Design for Sustainable Behavior: Investigating Health and Social Impacts

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Abstract:

Usage stage of product life cycle is the key phase that has the most impact on environment. In this stage the consumer behavior can play a key role in reducing this impact and this the focus point of design for sustainable behavior. In this paper, we go beyond the usual understanding of the environment as physical resources and surrounding. We focus on the health and social impact of human life and attempt to investigate how design for sustainable behavior can present an approach to decrease these impacts in modern life. Through focus groups and case studies, we present a new concept how to use design for sustainable behavior to improve life quality of people through investigation of health and social impact. This investigation was done by a focus group of designers and they presented two case studies. The first case study attempted to improve healthy life style through reducing sugar usage in our diet. The second case study paid attention to the importance of family mealtime and how it can be improved through technology.

Introduction

The aim of sustainable design is to improve people's life through performing their daily tasks in a manner that minimizes adverse environmental and social effects (Lockton et al., 2008; De Medeiros et al., 2018). As most impacts happens in the usage phase of product life cycle, this led to pay attention to the role of behavior during the usage of the product and its impact on environment. Researchers and designers developed various methods to affect the user behavior with the intend of reducing environmental impact (Lilley, 2005; Lidman & Renström, 2011; Chiu et al., 2020). The most effective approach is design for sustainable behavior which attempts to find more sustainable solutions for people's everyday problems.

Design for sustainable behavior studies how behavior change can reduce environmental impact. Strategies developed in this domain investigated how a product can make changes in the user behavior (Zachrisson & Boks, 2010). Theories of behavior were involved to understand how the behavior is formed and how it can be changed. People change their behavior due to many factors. Some change their behavior when they be more aware of the results of their behavior. Others need be encouraged by a reward or be feared by a fine or a punishment (Webb et al., 2010; Davis et al., 2015). Researchers converted these methods to strategies that can be used by a designer to create a product that change the user behavior into a more sustainable behavior.

As the environment was a focus point of design for sustainable behavior, most applications were related to the energy and resources saving. There are many examples of products that indicates this hypothesis such as power aware cord (poweraware, 2024) and home energy monitors (smartgreenshop, 2024). These devices make the electricity used visual to the consumer to be aware of the amount of his usage. This can help in reducing using of electricity in homes. In this paper, we investigated health and social sides of sustainable behavior. We found that a designer can help people to improve the quality of their health and social life through designing products that change their behavior.

Design and Sustainability

Through the last two centuries, humans have achieved a great development in science and technology. This huge development led to a lifestyle which is very harmful for nature (Diesendorf, 2000). According to that, various alarms had been set to change this harmful lifestyle and technological practices. Many attempts were made to find a new approach to rescue the environment, especially in various domains such as agriculture, architecture, industry, and design. In 1983, the United Nation established the World Commission on Environment and Development to study the connection between environment and development. In 1987, this committee published a report that was entitled "the Brundtland Report" (WCED, 1987). This report explained that the goal of sustainability is to meet our needs without affecting the next generations (Arena et al., 2009). In design domain, there were many approaches that

attempted to pay attention to environment such as environmental design (Forsyth & Crewe, 2006), eco-design (Knight & Jenkins, 2009), green design (Fullerton, 1998), but the more general and effective approach is design for sustainability or sustainable design (Mihelcic & Zimmerman, 2021). Design for sustainability is a part of the bigger picture of sustainable development, so it's noticeable that there are various domains for it and product design is one of these areas of interest.

Design for sustainability targets basically to reduce the amount of energy and resources that are used by humans. In product design, it was noticeable that the usage phase is responsible for the biggest consuming of energy and resources. From this point, design for sustainable behavior was introduced as an approach for design to help people reduce the negative environmental and social impact through changing their behavior (Lilley, 2009). In this approach, people are a centric part of the solution.

In this context, understanding behavior is very crucial for the design process. Various researchers and scientists developed definitions and theories to explain what behavior is and how it works (Uher, 2016). Behavior can be defined as the way one acts towards others or situations. It is often a response to a particular situation or stimulus. Humans usually do a behavior to obtain a need of to avoid a pain. There are many factors that may control the behavior of someone. These factors include:

- Physical factors: such as gender, age, and health.
- Personal and emotional factors: such as personality, beliefs, expectations, emotions, and mental health.
- Life experience: such as family, friends, and culture.

By understanding the human behavior in the context of product design, we observe that the behavior is a communication process between the user and the product. This process happens from the moment that a consumer decides to buy the product in. According to this point of view, various strategies were developed by several researchers. These strategies can be divided into three categories: learning and motivation, technology, and innovation.

1- Learning and Motivation:
- In this category, a designer attempts to increase the consumer's awareness towards the environment. The aim of this process is to encourage the consumer to take environmentally friendly decisions in the usage phase (Lidman & Renström, 2011). This can be achieved in various ways. Making consuming visible through using phase may inspire consumers to change their usage behavior into a more responsible behavior towards environment and resources. Another method that can be used is to motivate consumers to change their behavior to get a reward or avoid a penalty (Oakley et al., 2008; Zachrisson & Boks, 2010; Scurati et al., 2021).

2- Technology:
- Using technology can be very useful in achieving good results in behavior change (Kuo et al., 2018; Chiu, 2020). It can add restrictions for the consumer to prevent him from using the product in a harmful way for the environment. It also can give him feedback and information on his consuming behavior and allow him to change his behavior freely (Iveroth, 2014).

3- Innovation:
- This method depends on the ability of the designer to present a creative and clever product that can make the process of behavior change an endearing process to the soul. The change here stems from the consumer himself which makes the change last.

To put these strategies into applications, designers use many design methods for firstly understanding the behavior that should be changed and then to create a product that can stimulate humans to achieve that change. Behavior studying can be done in some ways depending on type of behavior, place of behavior, and time of behavior. The most used methods are observation and surveys (Chrysochou, 2017). These two methods are used to collect data about the user, the behavior, and the usage phase. A second step in understanding the behavior is to analysis behavior within factors affect it. This can lead designers to use methods such as scenarios and role playing. Data collected is used then to create a product that stimulates behavior change.

According to these strategies, various products were developed to change the usage behavior of consumers to be more sustainable. Most of these products are related to energy consumption and how to reduce it. On the other hand, health and social impacts of unsustainable human behavior are not investigated enough in the domain of sustainable behavior.

Design Process

The product design process is a systematic approach that involves turning an idea into a tangible product (Lawson, 2007). It typically consists of several key stages, each contributing to the overall development and refinement of the product. While different design processes may have variations, a common framework includes the following stages (Ulrich & Eppinger, 2016):

1- Research and Conceptualization:

- Identify a need or opportunity.
- Conduct market research.
- Generate and evaluate conceptual ideas.
2- Prototyping and Testing:
   - Create a prototype of the selected concept.
   - Test the prototype, gather user feedback, and iterate.
3- Detail Design and Specification:
   - Develop detailed specifications, including materials and dimensions.
   - Create detailed drawings or digital models.
   4- Manufacturing and Quality Assurance:
   - Choose manufacturing methods.
   - Develop the final product, ensuring quality through testing.
5- Launch and Marketing:
   - Develop a marketing strategy.
   - Launch the product in the market and monitor performance.

These steps provide a concise overview of the product design process, from idea generation to bringing the product to market. Flexibility and iteration are essential throughout each step to adapt to evolving insights and user feedback.

Methodology

A focus group of 10 product designers was selected, five product design students in level four, three senior product designers, and two design experts. Selection was proceeded according to their desire in participation and their previous experience in conducting research, working in projects, or studying topics related to sustainable design. An oral presentation by the author was conducted first to present design for sustainable behavior to audience. This presentation included an introduction to the topic and related strategies. The author explained the target of the focus group which was to investigate health and social impacts through behavior change. The group was divided into two sub-groups, the first one was to investigate health impacts and the second is to investigate social impacts. Participants of each group should conduct a case study for their assigned domain.

The focus group took two days, five hours each to allow enough time for participants to investigate targeted behavior and find out how a product can change it. In the first day, participants conducted a brainstorming for one hour to investigate what types of daily behavior can be changed to improve the sustainability of human life. The next two hours, they take a tour around the campus to collect data from people. They used observations, interviews, and surveys to collect their data. In the last two hours on the first day, they analyzed data collected and came up with a conclusion for the next day.

In the second day, the two groups developed a concept to change a harmful behavior in both health and social domains. An ideation process was done throughout the day and each group did an oral presentation to show up their final idea. A discussion was conducted at the end of the day to evaluate the experience from their point of view.

The two days led to two case studies. The first one is related to the social impacts of mobile phone usage during family mealtime and how this affects the communication process between family members. The second case study is related to the health impacts of unhealthy food on the human.

Case study 1:

Family mealtime is when everyone at home sits down and enjoys a meal together. This can be at breakfast, lunch, and/or dinner. Family mealtime plays a crucial role in fostering strong social bonds among family members. Sharing meals provides a dedicated time for connection, communication, and the reinforcement of familial ties. It offers a platform for open conversations, the exchange of experiences, and the cultivation of a supportive and cohesive family environment. Recently, this time has been reduced due to modern life style and even when a family are gathering for meals, this time is interrupted by mobile phone usage.

The intrusion of mobile phones during family meals poses a potential threat to the cohesion and communication within a family. Constant use of phones can lead to distractions, diminishing the quality of interaction among family members. Research suggests that excessive screen time, particularly during meals, is associated with reduced face-to-face communication and may contribute to a sense of disconnection within the family unit. Encouraging mindful and technology-free meal times fosters a more engaged and present family environment, allowing for meaningful conversations and strengthening the social fabric of the family.

The first group used mind map technique to survey types of behavior in home, work, and street. This mind map showed several unsustainable types of behavior that impact the social life of the human. The manner of mobile phone usage during family mealtime was selected to be the target behavior. Through brainstorming, members of the first group attempt to find out a product idea that encourage more communication between family members during mealtime through reducing the usage of mobile phones in this time. Two main solutions were developed, the first one is an application with parental control to switch off phones during mealtime. The second solution is a dining table device that controls family members' phones in mealtime to allow them for more communication. The device was labeled as the "Family-Connect" by

the group to add the sense of fun to it. The device could be placed on the dining table during meals. It syncs with family members' smartphones and, during mealtime, activates a "Family Time" mode. In this mode, incoming notifications are muted, and only essential calls are allowed. The hub could display a soft, ambient light to signify the dedicated family time. It aims to minimize distractions, foster meaningful conversations, and strengthen family bonds during meals. The device could be customizable and adaptable to different family preferences and sizes.

Case study 2:

The prevalence of unhealthy food in modern life poses a significant threat to human health, leading to a range of adverse consequences. The abundance of processed and high-calorie food options, often laden with excessive sugar, salt, and saturated fats, has become a major contributor to the rising rates of obesity, cardiovascular diseases, and other health issues. This shed light on the dangers associated with the consumption of unhealthy foods, emphasizing the need for awareness and lifestyle changes to mitigate the detrimental impact on human well-being.

Excessive sugar consumption has become a concerning aspect of contemporary diets as it is contributing to a myriad of health problems. Sugar is pervasive in various food items, and its intake extends beyond the obvious sweet treats. Processed foods, including soft drinks, cereals, condiments, and even seemingly healthy options like yogurt and granola bars, often harbor hidden sugars. High-fructose corn syrup, sucrose, and other sweetening agents are commonly used in the food industry to enhance flavor. The overconsumption of these sugary additives is linked to an increased risk of obesity, type 2 diabetes, cardiovascular diseases, and dental issues. Understanding the diverse array of foods containing excessive sugar is essential for making informed dietary choices and promoting overall health and well-being.

The second group paid attention to that danger on human health. Through design techniques, they developed a spoon to analyze the sugar in food. The device is shaped as a spoon that could be equipped with a small infrared sensor capable of analyzing the sugar content in various food items. Users would simply point the spoon at the food, and it would provide real-time information on the sugar content, displaying it on a connected app. The app could also offer personalized recommendations based on the user's dietary preferences and health goals, promoting informed and healthier food choices. The spoon aims to empower individuals to make conscious decisions about their sugar intake, fostering a more health-conscious approach to nutrition.
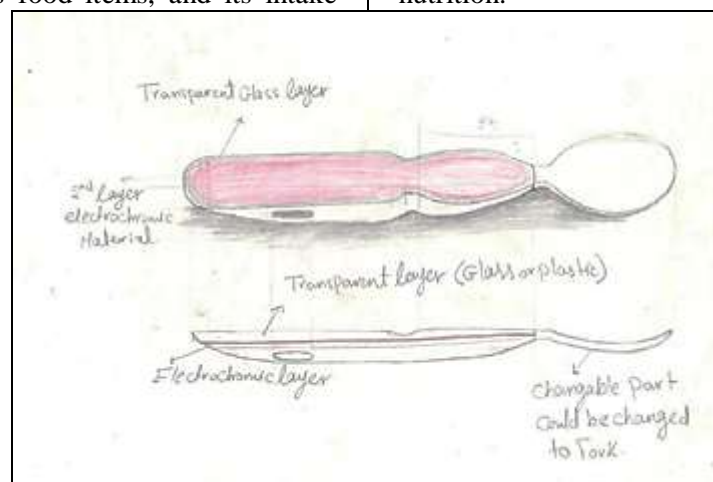

Figure 1 shows the suggested Sugar Spoon

Discussion

Design for sustainable behavior involves creating products, services, and systems that encourage and support environmentally friendly actions and lifestyles. The impact of such design extends beyond the environment and can significantly influence both social and health aspects of human life. From the previous two case studies, it is obvious that design for sustainable behavior can play a key role in the human life.

The first case study investigated a common behavior within modern families. Usage of mobile phones during meal gathering that prevent good communication between family members. This can lead to bad relationship within family due to reducing the quality of interaction, fostering a sense of disconnection and isolation, and missing opportunities for bonding. This also sets poor role modeling behavior, decreases presence and attention, increases tension and conflict, and potentially impacts mental well-being. Establishing boundaries and dedicating mealtime as a technology-free zone can contribute to more meaningful connections and a healthier family dynamic. The suggested solution merged the two

strategies: learning and motivation, and technology. It depends on the awareness of the parents and their desire to encourage positive communication between family members. It uses technology to add restrictions on mobile phone usage during family mealtime.

The second case study explored the harm of sugar consumption in food especially for diabetic patients. There is a constant need for them to control the amount of sugar they consume. The suggested spoon depends on developing an existing device that measure the amount of sugar in food. This device is the refractometer. This device analyzes the contents of the food by taking samples of it. The idea of red infrared sensor can be considered an applying of the technology and innovation strategies in design for sustainable behavior.

Conclusion and future work

This research investigated the possibility of using design for sustainable design to improve human health and social life. Through case studies, it is obvious that it can change various areas of human behavior to be more sustainable, healthier, and better socially. The first case study attempts to help families to have a more quality time during meals through using technology. The second case study targeted to help people to avoid hidden sugar in food which can help them to achieve a healthier life style.

From previous results, future works should concentrate on investigating more areas to apply the principles of design for sustainable behavior. It is obvious that there are various applications which can change the life of human dramatically.

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