designed by using the approach provided in this thesis can change children's habit or definitely help them form a habit.

1.6 Procedures and Methodology

- Study the concept of habits
- Study how habits can be formed
- Study how habits can be changed
- Study children's psychology
- Study existing products
- Develop guidelines to help design products helping children develop a habit
- Examine the approach through designing a product which helps children form a new habit

1.7 Anticipated Outcomes

The primary outcome is to design an approach to help designers design products which can help children develop new habits. This approach can be applied to different categories of products.

Chapter2 Literature Review

2.1 Habit

2.1.1 The habit loop

Habit is a particular act or way of acting that people tend to do regularly (“Meaning of habit in English”, 2019). Studies by neurobiologists, cognitive psychologists, and others indicate that from 40 to 95 percent of human behavior—how we think, what we say, and our overall actions—falls into the habit category

As the habit is forming, it can be analyzed in three parts: the cue, the routine, and the reward. The cue is the thing that causes the habit to come about, the trigger of the habitual behavior. This could be anything that one's mind associates with that habit and will automatically let a habit come to the surface. The routine is the actual habit that one exhibits, and the reward, a positive feeling, therefore continues the "habit loop" (Duhigg, 2012).

In the early 1990s, the MIT researchers began wondering if the basal ganglia might be integral to habits. They noticed that animals with injured basal ganglia suddenly developed problems with tasks such as learning how to run through mazes or remembering how to open food containers. They decided to experiment by employing new micro-technologies that allowed them to observe, in minute detail, what was occurring within the heads of rats as they performed dozens of routines. In surgery, each rat had what looked like a small joystick and dozens of tiny wires inserted into its skull.

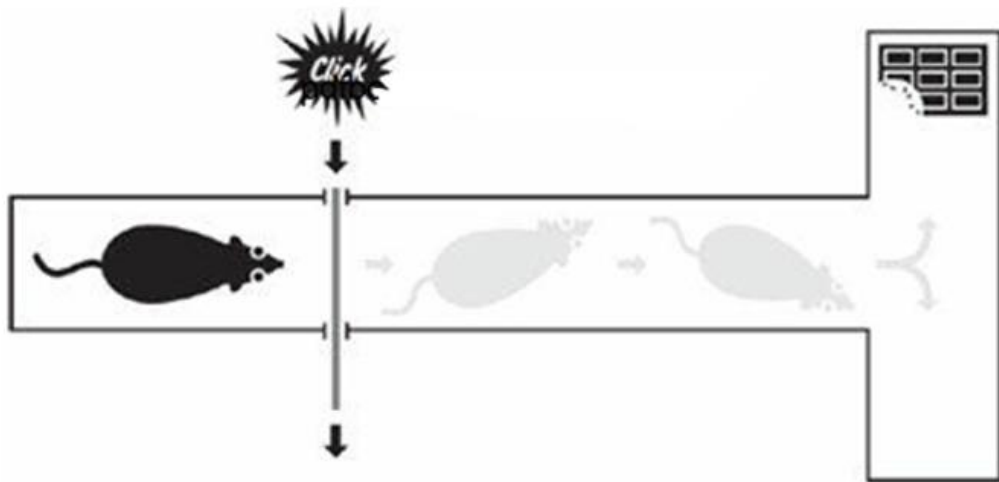


Figure 2.1 The rat experiment (Duhigg, 2012)

Afterwards, the animal was placed into a T-shaped maze with chocolate at one end. The maze was structured so that each rat was positioned behind a partition that opened when a loud click sounded. Initially, when a rat heard the click and saw the partition disappear, it would usually wander up and down the center aisle, sniffing in corners and scratching at walls. It appeared to smell the chocolate, but couldn't figure out how to find it. When it reached the top of the T, it often turned to the right, away from the chocolate, and then wander left, sometimes pausing for no obvious reason. Eventually, most animals discovered the reward. But there was no discernible pattern in their meanderings. It seemed as if each rat was taking a leisurely, unthinking stroll. As the scientists repeated their experiment again and again, the rat stopped sniffing corners and making wrong turns. Instead, they zipped through the maze faster and faster. And within their brains, something unexpected occurred: As each rat learned how to navigate the maze, its mental activity decreased. As the route became more and more automatic, each rat started thinking less and less.

The internalization---run straight, hang a left, eat the chocolate---relied upon the basal ganglia, the brain probes indicated. The neurological structure seemed to take over as the rat ran faster and faster and its brain worked less and less. The basal ganglia, in other words stored habits even while the rest of the brain went to sleep.

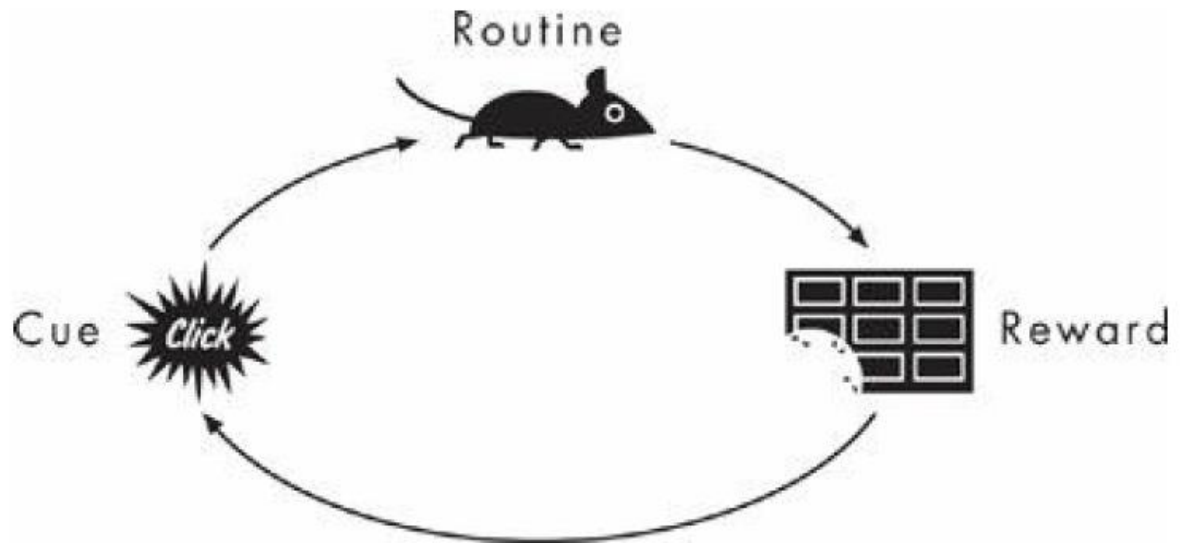


Figure 2.2 Habit loop in the rat experiment (Duhigg, 2012)

This process, in which the brain converts a sequence of actions into automatic routine, is known as “chunking”, and it’s at the root of how habits form (Duhigg, 2012).

In our daily life, there are countless behavioral chunks that we do. There are simple ones: You take off your slippers before putting on shoes when you are going out. Some behavioral chunks are more complicated, like driving or cooking. We form those habits after repetition so we don’t have to use our brain but our habit to do those things. Once the habit loop is established, it will be effortless for our brain to complete daily tasks. This is the reason that people with damaged basal ganglia often have trouble doing simple activities. They have to think and decide before doing things like putting the right or left foot in the shoes first or how to insert

keys into the doors. So for us, we make these decisions unthinkingly because those are our habits which are ran by basal ganglia.

It explains that why it is so hard to develop new habits for eating or exercising. Once you have the habit which is lying on sofa instead of exercising after meal, it will be kept for a long time since exercising makes you feel tired but instead, chilling on sofa makes you feel comfortable. A goal may trigger a habit initially, but over time it becomes less necessary and the habit becomes more automatic.

2.1.2 The importance of craving

Habits are strong because they can create neurological cravings. We won't notice these cravings until they appear, so we often ignore their influence.

Doctor Wolfram Schultz and his team (1992) conducted an experiment in 1990s. In the experiment, they used lights of different color to instruct monkeys to do an arm-reaching movement or refrain from moving, respectively, when a trigger light was illuminated a few seconds later. Task performance was reinforced by liquid reward in both situations.

First, the team made the habit loop for the monkey: The cue was the trigger light, the routine was the arm-reaching movement and the juice is the reward. Then the experiment was adjusted. They started to delay the reward. But the delayed arrival of reward did not affect reaction times, movement times and muscle activity. Then they prevented the delivery of reward by closing the liquid tube leading to the animal's mouth. On one occasion, neuronal activation continued beyond the usual time of reward delivery and remained present beyond the recording duration of individual trials. The continued activity was seen immediately with the trial in which

reward failed to arrive and ended with the last trial. Thus, activations remained present when the animal erroneously expected a reward.

From the experiment, we can see that the monkey with the habit of being rewarded after the arm-reaching movement had a craving for the reward. Once the triggering light was shown, before he could get the reward, his brain would get into this mode: I've got the reward already, so if the juice didn't arrive, the joy of getting reward will become a craving. If the craving wasn't satisfied, it would drive the monkey into anger or anxiety and depression.

Similar things happen in human's life. People who are used to gambling tend to sit in front of gambling table even if they have lost all their money because the anticipation and sense of craving is so overwhelming.

To understand the power of cravings in creating habits, consider how exercise habits emerge. In 2002 researchers at New Mexico State University wanted to understand why people habitually exercise. They studied 266 individuals, most of whom worked out at least three times a week. In one group, 92 percent of people said they habitually exercised because it made them "feel good" ---they grew to expect and crave the endorphins and other neurochemicals a workout provided. In another group, 67 percent of people said that working out gave them a sense of "accomplishment" --- they had come to crave a regular sense of triumph from tracking their performances, and that self-reward was enough to make the physical activity into a habit (Finlay, Trafimow, & Villarreal, 2002).

Countless studies have shown that a cue and a reward, on their own, aren't enough for a new habit to last. Only when the brain starts expecting the reward---craving the endorphins or sense of accomplishment---will it be automatic to finish the habit routine. The cue, in addition to triggering a routine, must also trigger a craving for the reward to come (Duhigg, 2012)

Another example is food. When we see food on the table, our brains begin anticipating that food, even if we are not hungry. Our brains are craving them. Even when we don't like the food, it's still hard for us to fight the urge. This is how habits work.

2.1.3 The habit zone

A company can begin to determine its product's habit-forming potential by plotting two factors: frequency (how often the behavior occurs) and perceived utility (how useful and rewarding the behavior is in the user's mind over alternative solutions) (Eyal, 2014).

Googling occurs multiple times per day, but any particular search is negligibly better than rival services like Bing. Conversely, using Amazon may be a less frequent occurrence, but users receive great value knowing they'll find whatever they need at the one and only "everything store" (Stone, 2013). Both are habits, one because of frequency and the other because of perceived utility.

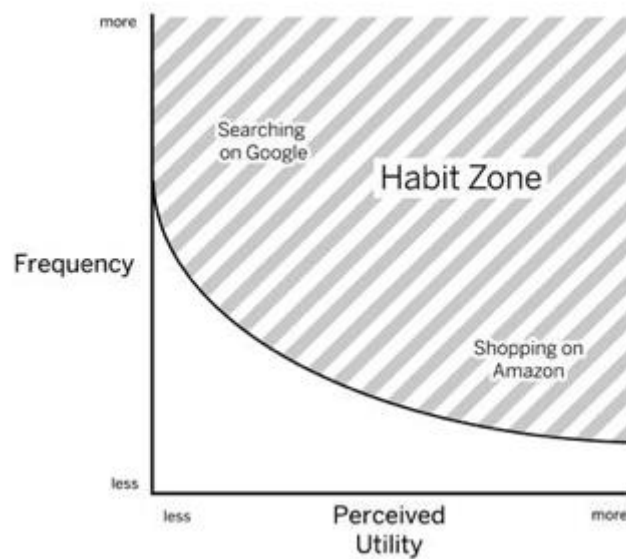


Figure 2.3 Habit zone (Eyal, 2014)

As represented in Figure 2.3, a behavior that occurs with enough frequency and perceived utility enters the habit zone, helping to make it a default behavior. If either of these factors falls short and the behavior lies below the threshold, it is less likely that the desired behavior will become a habit.

Note that the line slopes downward but never quite reaches the perceived utility axis. Some behaviors never become habits because they do not occur frequently enough. No matter how much utility is involved, infrequent behaviors remain conscious actions and never create the automatic response that is characteristic of habits. On the other axis, however, even a behavior that provides minimal perceived benefit can become a habit simply because it occurs frequently.

There are few rules when it comes to answer “How frequent is frequent enough?” and the answer is likely specific to each business and behavior. However, we know that higher frequency is better (Eyal, 2014).

While the habit loop (Duhigg, 2012) tells the principle of habit formation, the habit zone shows the importance of frequency. Frequency usually comes from cravings.

2.1.4 How to Develop Habits

2.1.4.1 Habits are powerful, but delicate.

Habits can emerge outside our consciousness or can be deliberately designed. They often occur without our permission but can be reshaped by fiddling with their parts. They shape our lives far more than we realize—they are so strong, in fact that they cause our brain to cling to them at the exclusion of all else, including common sense.

Consider fast food, for instance. It makes sense—when the kids are starving and you’re driving home after a long day—to stop, just this once, at McDonald’s or Burger King. The meals are inexpensive. It tastes so good. After all, one dose of processed meat, salty fries, and sugary soda poses a relatively small health risk, right? It’s not like you do it all the time.

But habits emerge without our permission. Studies indicate that families usually don’t intend to eat fast food on a regular basis. What happens is that a once a month pattern slowly becomes once a week, and then twice a week—as the cues and rewards create a habit—until the kids are consuming an unhealthy amount of hamburgers. When researchers tried to understand why families gradually increased their fast food consumption, they found a series of cues and rewards that most customers never knew were influencing their behaviors. They discovered the habit loop (Duhigg,2012).

Every McDonald’s, for instance, looks the same—the company deliberately tries to standardize store’s architecture and what employees say to customers, so everything is a consistent cue to trigger eating routines. The foods at some chains are specifically engineered to deliver a hit of salt and grease as fast as possible, causing your pleasure centers to light up and your brain to lock in the pattern. All the better for tightening the habit loop.

However, even these habits are delicate. When a fast food restaurant closes down, the families that previously ate there will often start having dinner at home, rather than seek out an alternative location. Even small shifts can end the pattern. But since we often don’t recognize these habit loops as they grow, we are blind to our ability to control them. By learning to observe the cues and rewards, though, we can change the routines (Duhigg, 2012).

2.1.4.5 Fogg Behavior Model

The Fogg Behavior Model (FBM) has three principal factors as *motivation*, *ability*, and *triggers*. It explained the basic principle behind human behaviors. In brief, the model asserts that for a target behavior to happen, a person must have sufficient motivation, sufficient ability, and an effective trigger. All three factors must be present at the same instant for the behavior to occur (Fogg, 2009).

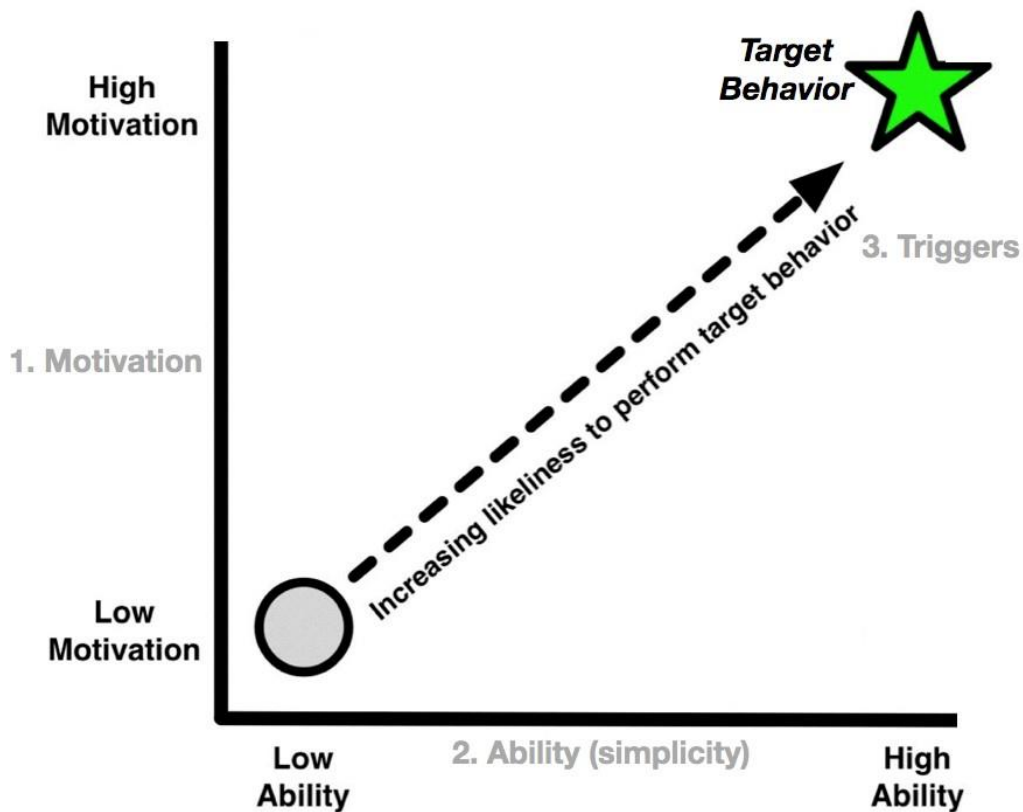


Figure 2.4 The Fogg Behavior Model has three factors: motivation, ability, and triggers (Fogg, 2009)

The two axes in Figure 2.6 define a plane. In the upper righthand corner is a star that represents the target behavior. The placement of this star is symbolic, meant to suggest that high motivation and high ability are typically necessary for a target behavior to occur. To emphasize this relationship between motivation, ability and target behavior, Figure 2.6 also has an arrow that extends diagonally across the plane, from the bottom left corner to the upper right. This arrow, as the words on the figure say, indicates that as a person has increased motivation and increased ability, the more likely it is that one will perform the target behavior.

Also in Figure 2.7 is a factor called “triggers.” The placement of this word is close to the target behavior star to imply that the trigger must be present for the target behavior to occur. While the axes are fixed, one can imagine that the star, representing the target behavior, as well as the related trigger, could be placed anywhere inside the plane defined by the axes.

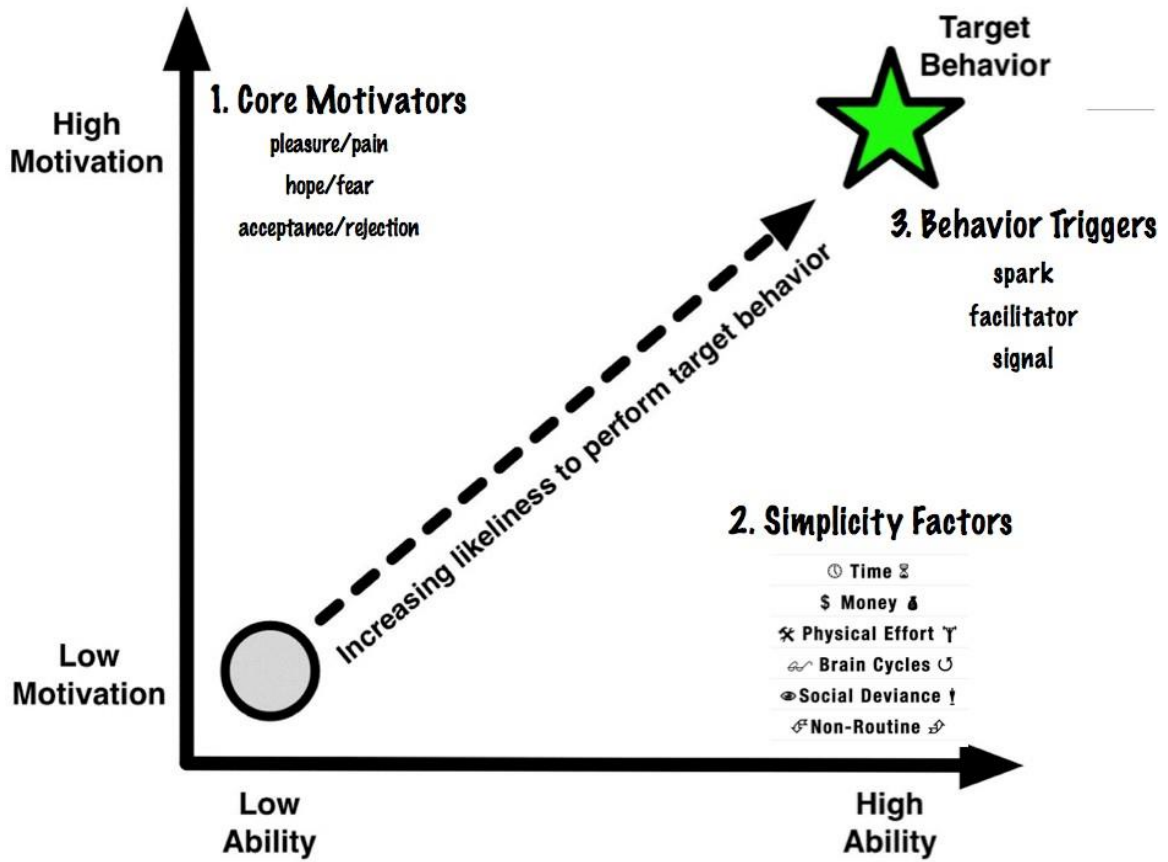


Figure 2.5: All three factors in the Fogg Behavior Model have subcomponents (Fogg, 2009)

Taken together, the three factors in the FBM become focal areas for persuasive technology. In general, persuasive design focuses on increasing motivation, increasing ability (simplicity), and triggering behavior (Fogg, 2009.)

2.1.4.6 Reinforcement

Reinforcement is a consequence that occurs after a behavior and increases the chance that the behavior will occur again.

Why do reinforcers “reinforce”? Reinforcers are any stimulus that strengthens a response

by making it more likely to occur in the future. Reinforcers reinforce because (1) they are pleasant and (2) people are motivated to repeat behaviors that produce pleasant outcomes. Another possibility is that reinforcers provide information about consequences of behavior that can be used to respond adaptively to the environment to control individual fates.

Based on Watson and Ramey's (1972) experiment, it suggests that an initially pleasant stimulus is unlikely to reinforce anything merely because it is pleasant. However, a pleasant stimulus can become a reinforcer if it provides information that allows the learner to control its appearance or to otherwise determine his or her own fate (cited in Shaffer, 1996).

Besides positive reinforcers, there are also negative ones. In one set of experiments, for example, researchers affiliated with the National Institute on Alcohol Abuse and Alcoholism trained mice to press levers in response to certain cues until the behavior became a habit. The mice were always rewarded with food. Then, the scientists poisoned the food so that it made the animals violently ill, or electrified the floor, so that when the mice walked toward their rewards they receive a shock. The mice knew the food and cage were dangerous—when they were offered the poisoned pellets in a bowl or saw the electrified floor panels, they stayed away. When they saw their old cues, however they unthinkingly pressed the lever and ate the food, or they walked across the floor, even as they vomited or jumped from the electricity. The habit was so ingrained the mice couldn't stop themselves (as cited in Duhigg, 2012, p. 26). The reliability of this phenomenon demonstrates that punishment does not change the tendency to engage in the behavior that was punished. Instead, it makes the person or the rat want to avoid the source of punishment.

If we put negative reinforcers on children, they will work, but they won't last long. Children will only behave when their parents, which are negative reinforcers for them, are

around them. Without parents attention, it will be easy for them to fall back to the old bad habits. Because punishment does not change the tendency to engage in the behavior.

Therefore, positive reinforcers are more welcomed.

2.1.4.2 Context matters

There is no specific set of steps to develop habits that are guaranteed to work for every person. We know that a habit cannot be eradicated—it must, instead, be replaced. And we know that habits are most malleable when the Golden Rule of habit change is applied: If we keep the same cue and the same reward, a new routine can be inserted. But that’s not enough. For a habit to stay changed, people must believe change is possible.

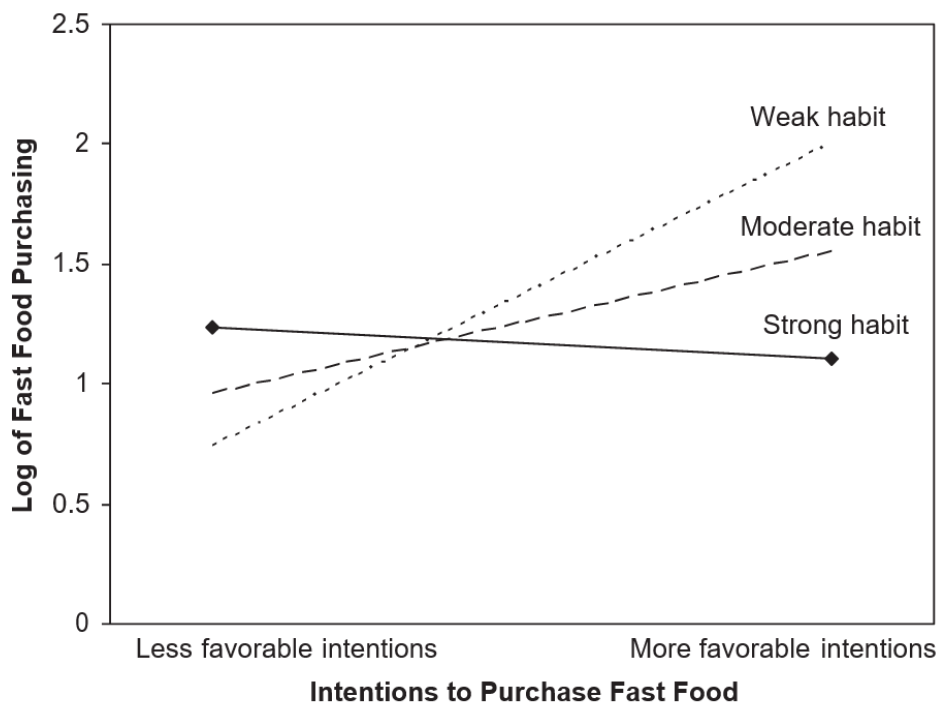


Figure 2.6 Frequency of purchasing fast food over 1 week as a function of habit strength (based on frequency of past fast-food purchasing in the presence of particular other people) and the intention to purchase fast food. Habit strength moderated the extent to which intentions guided action. Data from Song and Wood (2006).

If someone wants to quit smoking, he or she must figure out a different routine that will satisfy the cravings filled by cigarettes. If someone wants to lose weight, he or she should study habits to determine why he or she really leaves the desk for a snack each day. The evidence is clear: If you want to change a habit, you must find an alternative routine, and your odds of success go up dramatically when you commit to changing as part of a group.

The mechanisms of habitual control pose a particular challenge for changing behavior. Public health campaigns and other informational interventions are designed to change beliefs. However, for habits, changing minds does not necessarily mean changing behavior. In illustration, Webb and Sheeran's (2006) meta-analytic review compared the effectiveness of persuasive messages and other interventions in changing people's intentions versus changing their behavior. For course enrollment and other actions that were not easily repeated into habits, interventions that changed intentions also changed behavior. But for exercising and other behaviors that people could repeat into habits, interventions that changed intentions had limited effect on behavior.

Despite insensitivity to informational interventions, habit performance should be vulnerable to changes in the performance context. To test this idea, Wood, Tam, and Witt (2005) examined change in college students' habitual behaviors of exercising, reading the paper, and watching TV upon transferring to a new university. In general, students performed these actions

when they intended to do so. However, a mark of strong habits is frequent performance regardless of people’s intentions, provided that contexts remain stable. In support, habit performance continued to be cued independently of intention only when students perceived that the context of performance was stable across the transfer. When the performance context changed with the transfer, apparently strong habits were no longer cued automatically, and students continued to exercise only if they intended to do so. Thus, context change disrupted performance of strong habits, bringing them under intentional control. The performance of weak habits, in contrast, varied with intentions regardless of context stability. The data for exercising and for newspaper reading are presented in Figure 2.5.

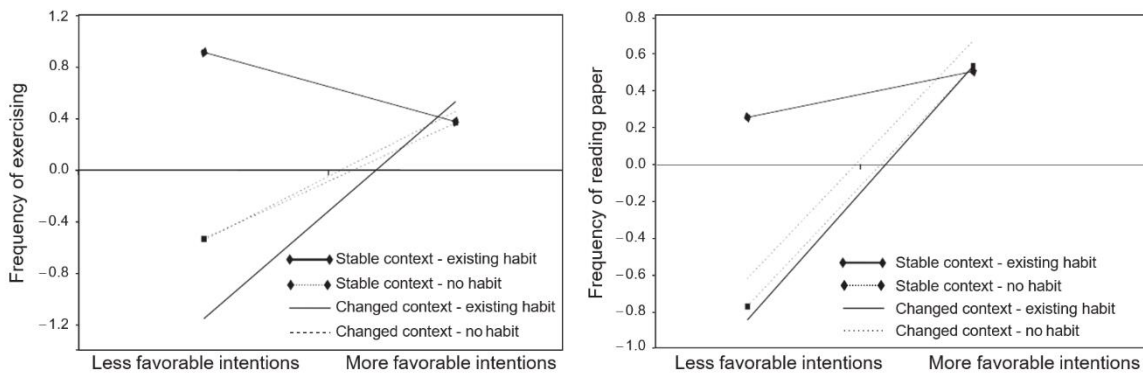


Figure 2.7 Frequency of students’ exercise (left panel) and newspaper-reading (right panel) behavior after moving to a new university as a function of (a) whether students had an existing habit for the behavior at their old university, (b) their intentions to perform the behavior at the new university, and (c) change in the contexts in which they performed the behavior after the move. Students with strong habits whose performance contexts changed little across the transfer carried over their habits to the new university regardless of their intentions. In contrast, students with strong habits who experienced a change in performance contexts carried over their habits only when the behavior was accompanied by a favorable intention. For those without

habits, behavior performance was predicted by favorable intentions irrespective of context change. Data from Wood, Tam, and Witt (2005).

In general, change in performance contexts is likely to be an important ingredient in interventions to change many everyday behaviors. This is especially true within the health domain, given that five of the leading health risks in the U.S. emerge from everyday repetition of action—substance abuse, obesity, tobacco use, risky sexual behavior, and inadequate exercise. Verplanken and Wood (2006) proposed that effective habit- change strategies might target interventions for times when people are naturally changing performance contexts. For example, to increase bus ridership, some metropolitan transit services provide free passes and route information to new residents, a group yet to establish relevant habits and hence open to such influence. Also, given the importance of context cues in changing habits, public policy can be oriented toward structural changes and supports for desired behaviors (e.g., sidewalks to encourage exercise).(Neal & Wood & Quinn 2006).

2.1.4.3 Self-regulation

Successful self-regulation is a multifaceted process. Unfortunately, many factors can contribute to a failure in self-regulation. One major account of self-regulation failure is an inadequacy in self-regulatory "strength". This implies that a person is not able to mobilize (psychologically) what it takes to override unwanted thoughts, feelings or impulses. According to this resource-depletion model of self- regulation, a person at any time has limited amounts of generalized self-regulatory resources. Accordingly, an initial act which requires self-regulatory

resources may be followed by a period of vulnerability, i.e. when self-regulatory resources are needed but depleted. Thus, if one in this period of ego-depletion is exposed to a situation (impulse) which requires effective self-regulation, then a failure in self-regulation is likely to happen because he or she is temporarily depleted on those resources.

People can be temporarily depleted or fatigued of self-regulatory resources, for example when they try to resist temptations, control their emotions or try not to act (automatically) upon their impulses. For example, if you a few days into a smoking cessation attempt experience a problematic job situation (e.g. you get negative feedback from your boss), you may need to use self-regulatory resources to both cope with the resulting negative emotions and try to improve your performance. If you simultaneously or shortly after are exposed to a temptation to smoke (e.g. is exposed to someone smoking a cigarette) then you are probably at risk to relapse because your self-regulatory capacities may be temporarily (partially) depleted (Kraft, Dorzd, & Kallevik, 2008)

2.1.4.4 Investment

The second most important factor in habit formation (besides frequency) is a change in the participant's attitude about the behavior (Eyal, 2014).

In order for a change in attitude to occur, there must be a change in how users perceive the behavior. Escalation of commitment is a human behavior pattern in which an individual or group facing increasingly negative outcomes from a decision, action, or investment nevertheless continues the behavior instead of altering course. The actor maintains behaviors that are irrational but align with previous decisions and actions (Staw, 1997).

To apply it in design process, escalation of commitment means that the more users invest time and effort into a product, the more they value it. Considering what they have invested, it's more possible for them to do the behavior again.

There are 3 tendencies:

- We irrationally value our effort—businesses that leverage user effort confer higher value to their products simply because users have put work into them.
- We also seek to be consistent with our past behaviors.
- We avoid cognitive dissonance (the psychological pain of two conflicting ideas)

These tendencies of ours lead to a mental process known as rationalization, in which we change our attitudes and beliefs to adapt psychologically. Rationalization helps us give reasons for our behaviors, even when those reasons might have been designed by others. (Ong, 2017)

The big idea behind the investment phase is to leverage the user's understanding that the service will get better with use and personal investment. Sometimes, when we are using a product, we are adding value to the product, which is storing value. The stored value users put into the product increases the likelihood they will use it again in the future and comes in a variety of forms like content, data, reputation, skills and the rest. However, the investment phase is not a carte blanche tool for asking users to do onerous tasks (Eyal, 2014).

In order to achieve the intended behavior in the investment phase, the designer must consider whether users have sufficient motivation and ability to engage in the intended behavior.

2.1.5 Overview

Habit formation follows the habits loop (Duhigg, 2012), which is cue-routine-reward. Craving makes people repeat the loop to reach a high frequency. With a complete loop and high frequency, a habit can be formed and recorded in our basal ganglia, which makes it easier for people to make decisions when performing these habitual behaviors. And, each step included in habit formation is influenced by many different factors; some factors are affected by each other, too.

The cues can be categorized as external cues and internal triggers.

External cues are those “reminders” in people’s living environment. Any objects that can remind people of some certain behavior are the external cues. For example, seeing a commercial of Facebook on some website can make people open their Facebook app. External cues can also be the whole context; stable performance context makes people keep same habits easily. To put it on the product level, we cannot decide the whole using context for users by a separate product, but we can remind users to use the product by understandable and eye-catching instructions.

Internal triggers are related to motivation. When someone has a strong motivation to complete something, which produces enough cravings, then the “routine” is going to be done for sure.

From my point of view, motivation is related to the “rewards”. We can divide rewards into instant rewards and long-term rewards. For those habits such as eating junk food, smoking and alcohol abuse, an instant reward is provided. People can feel the pleasure from these behaviors immediately. They have strong motivation to perform these habits. On the other hand, some habits provide long-term rewards, such as regular exercising and reading. If people cannot feel the

instant pleasure of these good habits, they need to understand the long-term reward, so then they can have the motivation to perform these behaviors. For a product, if designer provides more rewards, both instant and long-term, the users are more motivated to complete the behavior. Also, a long-term reward system can make users repeat their behavior more because investment can change their attitudes towards the behavior.

Internal triggers can also be provided when a product is coupled with a pre-existing routine. People tend to do things which they are familiar with. The same old cues can trigger their old habit to make them start the new behavior.

Whether a routine can be done is decided by our abilities. The simpler the “routine” is, the less effort is needed. Physical effort and brain cycles contribute to the simplicity of a behavior. When a behavior is too difficult, our motivation to finish it is going to decrease, then more reward is needed to help us improve the motivation to finish it.

Why do we need to choose positive things as our rewards? As it says in Chapter 2.1.4.6, people are motivated to repeat behaviors that produce pleasant outcomes. Also, as I mentioned above, long-term rewards and instant rewards can be added together to affect people’s motivation to finish behaviors. What is more, long-term rewards help the repetition of habits. People tend to go back to the things which provide long-term rewards. Because they don’t want to give up the investment they have put in them.

2.2 Children’s Development

From the study of habits above, we can know that people’s cognitive level and physical capability strongly influence the formation of habits. Children grow every day. They have

different levels of cognitive development and motor development in different age ranges.

Therefore, to design habit-formation products matching the development level of children in different age range, children's development status in different aspects is going to be studied in this section.

2.2.1 Cognitive Development

Young children are different from adults. They understand the world from a very different point of view. Consequently, they make interpretations about incidents and their behavior which are inconsistent from those of the adults involved. The major features of young children's intellectual development are that it is egocentric and dominated by their own perspective. They are cognitively unable to comprehend that others may view the situation differently.

In addition, young children are unable to defer gratification of their needs. Consequently, their behavior appears selfish and inconsiderate with little interest in or regard for other people's feeling or needs. Cognitive immaturity can be the cause of such inappropriate behaviors as telling lies, being selfish, taking things and misunderstanding. (Rodd, 1996).

Jean Piaget's cognitive-development theory says that infants are born predisposed to adapt to and learn from their environment. Young children learn from their environment by acting upon it. The action of the individual child enables that child to gradually construct knowledge; the two process of accommodation and assimilation are used to organize the knowledge to fit into existing mental structures. Young children are biologically motivated to gain, expand and refine knowledge about the world and as they do so their mental structures change. Following is a discussion of Piaget's development phases summarized by Turner and Hamner (1994).

The sensorimotor stage (Birth-2 years) During this period, infants develop their cognitive

capacity from inborn, reflexive actions to explorative skills which allow them to understand the relationship between their own behavior and its effects upon object and people. By two years of age, toddlers are capable of intentional and purposeful behavior and are interested in autonomy. Behavior expressions of experimentation and testing out are not intentional misbehavior but rather active efforts to discover and learn about the world.

The pre-operational stage (2-7 years) This consists of two sub-stages in which major shifts in young children's thinking can be seen. The first sub-stage is called pre-conceptual and covers the age period of approximately 2 to 4 years. The young children demonstrate a limited but increasing ability to use symbolic functioning which is evidenced by language, pretend play and drawing. Forming true concepts and thinking logically is restricted in this stage and it cannot be taught by adults. Only maturity and the opportunity to interact with the environment will produce the ability to reason and think logically.

The second stage in the pre-operational period is called the intuitive stage and covers the age of approximately four to seven years. Young children in the intuitive stage cannot think by operations yet but can form mental representations of objects and events

The concrete operations stage (7-11 years) This is when children gradually exhibit the ability to understand the logical principles that apply to concrete, external objects. Children can form true concepts, are less egocentric, can reverse operations, understand cause and effect and are more flexible in their thinking and reasoning.

While children are still very concrete and literal in their thinking at this point in development, they become much more adept at using logic. The egocentrism of the previous stage begins to disappear as kids become better at thinking about how other people might view a situation.

While thinking becomes much more logical during the concrete operational state, it can also be very rigid. Children at this point in development tend to struggle with abstract and hypothetical concepts.

During this stage, children also become less egocentric and begin to think about how other people might think and feel. Children in the concrete operational stage also begin to understand that their thoughts are unique to them and that not everyone else necessarily shares their thoughts, feelings, and opinions.

The formal operations stage (11 plus years) This is attained through early adolescence where children develop the capacity to think much like adults. Their thinking demonstrates the ability to think abstractly within the constraints of the immediate situation and to think in terms of possibilities and probabilities.

In contrast to Piaget, Vygotsky (1962,1978) took a socio-cultural perspective and believed that children’s intellectual development has its own origin in social contexts. Young children moved to higher development levels when they were stimulated and guided at the outside of their limits.

Based on Piaget’s theory, we can have the table below:

Stage		Description of Stage	Key Development Events
Sensorimotor (0-2 years)		Experiencing the world through senses and actions (looking, touching, mouthing and grasping)	Object permanence
Preoperational	Preconceptual (2-4 years)	Thinking logically is restricted, learning from environment	Language development Egocentrism

	Intuitive (4-7 years)	Cannot think by operations yet but can form mental representations of objects and events	Symbolic functioning
Concrete operational (7-11 years)		Thinking logically about concrete events; grasping concrete analogies and performing arithmetical operations	Conservation Mathematical transformations Less egocentric
Formal operational (11 plus years)		Abstract reasoning	Abstract logic Potential for mature moral reasoning

Table 2.1 Piaget’s stage of cognitive development

We can extract two main elements in Piaget’s theory influencing habit formation. One is logic reasoning skills. Children’s logical reasoning skills are highly related to if they can understand the instruction from a product, and how much brain effort they are require to finish the behavior the product requires. The other one is children’s moral development. When children understand social expectations and rules more and are less egocentric, they will have the more motivation to perform those behavior. To help understand the development stage, it will be defined as undeveloped, developing, partly developed, and developed. Different color will be used to represent these four development levels.


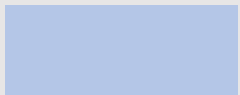

Color				
Development level	Undeveloped	Developing	Partly developed	Developed

Table 2.2 Color representation for different development levels

2.2.1.1 Logical reasoning

Accord to Piaget's theory, children have a restricted ability to think and reason logically during 2-3 years. And during 4-7 years, which is the intuitive stage, young children cannot think by operations yet but can form mental representations of objects and events and are able to manipulate and transform information in rudimentary ways. However, their thinking is dominated by intuitions.

Starting from age 7 until 11, children start to gradually develop the ability to understand the logic principles. Abstract, hypothetical thinking is not yet developed in the child, and children can only solve problems that apply to concrete events or objects. Children in this stage commonly experience difficulties with figuring out logic in their heads. Piaget determined that children in the concrete operational stage were able to incorporate inductive logic. On the other hand, children at this age have difficulty using deductive logic, which involves using a general principle to predict the outcome of a specific event. This includes mental reversibility. An example of this is being able to reverse the order of relationships between mental categories. For example, a child might be able to recognize that his or her dog is a Labrador, that a Labrador is a dog, and that a dog is an animal, and draw conclusions from the information available, as well as apply all these processes to hypothetical situations (Santrock, 2008).

As for formal operational stage, intelligence is demonstrated through the logical use of symbols related to abstract concepts. This form of thought includes "assumptions that have no necessary relation to reality" (Piaget, 1972, p. #). At this point, the person is capable of hypothetical and deductive reasoning. During this time, people develop the ability to think about

abstract concepts. In conclusion, we can have the chart below.

Age	2-3	4-7	7-11	11+
Development status	Restricted ability	Mostly think by intuition	Can incorporate inductive logic	Deductive logic is developed
Development level	Undeveloped	Developing	Partly developed	Developed

Table 2.3 Development levels of logical reasoning skills

2.2.1.2 Moral development

One of the earliest explanations concerning how morality develops in children came from Freud’s psychoanalytic theory which emphasize the importance of the development of a personality construct called the Superego and the associated constructs of the conscience and guilt.

Psychoanalytic theory proposes that children’s beliefs about what is right and wrong are based on the values and idea of the particular culture in which the child is reared. It argues that, around five years of age, the child develops a conscience which contains all the knowledge of the

acts that deserve to be punished. The ego ideal contains all the information about acts that should be rewarded. When a child internalizes this information, the conscience generates guilt which makes her feel uncomfortable when she does things considered to be bad or “naughty”. On the other hand, when children engage in behaviors considered to be right or good, the ego ideal generates feelings of satisfaction and happiness. Such feelings motivate the child to engage in acceptable behavior and to refrain from displaying unacceptable behavior.

Although prosocial behavior is valued in many societies as a characteristic of mature human beings who can and choose to act in a socially responsible manner (such as showing concern for our companions, helping and nurturing others when it is in our power to do so), numerous developmental theorists, including Freud and Piaget, claim that young children were oriented to and interested only in themselves. Young children were considered to be egocentric, interested only in having their own needs met rather than in meeting the need of others. Such theorists argued that genuine concern for others was developed in older children and adolescents. Yet, parents and early childhood professionals have reported observation of prosocial behavior in children as 12 months of age as well as a gradual but increasing frequency of such behavior as children grow older (Eisenberg, 1992). It must be noted that despite this developmental trend, great individual variation exists in relation to whether young children will respond prosocially to another child. While many children have the capacity to do so, they may not always behave prosocially due to a range of factors, including important contextual determinants (Rodd, 1996).

2.2.1.2.1 Egocentrism and Perspective taking

Egocentrism is the inability to differentiate between self and other. More specifically, it is

the inability to untangle subjective schemas from objective reality and an inability to understand or assume any perspective other than one's own (Anderman & Anderman, 2009). Perspective-taking is the act of perceiving a situation or understanding a concept from an alternative point of view, such as that of another individual (Galinsky, Maddux, Gilin, & White, 2008).

The infant in the sensorimotor stage is extremely egocentric. During these first 2 years of development, infants are unaware that alternative perceptual, affective, and conceptual perspectives exist. Once they reach the preoperational stage (2–7 years), children come to recognize the existence of alternative perspectives but usually fail to adopt these viewpoints when necessary. Piaget's observation that older children stopped displaying such instantiations of egocentrism led him to argue that children overcome egocentrism when they reach the concrete-operational stage and come to appreciate that different perspectives afford different perceptions. Piaget's theory of cognitive development posits that by age 7, most of us are free of egocentrism. (Royzman, Cassidy, & Baron, 2003).

Based on Selman's (2007) stages of perspective-taking development, starting from age 5 to age 9, children understand that different perspectives may lead to different results because people have access to different information. Despite the realization that the perspectives can differ (based on the different information that each may have) the preponderant tendency is to consider one's own perspective as valid. The child may believe that the sole reason for different perspectives is because of differences in information.

From age 7 to 12, which is called self-reflective stage, children can "step in another person's shoes" and view their own thoughts, feelings, and behavior from the other person's perspective. They also recognize that others can do the same. This not just a logical realization that someone can have a different perspective but also a realization that either perspective can be

equally valid given the other person’s unique situation. Thus, one thinks and feels like the other person and can both suffer and enjoy the outcomes of situations as they unfold from the other person’s perspective. What is lacking, however, is for the child to be able to consider both perspectives simultaneously.

From age 10-15, children can step outside a two-person situation and imagine how the self and other are viewed from the point of view of a third, impartial party. This includes the ability to keep multiple perspectives in mind at the same time. One does not see from this perspective and then from the other—one looks at the entire big picture or view and understands that different people have different perspectives.

We can have the table below to summarize:

Age	0-5	5-9	7-12	11+
Development status	Extremely egocentric	May believe that the sole reason for different perspectives is because of differences in information	View their own thoughts, feelings, and behavior from the other person's perspective.	Can imagine how the self and other are viewed from the point of view of a third, impartial party.
Development level	Undeveloped	Developing	Partly developed	Developed

Table 2.4 Development levels of Perspective taking skills

2.2.1.2.2 Concept of right and wrong

Gelernter (1994) from the Seattle times interviewed four different child-development experts to explain how and when children develop a moral sense, and what the milestones along the age continuum are for acquiring different kinds of self-knowledge, conscience, and judgment.

Toddlers, preschoolers: Basically, normal toddlers and preschoolers learn by being told what to do and by being reminded each time. By age 3 or 4, the parent still is their "external conscience," reinforcing their memory of what they're supposed to do. Children will start to do something they are not supposed to do, see if parents are watching, and if they are not, the children will do it. It's not that they don't know what they shouldn't be doing, but the way they actually stop themselves is because their parents are there.

Younger children: By about age 6, normal children are developing an internal conscience. They have a pretty good sense, inside of themselves, of what they're not supposed to do; if they do something wrong, bells go off for them.

By about age 9 or 10, children grasp the idea that we have to have rules so people can get along, and we don't have chaos. The more they function in the world outside the family, the more they have a need to learn structure and rules to deal with this outside world. They go through a phase of being very preoccupied with rules, such as rules of games, and get very upset with each other if someone doesn't follow the rules.

Ages 12-13: Ages 12 and 13 tend to be a transitional, awkward period: the child is making

the transition from childhood to added responsibility and added independence.

From above we can have the table below:

Age	0-3	3-6	6-10	10-13
Development status	Have no concept of right and wrong, parents are their external consciences	Developing internal conscience	Have the idea of rules	Adding responsibility and independence.
Development Level	Undeveloped	Developing	Partly developed	Developed

Table 2.5 Development level of concept of right and wrong

2.2.2 Motor Development

Motor development is a progressive change in motor behavior throughout life, which includes an interaction between the task, the biology of the individual and the influence of the environment (Gallahue & Ozmun, 2006).

In Gallahue’s theory (2006), movement skills can be classified as locomotor, manipulative and stability movement. The skills are classified on the basis of their intent.

Although all movement tasks involve an element of balance, movements in which one's body orientation places a premium on gaining and/or maintaining a stable body orientation are called stability tasks. Sitting and standing, balancing on a narrow beam, body rolling, and dodging fit into this category, as do axial movements such as bending or stretching and twisting or turning. Movements for the purpose of transporting the body from one point to another such as walking, running, or performing the high jump or the hurdling event in track and field are locomotor tasks. Those that involve giving force to an object or receiving force from an object are object manipulation tasks.

By compiling previous research, Gallahue and Ozmun (2006) proposed a two-dimensional model for classifying movement development (see Table 2.1).

Phases of Motor Development	Intended Function of the Movement Task		
	Stability (Emphasis is on body balance in static and dynamic movement situations)	Locomotion (Emphasis is on body transportation from point to point)	Manipulation (Emphasis is on imparting force to or receiving force from an object)
Reflexive Movement Phase: Involuntary subcortically controlled movements in utero and early infancy	<ul style="list-style-type: none"> • Labyrinthine righting reflex • Neck righting reflex • Body righting reflex 	<ul style="list-style-type: none"> • Crawling reflex • Primary stepping reflex • Swimming reflex 	<ul style="list-style-type: none"> • Palmer grasp reflex • Plantar grasp reflex • Pull-up reflex
Rudimentary Movement Phase: The maturationally influenced movements of infancy	<ul style="list-style-type: none"> • Control of head and neck • Control of trunk • Unsupported sitting • Standing 	<ul style="list-style-type: none"> • Crawling • Creeping • Upright gait 	<ul style="list-style-type: none"> • Reaching • Grasping • Releasing
Rudimentary Movement Phase: The basic movement skills of childhood	<ul style="list-style-type: none"> • Balancing on one foot • Walking on a low beam • Axial movements 	<ul style="list-style-type: none"> • Walking • Running • Jumping • Hopping 	<ul style="list-style-type: none"> • Throwing • Catching • Kicking • Striking
Specialized Movement Phase: The complex skills of later childhood and beyond	<ul style="list-style-type: none"> • Performing a balance beam routine in gymnastics • Defending a goal kick in soccer football 	<ul style="list-style-type: none"> • Running the 100-meter dash or hurdles event in track • Walking on a crowded street 	<ul style="list-style-type: none"> • Performing a goal kick in soccer or football • Striking a pitched ball

Table 2. 6 Gallahue's Two-dimensional Model for Classifying Movement

(Gallahue & Ozmun, 2006)

This two-dimensional model (Table 2.1) was originally proposed by the senior author (Gallahue, Werner, & Luedke 1972, 1975; Gallahue, 1982). It will be elaborated on more fully throughout the thesis and is only briefly discussed here. This descriptive two-dimensional model of motor development emphasizes: (1) the intended function of the movement task as expressed in the three movement categories of stability, locomotion, and manipulation; and (2) the phases of motor development as expressed by their complexity through the terms reflexive, rudimentary, fundamental, and specialized movement phases.

Reflexive movements are subcortically controlled and as a result, involuntary. Although we all possess a variety of primitive reflexes, they are of special importance in their postural form during early infancy (0-4 months). The postural reflexes are represented in their stability, locomotor and manipulative forms through involuntary actions such as the labyrinthine and body righting reflexes (stability), the primary stepping and crawling reflexes (locomotion), and the palmer and planter grasping reflexes (manipulation).

Rudimentary movements are voluntary movements typically mastered during infancy (0-2 years). They involve basic stability skills such as gaining control of the muscles of the head and trunk; manipulative such as reaching for and grasping and releasing objects; and locomotor skills such as crawling, creeping, and walking with support.

Fundamental movements are gross motor skills common to daily living and typically mastered during childhood (2-7 years). They included fundamental stability movements such as sitting, standing, bending, stretching, twisting, and turning. They also include fundamental locomotor actions such as running, jumping, hopping and leaping and fundamental object manipulation tasks such as throwing, catching, kicking, and striking.

Specialized movements are fundamental movements that have been refined or combined with other movements into more complex forms. They are typically mastered during later childhood and beyond (7-adulthood) and may take the form of complex skills for daily living, recreational activities, and competitive sport. Walking on a slippery surface, downhill skiing, and performing a competitive gymnastics routine on the balance beam are examples of specialized stability skills. Specialized locomotor and manipulative skills are found in the daily living activities of carrying a suitcase up a flight of stairs or stepping on to a moving escalator with a shopping bag full of purchase. They are also found in a recreational game of golf or tennis and the competitive sports of soccer, football, and basketball.

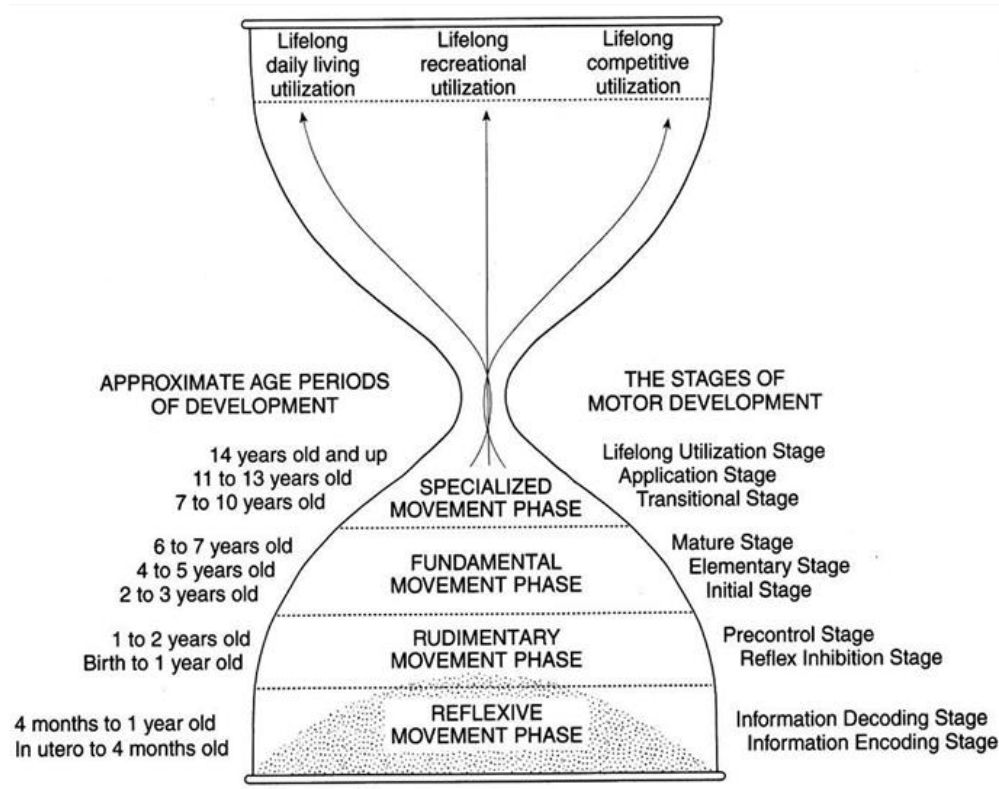


Figure 2.8 Motor development phases (Gallahue & Ozmun, 2006)

The specialized movement abilities are an outgrowth of the fundamental movement abilities that become tools applied for the use of daily life, from the standpoint of development, all the abilities are well-developed. So while making the table below, the ability development in fundamental movement stage will be emphasized. Gallahue and Ozmun (2006) used some selected abilities to represent the stability, locomotor and manipulative ability. Stability ability contains dynamic balance (the ability that maintaining one's equilibrium as the center of gravity shifts) and static balance (the ability that maintaining one's equilibrium while the center of gravity remains stationary). The locomotor ability includes walking and running, jumping and hopping, and galloping and skipping. The manipulative ability holds grasping, throwing and catching, striking and kicking.

Age		1-2	2-3	3-4	4-5	5-6	6-7
Stability Ability	Dynamic Balance			Walks 1-inch straight line; Walks on 4-inch beam	Walks 1-inch circular line; Walks on 2- or 3-inch beam		
	Static Balance	Stands alone				Balances on one foot 3-5 seconds	
Locomotor Ability	Walking & Running	Mature walk	First true run		Efficient and refined run	Mature run	
	Jumping & Hopping		Jump down from object	Hops 3 times on preferred foot	Hops 4 to 6 times on same foot	Jump for distance and height; Hops 8 to 10 times on same foot	Mature jump; Mature hop
	Galloping & Skipping				Inefficient gallop; One-footed skip	Skillful skipping	Skillful Galloping
Manipulative Ability	Grasping	Controlled pincer grasp and release	Grasp crayon with thumb and fingers			Grasp pencil with three fingers	

Throwing & Catching		Throw with forearm only; Respond with delayed arm movement (catch)	Throw with forearm and body rotation; Catch with body		Catch with hands	Mature throwing; Mature catching
Striking		Swing in a vertical plane		Swing in a horizontal plane	Using body weight	Mature striking
Kicking	Only push, no kick	Kick with a straight leg, little body movement	Flex lower leg backward	Greater backward and forward swing	Mature kicking	

Table 2.7 Development Stages in Stability, Locomotor and Manipulative Ability (Liu, 2018)

Age		0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12+
Stability	Dynamic Balance													
	Static Balance													
Locomotor	Walking & Running													
	Jumping & Hopping													
	Galloping & Skipping													
Manipulation	Grasping													
	Throwing & Catching													
	Striking													
	Kicking													

Table 2.8 Development level of motor development

2.2.3 Compiled development level table

After studying all the development level tables in chapter 2.2, we can have the table below:

Age			0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12+
Motor	Stability	Dynamic Balance	Grey		Blue		Orange		Green						
		Static Balance	Blue				Orange			Green					
	Locomotor	Walking & Running	Blue				Orange		Green						
		Jumping & Hopping	Grey	Blue						Green					
		Galloping & Skipping	Grey		Blue		Orange		Green						
	Manipulation	Grasping	Blue				Orange			Green					
		Throwing & Catching	Grey		Blue			Orange		Green					
		Striking	Grey		Blue			Orange		Green					
		Kicking	Grey	Blue		Orange			Green						
	Cognitive	Logic & reasoning	Grey				Blue	Orange					Green		
		Perspective taking	Grey				Blue			Orange		Green			
		Concept of right and wrong	Grey	Blue		Orange			Green						

Table 2.9 Compiled development level table.

This table can be used in Chapter 4

Chapter 3 Case Study

To better develop the guidelines, some existing products are going to be studied in this chapter. Both advantages and disadvantages will be discussed to see how they changes users' habits and behaviors.

3.1 Light with a dish by Naoto Fukasawa

Naoto Fukasawa (2004) developed a design philosophy called “without thought”. Fukasawa described his philosophy like this: “The design of an object corresponds to our unconscious movements and the environment that surrounds us. Thinking needs time, feeling can be done in a moment. When you see something for the first time it seems to be important. but it's the later, when you use the object that you realize that what you've missed initially is the essence of what design is all about, and that is the idea behind ‘without thought’” (p. #).

Light with a dish (Figure 3.1) is one of the classical products designed by this philosophy. The key of this design is: if you put something in the dish, the light will turn on automatically.



Figure 3.1 Light with a dish (Fukasawa, 2003)

The product can be considered as a habit changing product. Customers are suggested to put the light near the door. Then when they step into their home, they can put their keys or any other accessories in the dish. By doing this, the light will come on at the same time. Then customers can feel welcomed. This process highly reduces the possibility that customers put their keys somewhere unknown and cannot find them when they are about to go out. The main reason for this product can change people's habit is the action, which is putting keys in the plate.

3.2 Bottle bank arcade

Bottle bank arcade glass recycling (Figure 3.2) is an innovation in which a glass bottle collection bin was refitted to resemble an arcade machine in Sweden. It is complete with

console, sound effects, and flashing points counter.

This project is one of the winners of the Fun Theory competition, an initiative of German automaker Volkswagen. The Fun Theory runs on the idea that people can be influenced to change their behavior for the better if there's fun in doing it: "...the thought that something as simple as fun is the easiest way to change people's behavior for the better. Be it for yourself, for the environment, or for something entirely different, the only thing that matters is that it changes for the better" (source citation).



Figure 3.2 Bottle bank arcade (Osborne, 2009)

People were so amused and inspired by the idea (Figure 3.2) that in one single evening, over one hundred people used the arcade machine/recycler compared to just two people using an ordinary bottle bank nearby (Osborne, 2009).



Figure 3.3 Lots of people are trying bottle bank arcade out (Osborne, 2009)

3.3 Bubble toothbrush

Bubble toothbrush (Figure 3.4) is a device that can guide children to brush their teeth through a more interesting and acceptable way (Li, 2014).

Without correct guidance, most people would tend to brush their teeth transversely instead of brushing their teeth vertically. To help children learn the right way to brush teeth, bubble toothbrush would blow bubbles if the sensor feels the upright moving.



Figure 3.4 Bubble toothbrush (Li, 2014)

The toothbrush is intended to change children's habit of brushing their teeth. The designers used an interesting way to attract kids to use the right way to brush teeth.

3.4 Nico eats toolkit

Nico eats toolkit is a set of utensils and recipe books helping children experiment with food and flavors. The designers revolve around fictional food inventor Nico, who appears in a series of stories that guide children through preparing ingredients and making meals.



Figure 3.5 Nico eats toolkit (Yasin, 2017)

Kids are encouraged to read the books and make use of an accompanying collection of Nico Cooks tools – designed with striking shapes in pastel colors to be more accessible and appealing for younger users. The designers’ research revealed that many children's fear of new

foods discouraged them from trying unfamiliar ingredients. Rather than pressuring children into trying new flavors, the Nico Cooks utensils offer a more playful alternative, letting them be more hands-on and make their own food.

"This encourages them to approach food with a playful, curious and inquisitive attitude, that they can bring to the dinner table," added the designer.

3.5 Conclusion

For the Light with a plate, the main reason that it can change people's behavior is that the action, which is putting keys in the plate when arriving home, is one of those "unconscious movements". It is so simple that no thoughts and efforts need to be taken to complete it. Because of the effortlessness, users don't need a lot motivation to finish the routine. To put it in other words, a little reward is motivating enough for people to loop the behavior routine.

Bottle bank arcade, as a pop-up bottle bank, accomplished its mission perfectly, but it was not designed for change people's behavior consistently. It does not have an effective long-term reward system, so there is no reason for people to repeat this behavior and make it a habit. except for those who will not be tired of the instant award providing by the bottle bank.

Bubble toothbrush has the same problem. For kids, the bubbles are pleasant enough to make them brush their teeth vertically. However, we cannot know if children will still be interested in making bubbles after using the product for a long time. Children can repeat the behavior because that they feel pleased when they see the bubbles. When they are tired of the instant reward of seeing bubbles, we don't know if they will continue the behavior.

Nico eats toolkits help children develop a playful attitude towards eating. Compared

with eating strange foods, changing tableware into experiment utensils can bring more pleasure to children. Also, the book provides a strong psychological suggestion that using Nico eats toolkit is not just for eating food but exploring it, which changes the using context of eating utensils. All of these improve children's will to use the product and try new recipes. However, it is uncertain that whether using this product set can help children form the habit of exploring new food, because we cannot know if children are always willing to use these toolkits. The long-term reward of this product is being healthy after adding diversity to food, but this can only be understood by children when their cognitive skills are mature enough.

From these four products, the rules of habit formation studied in Chapter 2.1 are further proved: the key elements in habit formation are cue, routine and reward, and these elements are affected by each other.

Chapter 4 Design Approach

4.1 Identify

To begin with, designers need to choose a habit they want the young users to form. Based on research on habits in Chapter 2.1, the chosen habit must be performed with high frequency.

After habit selection, designers should find related products, which can have strong connection with the chosen habit.

Then designers need to define the age range for the whole product system. Some limitations must be given by certain products. For example, if designers want to help children change their way to brush teeth by designing a new electrical toothbrush, they should notice that only children older than three years old can use it.

4.2 Values

From Chapter 2.1, we can know that habit formation is decided by cue, routine and reward, and the three main factors are influenced by their sub factors. To define how children's development level affects these sub factors, we can apply values to them for further evaluation. In previous study, children's development levels are divided into undeveloped, developing, partly developed, and developed. We can give these four levels relevant values: undeveloped got 0,

developing got 1, partly developed got 2, and developed got 3.

Development level	Undeveloped	Developing	Partly developed	Developed
Value	0	1	2	3

Table 4.1 Value of different development levels

4.2.1 Cue

Cues can be categorized as external cues and internal triggers. They are going to be discussed separately here.

4.2.1.1 External cues

Changing a habit starts by first cueing users with a call to action. External cues are embedded with information, which tells the user what to do next. They can be understood as instructors leading children to use the products. The instructors can be metaphors guiding children to operate products; they can also be a handbook telling users how to use products. If designers need to put instructors in their design, they should consider if children’s logic and reasoning ability can make them understand the instructors. From Chapter 2.2 we can have the table below.

Age	0-4	4-7	7-11	11+
Development level	Undeveloped	Developing	Partly developed	Developed



Table 4.2 Development levels of logic and reasoning skills

For instance, for children with developing skills of logic and reasoning skills, shapes and images may be more understandable. Instruction books with lots of words can be hard for them to comprehend. Therefore, the complexity of instructors should match children’s logic and reasoning development level. Usually, with more intuitive instructors, children are more likely to start the designed behaviors, so we can see the complexity of instructors as negative effects on habit formation. Different values can be applied on different extent of complexity of instructors as the table below.

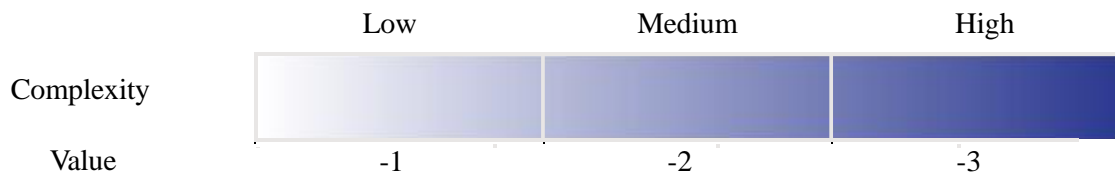


Table 4.3 Value of complexity of instructor

Thus, if the designer is designing for children with developed logic and reasoning skills, we can have the value 3. If the complexity of the instructor is low, we can have value -1. Then we can have the value of the instructor of the product: $3+(-1) = 2$. For children in the same development level of logic and reasoning skills, let the value of development level be V_{LR} , the value of complexity be V_C , the value of the instructor be V . We can have the formula below:

$$V = V_{LR} + V_C$$

If the designer is designing for children with different levels of logic and reasoning development, for example: children from 7 to 12 years old, we need to take each sub age range's proportion in the whole chosen age into consideration. For instance, for the chosen age range 7 to 12, most of them have partly developed logic and reasoning skills which are children from 7 to 11. Let the length of the chosen age range be L , the length of the sub age range be L_s , the proportion of each sub age range be $P_x, x=1,2,3$, so we can have the formula below to calculate the proportion of each sub age range:

$$P_x = L_s / L$$

Let the value of instructors for children in different sub age range be $V_x, x=1,2,3$, Then the value of instructors should be:

$$V = P_1 V_1 + P_2 V_2 + P_3 V_3$$

For children with undeveloped logic and reasoning skills, it is suggested not to design instructors since they cannot understand them.

If the product has no instructor, the value of instructor will automatically become 0.

4.2.1.2 Internal triggers

When a product becomes tightly coupled with a thought, an emotion or a pre-existing routine, it leverages an internal trigger. It cannot be seen, touched or heard. Internal triggers manifest automatically in one's mind. From previous research on habits, we know that positive moods can encourage people to complete behaviors. Good habits usually provide people with long-term rewards which means when people can only have the rewards after repeating the

behavior for a while, such as exercising, reading, healthy eating. However, for children, not all of them can understand long-term rewards. This kind of internal trigger is highly related to children’s moral development. The second kind of internal trigger comes from the similarity between existing products and designers’ concepts. The last kind internal trigger comes from the rewards provided by product, which is going to be studied later in the reward section. In this section, how children’s moral development and pre-existing routine can affect habit formation is going to be discussed.

4.2.1.2.1 Children’s moral development

Based on Table 2.8 and Table 4.1, we can have values of children’s moral development in different age ranges.

Age		0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12+
Moral	Perspective taking	0					1			2		3		
	Concept of right and wrong	0	1		2		3							

Table 4.4 Value of children’s moral development

Children’s perspective taking skills shows how egocentric they are. If children are super egocentric, it will be hard for them to view their own thoughts from other perspectives, which means they cannot comprehend that things teachers and parents ask them to do are good for them unless they can produce positive moods instantly after doing that. Understanding right and wrong also contributes to their internal trigger to finish something. If they know something is right, it

will be more possible for them to have internal triggers to complete it. Therefore, to evaluate the value of children’s moral development, we need to add value of perspective taking skills and value of concept of right and wrong

4.2.1.2.2 Similarity

Familiar products can erase the strangeness and anxiety in user’s mind. Compared to learning new things, pre-existing routines also reduce the cost of time and energy. Designers should conduct a research on existing products, so then designers will have a knowledge of their using method. Then they can make a comparison between the existing products and their concepts. If their concepts share no similarity with existing products in the market, it will be hard for users to build connection with them. From different to similar, we can apply values to different extent of similarities.

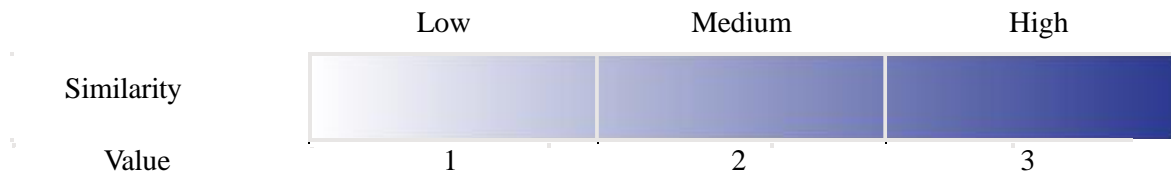


Table 4.5 Value of internal trigger based on similarity

Therefore, after comparison and analysis, designers can decide the value of similarity between their designs and existing products.

4.2.2 Routine

The routine here can be understood as the process that users operating the products. Factors affecting whether routine can be finished can be categorized as physical routines and brain routines.

4.2.2.1 Physical routines

How much physical efforts are going to be consumed in a physical routine is decided by children's ability and the routine's difficulty.

Children's physical ability depends on their development level of motor ability. Children's motor development has been studied in Chapter 2. Firstly, by doing research on existing products, designers will decide which basic physical actions are going to be involved in the process of using their products. What needs to be noticed is that since the age range has been decided before, these actions cannot be in the undeveloped level for children in the chosen age range. In this step, designers can use Table 2.6 and Table 2.7 to determine if the actions can be done by children in a certain age range. These actions involved in products' using process must have been mastered by children who is at the start of the chosen age range. For example, if the chosen age range is from 3 to 7, then children at 3 must be capable of finishing all the actions. Because if only children who are 5 can perform the actions, then children who are under 5 years old, which is still included in the chosen age range, will not be able to use the product.

After choosing actions, as what we do in Chapter 4.2.1.1, we can apply values on these actions to evaluate the physical routine. Each action has different extents of difficulty to children

in different age range. The extent of difficulty of a basic action is decided by when children can master it. For instance, if the skill of finishing one action is acquired by children when they are two years old, then it must be easier for children who are older. Therefore, we can use the value of children’s motor development level to define the difficulty of a basic action.

Firstly, based on table 2.8 and table 4.1, we can have the table below:

Age		0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12+
Stability	Dynamic Balance	0		1		2		3						
	Static Balance	1				2			3					
Locomotor	Walking & Running	1			2		3							
	Jumping & Hopping	0	1					3						
	Galloping & Skipping	0		1		2		3						
Manipulation	Grasping	1			2		3							
	Throwing & Catching	0	1		2		3							
	Striking	0	1		2		3							
	Kicking	0		1		2				3				

Table 4.6 Value of children’s motor skills in different development levels

Since the more difficult the basic action is, the more difficult for children to perform it, we can see difficulty of an action as negative effects. When designers are choosing the basic actions, they have eliminated those undeveloped skills in the chosen age range, so no value is going to be applied to “undeveloped” to describe difficulty of one action. In summary, the value of difficulty of skills gotten in different age range should be

Age		0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12+
Stability	Dynamic Balance				-1	-2		-3						
	Static Balance	-1				-2			-3					
Locomotor	Walking & Running	-1			-2		-3							
	Jumping & Hopping		-1					-3						
	Galloping & Skipping				-1	-2		-3						
Manipulation	Grasping	-1			-2		-3							
	Throwing & Catching		-1			-2		-3						
	Striking		-1			-2		-3						
	Kicking				-1		-2				-3			

Table 4.7 Value of difficulty of children’s motor skills developed in different age range

Then how do we process the values? Here is an example. A designer has chosen age range 3 to7, and the basic actions involved in using routine are chosen to be walking and kicking based on Table 2.6. Firstly, we can have the table below:

Age	3-4	4-5	5-6	6-7
Walking	1	2		3
Kicking	1			2

Table 4.8 Value of children’s ability of walking and kicking in different age range

Then based on Table 4.8, the value of the difficulty of both walking and kicking are both

-1.

For walking, there are 3 different development levels in age range 3 to7, so we can divide it into 3 sub age ranges, which are 3 to4, 4 to5 and 5 to7. As what did in Section 4.2.1.1, the proportion of each sub stage needs to be calculated. Then we can have 3 to4 as 25%, 4 to5 as 50% and 5 to7 as 25%. Then the value of walking will be: $25\% (-1+1) + 50\% (-1+2) + 50\% (-1+3) = 1.5$.

Then the same approach can be used to calculate the value of kicking. Skipping the process, the value of kicking is: $75\% (-1+1) + 25\% (-1+2) = 0.25$.

Since the physical routine has only used motor skills of walking and kicking, we just need to add the values of walking and kicking together, and then we can have the value of the physical routine in this example: $1.5+0.25 = 1.75$. This approach can be applied to most situations.

The only exception for this situation is when the value of the development levels of the chosen actions in the chosen age range are all the same, which means all the difficulty of actions they need to finish just match their ability. For example, if the chosen age range is 3 to5, and the chosen action are jumping and galloping, children between 3 to5 years old can all finish primary jumping and primary gallop, but these are their upper limits. In this case, we do not use the approach above to calculate values of physical routines; instead, we need to consider how many actions need to be done when using the product. Thus, the quantity of actions is going to be affect the value of a physical routine. Also, because these actions reach the upper limits of children's ability, the larger the quantity is, the more burdened the children are. Then we can have the values below:

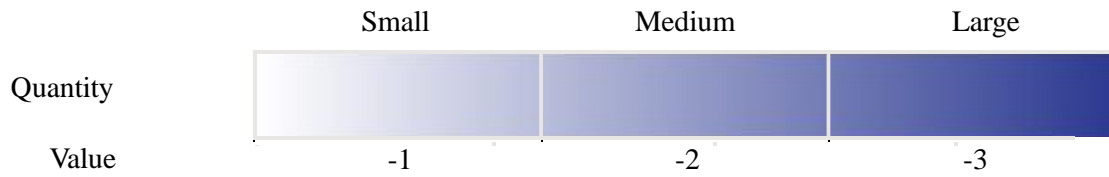


Table 4.9 Value of physical routines based on quantity

So in these special cases, we can use the table above to evaluate physical routines.

4.2.2.2 Brain routines

Brain routines can be considered as the thinking process while using a product. It is also affected by children's logic and reasoning skills. As how values of instructors can be calculated in Section 4.2.1.1, since brain routine are also affected by the same children factor, similar approach can be applied here.

If children need to think a lot when they use the product, the motivation they have to use the product will be less. Therefore, the difficulty of the thinking process will be considered as negative effect.

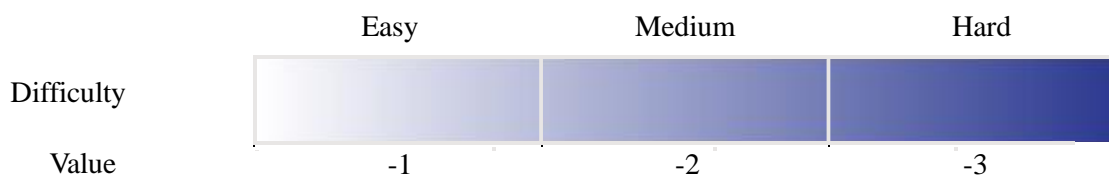


Table 4.10 The value of difficulty of brain effort

Then based on Table 4.3, Table 4.9, and the formula in Section 4.2.1.1, we can have the value of brain routines.

4.2.3 Reward

Reward includes instant reward and long-term reward. Instant reward is what providing instant feedback to users when they are using the product or right after finish using the product. On the other hand, long-term reward can be accumulated as the users keep using the products. Instant reward decides children’s motivation to use the product, while long-term reward decides if children will repeatedly use the product.

4.2.3.1 Instant reward

Instant reward can be anything making children produce a positive mood. Just like the bubble toothbrush mentioned in Chapter 3, instant rewards should be interesting and fun for children. Values can be applied to instant reward like below:

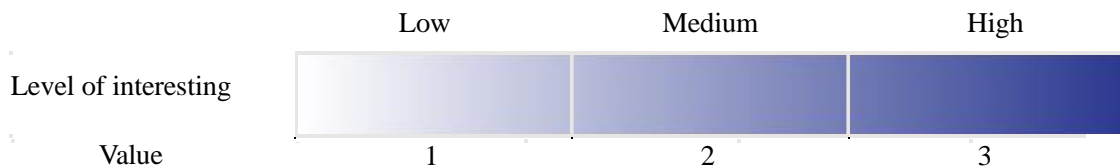


Table 4.11 Value of instant reward

4.2.3.2 Long-term reward

Long-term reward must be something users can have after using products for a while. It should be a rewarding system provided by products. This long-term rewarding system can also be considered something attracting user’s investment. If children keep paying their efforts and

time to the product, it will be hard for them to stop using it because human tend to irrationally value our effort (Eyal, 2014). Long-term reward is an important factor for repetition of behaviors, which makes a behavior become a habit. a pleasant stimulus can become a reinforcer if it provides information that allows the learner to control its appearance or to otherwise determine his or her own fate (cited in Shaffer, 1996).

Therefore, it should be attractive enough to make children invest. Values can be applied to long-term rewards as below:



Table 4.12 Value of long-term reward

4.2.4 Add up

After going through evaluation of all factors influencing habit formation, the next step is to add them up, and then we can have a number. The bigger the number is, the more possible that the product can successfully help children develop a habit.

4.3 Conclusion

The whole design process can be concluded as below:

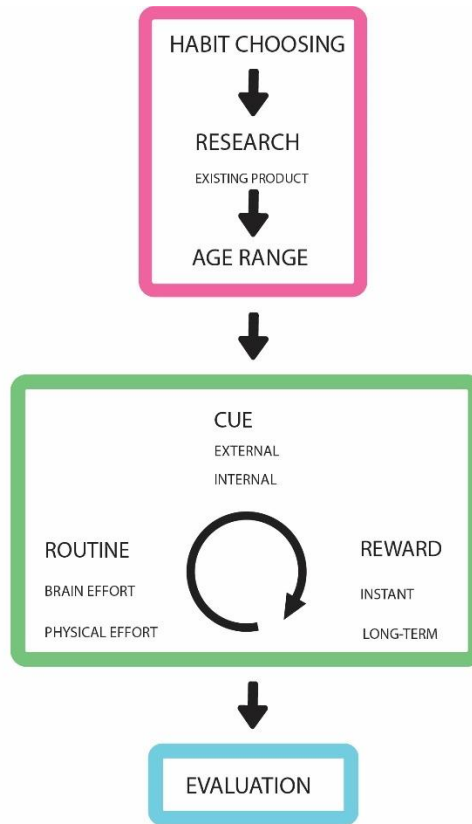


Figure 4.1 Flowchart of design process

After the design part, designers can use the list below to calculate the value of the product, which shows how possibly the product can help children develop the habit. If they have different design concepts, they can compare the values of their concepts to know that which one can more possibly change children’s behavior.

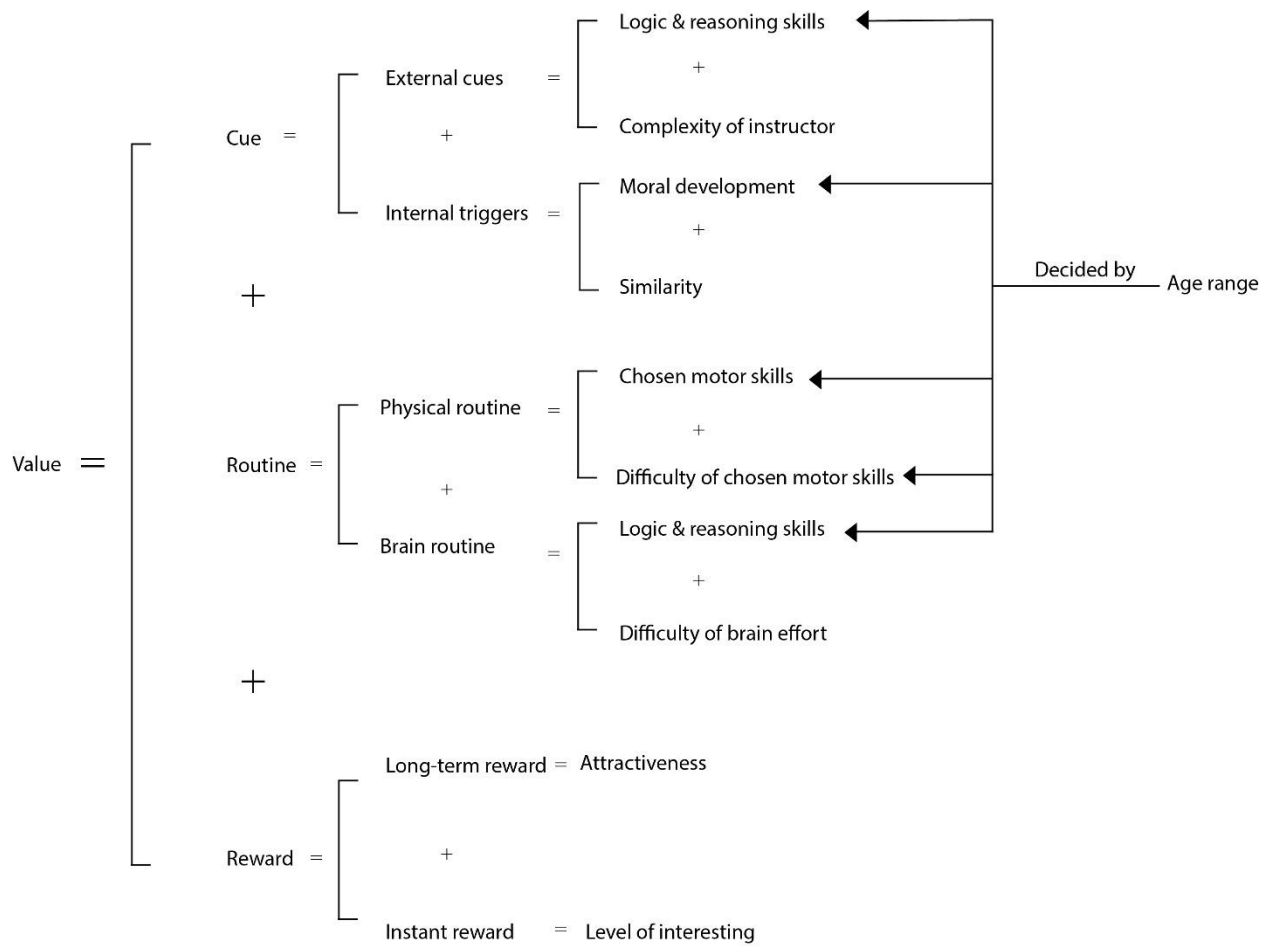


Figure 4.2 Evaluation method

Chapter 5 Design application

5.1 Habit choosing

Play is an important part of children's life. Most children grow up with plenty of toys and spend most of their free time playing with toys. A survey found that the average household owns 71 toys and one fifth of households possessed more than 100 toys, while more than one in 10 homes owned a vast collection of more than 200 toys (as cited in Jenett, 2018). Therefore, toy containers are indispensable for those families.

However, even with toy containers, children are not always willing to put toys away. Playing with toys is always fun, but after the fun part, putting them away seems to be boring and exhausting for children. On the other hand, developing the habit of putting things in the right place can bring lots of benefits to both of children and their families. Parents can be freed because they don't have to clean up the mess for their children. Children can understand the benefit of being organized, which will be helpful in their future lives. For these reasons, a product that can help children develop habit of putting toys away after playing with them will be designed in this chapter. To this chosen habit, toy container is the most related product.

5.2 Research on existing products

Toy containers on the market can be divided into two main categories. One is aimed to help children categorize their toys. These containers usually have different storage boxes, so children can put different types of toys in different boxes.



Figure 5.1 Toy organizers

The other kind of toy containers focus on being interesting. Basically, most of these toy containers look different from normal cubes. Appealing forms are applied so that they can attract children to use them.



Figure 5.2 Toy containers

What the two types of toy containers share in common is that they are all developed out of boxes or drawers. To use a toy container, children must have mastered two main motor skills, walking and grasping because they need to hold toys in their hands and walk to toy containers and put it in. Based on Table 2.8 (compiled development level table) we can have the table below:

Age		1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12+
Locomotor	Walking & Running	1			2		3						
Manipulation	Grasping	1			2		3						

Table 5.1 Children’s development level of walking and grasping

From around age one, most children are capable of walking slowly. Also, children younger than one year old can reach for and hold items with their entire fist. Therefore, on physical level, most children can start use toy containers from one year old.

Usually, preschool children spend more time playing with toys since they have more time at home. Also, during the time period, they have more types of toys than children under three.

In conclusion, the age range will be from three to six years old.

5.3 Final delivery

5.3.1 Using process

My final product is a robot themed toy box called Robox.

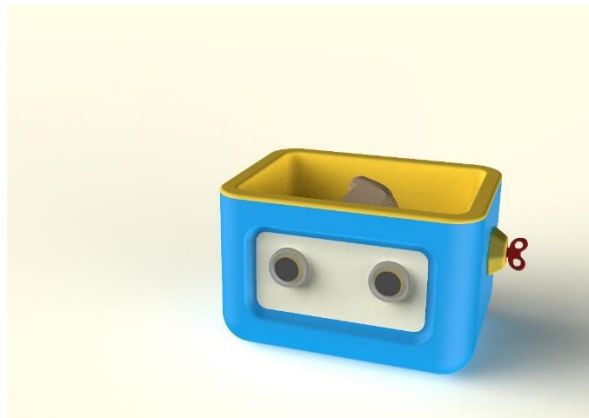
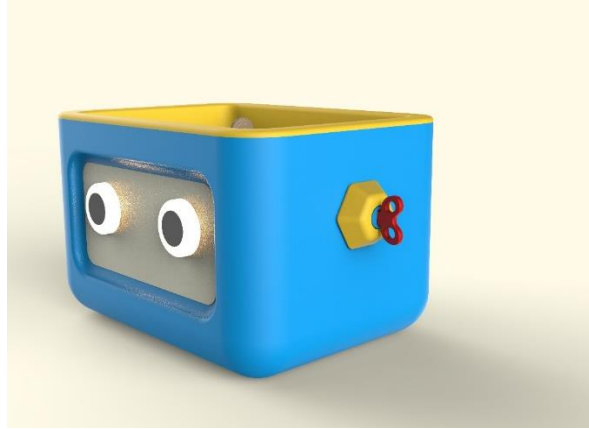


Figure 5.3 Robox

To use the toy box, first thing to do is to put all the toys in. Then parents can use the key to turn the box on.

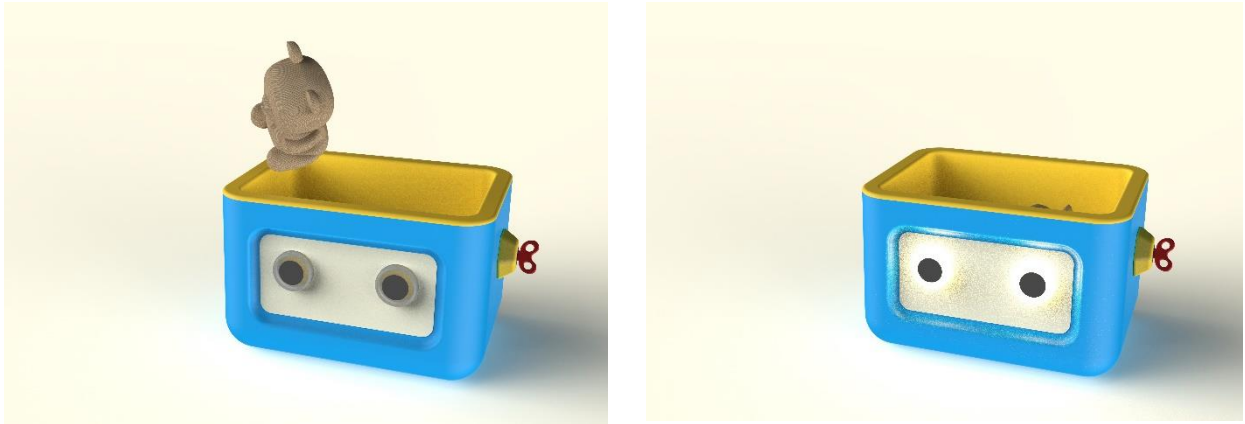


Figure 5.4 How to start Robox

At the same time, the weighting sensor set inside will start working and send the weight of toys to a microcontroller. And the eyes of the little robot will blink once and make a starting sound.

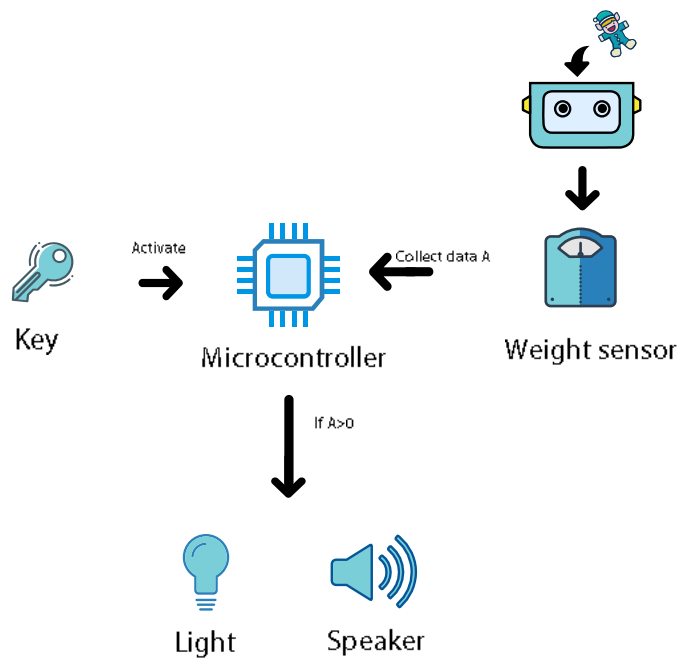


Figure 5.5 Flow chart of how to start Robox

Once the weight of all toys is recorded, the rewarding system is activated. Every night at 10 p.m., if the weight of toys in the box is the same as what is recorded before, the toy box will tell a story for 10 minutes. If the weight of toys is less than the record, then the story won't be continued that night. In addition, every time children put a toy in the box, cheering sounds will be made and its eyes will blink to encourage children.

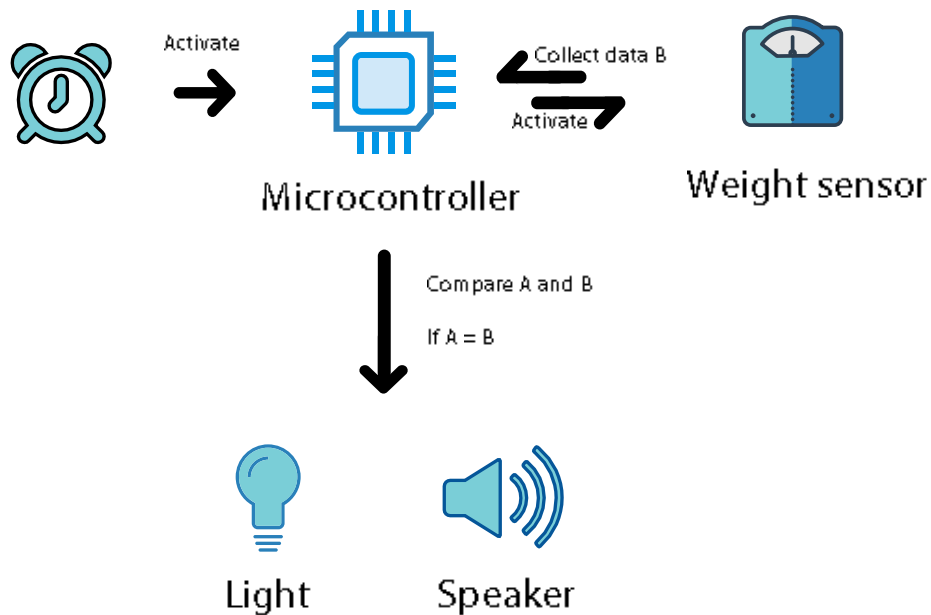


Figure 5.6 Flow chart of the reward

5.3.2 Evaluation

Whether a habit can be formed depends on cue, routine and reward. Based on the method developed in Chapter 3, a number will be given to represent how possible that Robox can help

children from age three to six years old develop the habit of putting toys away after playing with them.

External cue:

Value of external cue depend on children’s logic and reasoning skills and complexity of the product. First we need to calculate value of children from three to six’s logic and reasoning skills.

Age	3-4	4-5	5-6
Development level	Undeveloped		Developing
Value	0		1

Table 5.2 Children's development levels of logic and reasoning skills from 3-6

From the table above, value of children from 3 to 6’s logic and reasoning skills is 0.33. However, Robox doesn’t have any instructor for children, all they need to do is to put all their toys in the box, so no matter how undeveloped children’s logic and reasoning skills are, the complexity of instructor is 0.

Therefore, value of external cue is 0

Internal trigger

First, we need to calculate value of children’s moral development:

Age	3-4	4-5	5-6
-----	-----	-----	-----

Perspective taking	0	1
Concept of right and wrong	2	

Table 5.3 Children's moral development from 3 to 6

So we can have value of perspective taking skill is 0.33, concept of wrong and wrong is

2. Value of children's moral development is $2 + 0.33 = 2.33$.

As for similarity, Robox shares basically the same using method with products on the market. What children need to do is putting toys in the box. Therefore, the similarity is high.

Value of internal trigger is $2.33+3=5.33$

Physical routine

As discussed before, using Robox mainly needs two physical skills, which are walking and grasping.

Age	3-4	4-5	5-6
Walking	1		2
Grasping	1		2

Table 5.4 Value of children's walking and grasping skills from 3 to 6

Age	3-4	4-5	5-6
-----	-----	-----	-----

Walking	-1	-2
Grasping	-1	-2

Table 5.5 Value of difficulty of children's walking and grasping skills from 3 to 6

Value of walking is $\frac{2}{3}(1-1) + \frac{2}{3}(2-1) = 0.66$. Value of grasping is $\frac{2}{3}(1-1) + \frac{2}{3}(2-1) = 0.66$. So the value of Robox's using routine is $0.66 + 0.66 = 1.32$.

Brain routine

When using Robox, children do not need any thinking process to finish the routine, so the value of difficulty of brain effort will be -1. Value of children from 3-6's logic and reasoning skills is 0.33, so value of brain routine is -0.66.

Instant reward

Every time when children put a toy in Robox, it will have instant feedback, which are given by the light and sound. The feedback might not be very attractive to children, but it provides encouragement for children. So the value of instant reward is 1.

Long-term reward

For Robox, the long-term reward is stories. Every night Robox will tell a part of a story when the weight of toys meets the requirement, which is recorded before. If children don't put all the toys in the box before 10 p.m., then the story won't be continued. Children's investment here must be continuous; only when they put away toys every day before going to bed, they will have the chance to hear the whole story. The value of long-term reward is 2

Add up

The final step is to put all the values together:

External cue (0) + Internal trigger (5.33) + Physical routine (1.32) + Brain routine (-0.66)
 + Instant reward (1) + Long-term reward (2) = 9

The number 8.66 can represent for how Robox can help children from 3 to 6 years old develop the habit of putting toys away after playing with them.

We can put the numbers in the list below:

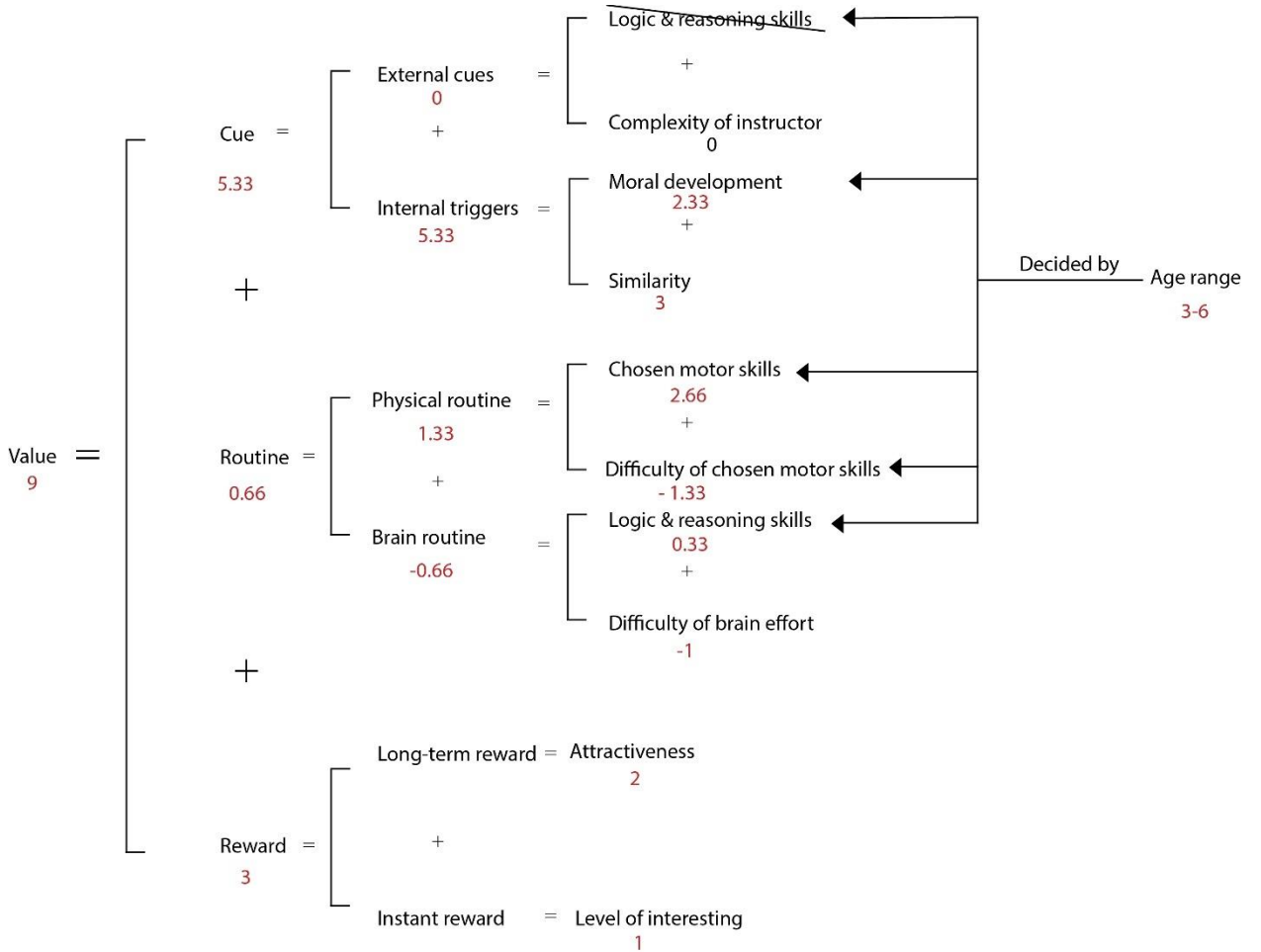


Figure 5.7 Value of Robox

Chapter 6 Conclusion

The intention of this thesis was to help designers design products which can help children develop habits. There are lots of factors contributing to forming a habit and these factors affect each other. My final approach mainly focuses on dealing with the relationship between the factors influencing habit forming. By digitalizing these factors, the relationships between them can be shown more directly. Designers can compare different ideas according to the evaluation method. Also, the method gives designer freedom to some subjective elements.

However, this approach only provides one simple solution. How habits are formed can be more complicated. Only main factors are mentioned in the approach. Parents' participation and other factors have not been taken into consideration. There are still more possibilities here.

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