

Combining sustainable aesthetics and a high product quality experience in a sustainable product

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Abstract

This paper describes the creation of a method and the application of that method in a case study on how a product can be designed to have a high sustainability, a sustainable aesthetic and a high consumer-appeal at the same time. Often, manual 'sustainable styling' that emphasizes the sustainable nature of a product results in a low quality user experience, either due to the use of biodegradable materials, or due to extremely rough production methods. Sometimes, this sustainable aesthetic even comes at the cost of a reduced real sustainability of the product. However, sustainability and a high product quality experience can go hand in hand. Included in this paper is a research on sustainable design that results in several design criteria on how to create a sustainable product with a sustainable aesthetic, as well as a case description of a redesign process for a Philips baby monitor that explores the application of the design criteria in combination with the needs and wishes of a specific target user group and company. The resulting product is completely different from the original product in both functionality and styling, but the sustainable design criteria have been applied properly, which leads to the product being at least just as appealing as its non-sustainable equivalents without having neglected the needs and wishes of the target group users and the company. In fact, sustainable design can greatly help both the user and the company, instead of compromising their needs.

Keywords

Product Design, Sustainability, Experience

1 INTRODUCTION

Sustainability is often confused with environmental friendliness. However, sustainability consists of several different facets, of which a healthy environment is only a single one. This paper will explain the core values of sustainability, after which several main design criteria will be derived that, when carefully applied, can be used to greatly improve a product's sustainability in the design process. Also, guidelines concerning the implementation of a sustainable aesthetic will be set up, after which the design criteria are tested in a case study. This case study consists of the redesign of a Philips baby monitor, and applies the described design criteria throughout the process. The resulting design is described in detail according to each of the design criteria. Lastly, the findings in this paper will be briefly discussed, and the most important conclusions and recommendations are provided.

2 SUSTAINABILITY

The most commonly used definition of sustainable development is the one that appears in Our Common Future (World Commission on Environment and Development, 1987), also known as the Brundtland Report: "Sustainable

development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This definition appeared in 1987 and is still used widely today. Contrary to popular conception, sustainable design does not only focus on maintaining a healthy environment, but connects the three most important factors that are of influence on the 'ability of future generations to meet their own needs'. These three factors are a healthy environment, a growing economy, and social justice, and they need to be in balance to achieve a sustainable society. (ACPA, 2008) Either of these factors needs to be equally considered when designing for sustainability. Placing emphasis on only one of them is almost always at the cost of one of the other factors. Therefore, a sustainable approach is a balanced approach. (Addis & Talbot, 2001)

2.1 Environment

Maintaining a healthy environment consists of several sub-goals that need to be reached. The depletion of resources is currently one of the most important threats for the sustainability of the environment, but also pollution of air, land, and water, and the fast increasing waste production are serious risks. To be able to cope with these problems, sustainable design needs to incorporate solutions that counter the risks. The

depletion of resource materials can be opposed by the use of renewable resources and recycling. Recycling can also be used to solve part of the waste problem, and thereby also counteract pollution.

A term coined by William McDonough and Michael Braungart (McDonough & Braungart, 2002) is **upcycling**, which is defined as 'the practice of taking something that is disposable and transforming it into something of greater use and value'. Using methods like this in a design process, the risks threatening the health of the environment can be thwarted much easier and faster.

2.2 Economy

A healthy and stable economy is a very important factor in providing for people's needs.

Technological and scientific innovations are only possible in a steady economy and so is the development of new and better products. Also, a healthy economy provides society with enough work and wages, thereby directly adding to the development of social justice, literally 'enriching the world'.

The most important concern of economic sustainability at this moment is the division between growing and declining economies: "A global economy with inequitable wealth distribution will be subject to continual international strife and conflict. Such strife and conflict, in turn, ensures the economic unsustainability of some nations and threatens the economic sustainability of all. Therefore, an equitable distribution of wealth among nations is required to maintain a global steady-state economy." (GP, 2004)

2.3 Society

The maintaining of social sustainability means keeping up the quality of life. An important factor in this is recognizing the value of social capital, and according to Goodland (Goodland, 2002), commonly shared rules, laws, and information (libraries, film, and diskettes) promote social sustainability. The most important threats for the sustainability of society are violence, mistrust, and loss of common values like tolerance, discipline and ethics.

3 SUSTAINABLE PRODUCT DESIGN

The concept of sustainable development, though clear, is a very abstract philosophy about how to approach development processes. It is not a clear method that provides set guidelines and rules, and sustainability in design cannot be seen as a measurable amount. However, there are some sources that provide basic, more defined, points of attention that can be used during a design process. Greenwood (Greenwood, 2004)

provides us with a list of design strategies, the most relevant ones being:

- clarify core functions;
- avoid hazardous materials or substances;
- seek simplification;
- design for durability;
- create loveable products;

There are of course much more strategies that can be used to improve a product's sustainability, but the reason that these strategies are some of the most relevant ones, is that they affect all three (environmental, economical, and social) sustainability aspects in a positive way. While most of them provide immediate improvements of overall sustainability, they also contain some pitfalls that need to be very clear during the design process to be able to avoid them. The benefits and drawbacks of each strategy will be described in the next paragraphs.

3.1 Clarify core functions

Clarifying core functions means designing around the single main function of a product. As long as the core function of a product is fulfilled completely and doing so in a very good way, the product will last longer for it will not be disposed due to poor quality. Also, products with a good fulfilment of their core function will sell well, thereby satisfying both the customers' and the producers' needs. The designer needs however be careful that reaching a very high functionality level may also be at the expense of environmental sustainability when i.e. more materials or less efficient manufacturing is required.

3.2 Avoid hazardous materials or substances

By avoiding hazardous or toxic materials not only the contamination of air, water and soil is reduced, but it also improves the health of manufacturing workers and the users of the product. While non-toxic substitute materials may be more expensive, there are reduced liabilities and fewer costs for expensive safety systems.

3.3 Seek simplification

Seeking simplification is in a way similar to clarification of the core functionality of the product. Nowadays, most products are unnecessary complex and designers can improve the overall sustainability of a product by reducing that complexity, returning to only the necessary functionality. Less components and lower material variety helps the recycling process of a product and improves efficiency. Also, the development, manufacturing, assembling and disposal costs can be greatly reduced when

designing for simplification. Another advantage is an improved overall usability and greater value for money. However, simple products may be less capable of meeting individual consumer's needs, and can result in a lower perceived value.

3.4 Design for durability

The opposite of planned obsolescence, design for durability has some large advantages for sustainability. By creating products that last longer than their current equivalents, a reduction of waste materials and resource consumption can be realized. While economically the sales turnover might decline, the long term production costs are reduced and customer-loyalty can be established easier. Also, durable products must be designed for upgrading, since they may become less clean or energy efficient in comparison to their newer equivalents as they are used longer and become older.

3.5 Create loveable products

Because products are often purchased for emotional reasons rather than purely functional reasons, they need to be designed to be loveable. Also the treatment during a products life and the decision to dispose of it are emotionally influenced. When a product is loved by its user, they will want to use it for as long as technically possible and treat it more careful. This greatly helps in improving a product's sustainability; the longer lifespan before disposal provides an environmental advantage, and the product is perceived as being higher in quality. When a product is loveable and thus meets the functional and emotional needs of the user, they will promote the product by word-of-mouth and customer-loyalty is improved. A downside could be an increase in development and manufacturing costs.

4 SUSTAINABLE AESTHETIC

Apart from creating products that are sustainable, an important factor is the creation of a sustainable aesthetic that provides customers with a reference of what a sustainable product looks like, and designers with a guideline of what a sustainable product should look like. However, as said by Walker (Walker, 1997), the definition of form, and detailing of shape and surface of a product are both constrained and largely determined by the overall production system. The implementation of sustainable design strategies limit the production system even more than already is the case, thereby for a large part automatically creating a unique aesthetic for products that are designed to be sustainable. Therefore, designers should not be attempting to create a new style which we might characterise as 'sustainable aesthetic'. This insight by Walker might be considered as a 'form follows

philosophy' instruction to designers that are creating sustainable products. Furthermore, the manual creation of an aesthetic for sustainable products will in most cases be in direct conflict with the design strategies provided for sustainable product design.

However, the idea of an aesthetic automatically sprouting from following sustainable design rules also implies that such a style is already present or at least forming. In 1994, Manzini (Manzini, 1994) said aesthetics always represent the values in a specific historical period, but that a sustainable aesthetic has not yet been formed since its principles are not fully absorbed into the values of our society. Manzini also argued that the transition to a sustainable society will be influenced greatly by aesthetics. The sustainable alternative needs to be made more appealing. Currently, however, we can easily say that sustainability principles are becoming part of our daily values very rapidly, so there must be products that embody these principles. Stilma (Stilma, 2004) researched the visual perception of environmental sustainability in products and came up with a list of design elements that are considered to create a 'positive environmental appearance'.

The most important and common of these elements are the following

- Smaller products
- Functionality and usability
- Plainness
- Wood and metal appearance
- Quality appearance
- Balance and unity
- Simplicity
- Rather round than sharp-edged, but not too roundly

Stilma also provides some elements that are found to cause a negative environmental appearance. These include aggressive, boasting or screaming design, too many colours, plastic appearance, transparent materials, domination of elements, excessive decoration, and black or yellow colouring.

Most of these product characteristics are linked directly to the use of sustainable production and manufacturing methods and the implementation of aforementioned design strategies. However, some of them seem to have no clear foundation or link with sustainability. For example, the use of round rather than sharp edges is a design decision that would not be the result of following any of the sustainable design strategies, except for possibly the creation of loveable products. Furthermore, the use of black and yellow colouring is not restricted by any of the sustainable design strategies, but is apparently

related to a negative environmental influence in the mind of the consumer. Therefore, these aesthetic design rules prove they are to be taken seriously when designing for sustainability; some of them do not directly result from following sustainable design strategies but can be used to enhance the sustainable aesthetic in a product.

5 DESIGN CRITERIA

By combining the design strategies for sustainable product design and the guidelines for creating a sustainable aesthetic, a set of design criteria can be created. The application of these criteria to a design or redesign process would result in a product that is both largely sustainable on all three sustainability levels, and has a sustainable aesthetic:

1. Focus on functionality
2. Clarity and simplicity
3. Quality and durability
4. Pure and honest materials
5. Loveable and friendly products
6. Think about the future

The designer should always keep in mind there is a delicate balance between these criteria which needs to be found, for they may sometimes contradict each other. The next few paragraphs will describe each criterion in more detail.

5.1 Focus on functionality

A product that does not fulfil its primary function is by definition a bad product. The very purpose of creating a product is to fulfil a function that cannot be fulfilled yet, or cannot be fulfilled enough. The designers should focus on carefully choosing a primary function and design the product to fulfil that function as good as possible. The addition of secondary functions may never be at the cost of the primary functionality.

5.2 Clarity and simplicity

A designer should keep a product as clear and simple as possible. Simplicity means avoiding needless secondary functions and finding the easiest solution to solve a problem. Simplicity also helps in creating clarity. The functioning and interaction of a product should be clear to the user. Complexity in interaction with the product leads to decreased functionality.

5.3 Quality and durability

A product should be designed to be as durable as possible. High quality manufacturing improves lifecycle length and decreases consumption rates. However, consider that quality improvements may go hand in hand with increased manufacturing costs or material usage.

5.4 Pure and honest materials

The use of pure and honest materials improves the user experience with the product. Use materials like wood or metal rather than synthetic materials. Avoid transparent materials, especially glass. Whenever using synthetic materials, consider carefully the different types and variants. Whenever possible, leave the material in its original colour and avoid painting.

5.5 Loveable and friendly products

Create products that people will love and care for. Products that are loved will have a longer lifecycle and will not be disposed for fashion or style reasons. Design products to look friendly and humble, not aggressive and loud.

5.6 Think about the future

Consider the future of the product. The product may need to be upgraded in a later stadium of its lifecycle, so design for upgrading. Also, design for maintenance, disassembly, remanufacturing and reuse.

6 CASE STUDY

To test the validity of these design criteria, they were applied in a case study. The case study consists of the redesign process of a Philips baby monitor (Philips Avent SCD530). The goal of this design process was to completely redesign the product following the sustainable design guidelines and criteria set up in this paper. Both the functionality and the visual styling are being redesigned.

6.1 Target user group

Apart from the guidelines for sustainable design, every project needs to fit certain user needs. Since every product design process has a different target user group, the guidelines for fitting the needs of the user are not included in the design criteria described before.

The target user group in the redesign process of the baby monitor, as provided by Philips, consists of young first time parents, especially mothers, that are well educated, have a busy lifestyle, an above average income, and live in a big city.

This target group has some very specific characteristics and needs, of which the most important are the following:

- The baby monitor needs to have a large range, since the parents might leave the house to visit someone in the neighbourhood.
- The baby monitor needs to have a 'vibrate' function to be able to use it in situations where loud sounds are not possible.

- The baby monitor needs to have a modern and sophisticated appearance, even after several years of use.
- The baby monitor needs to be the most appealing product among its competition, even if the users do not care too much about sustainability.

From these user needs, it becomes clear that the target group demands might contradict the sustainable design criteria on a couple occasions. Therefore, again, a balance needs to be found by the designer between the user values and the sustainability values.

However, a product that was created following the sustainable design criteria should not always have to make that sustainability its unique selling point. The product should be sustainable without the user noting it, and without forcing the user to act in a different way than they would normally. Ideally, the user should not have to be concerned with the sustainable nature of the product, but be able to rely on the fact that it is sustainable without having to do anything more than usual; the designer has a much larger influence on the overall effectiveness of sustainable products than the consumer.

6.2 Core design values

The design process aims to include the core values of the company that will be manufacturing the product: Philips. The main goal of Philips is to improve the quality of people's lives through the timely introduction of meaningful innovations. (Royal Philips, 2008) Also, Philips is strongly committed to 'meeting the pressing challenges facing the world' by 'using their expertise to simplify complex global challenges – the growing demands for energy efficiency and healthcare – they develop sustainable solutions for people in all markets.

The aforementioned 'invisible' sustainability perfectly fits in this philosophy. By exercising sustainability in designing products, the quality of people's lives improve on the long term. Also, improving the quality of life means that the current quality needs to be kept intact, and thus not to bother consumers with the fact that they need to think and act sustainable.

Also, the motto of the company is 'sense and simplicity', sense meaning the user and its feelings, needs and wishes should always be the primary point of interest, and simplicity meaning that products should be as straight-forward as possible.

6.3 Specific design criteria

For this specific case, the following design criteria can be added to the list:

- **Consider the user.** The product should provide in the needs of the described target user group.
- **Consider the company.** The product should follow the core values of the Royal Philips Company.

Appending these design criteria to the list of sustainable design criteria, the design process can be started.

6.4 Design process

Since the design criteria have no particular order of importance, several iterative loops need to be followed during the design process to make sure that neither of the criteria is neglected or dominating. The design process will however be described in the same order as the criteria are listed in this paper.

6.4.1 Focus on functionality

The primary goal of the product is to know when your baby is awake and if it needs attention. The product as it was before had a lot of secondary and even tertiary functions, such as a night light, sleep songs, a temperature sensor, a humidity sensor, a talk-back function, a digital display, and The product was stripped down to its essentials and functions that were considered to be distracting from the primary function were removed. The functions that remain are the DECT-technology for transmitting the sound signal, volume control, sensitivity control, battery indication light, signal indication light, and a power-on indication. This set of functions allows a fulfilment of the primary function just as much as before; the removed functions did not add to the fulfilment of the primary function.

6.4.2 Clarity and simplicity

To improve clarity and simplicity, some of the remaining functions were changed. Where first the signal indicator light was on during the presence of a continuous signal, the signal indicator light now indicates an absence of signal, causing it to catch the attention more effectively when something is wrong, and reducing the time the light needs to be on.

Also, the volume control was brought down to four levels: low, medium, high and off. When turned off, the vibrate function is automatically turned on, providing a vibrating movement when a sound signal is present. The same goes for the sensitivity; three levels of sensitivity can be selected. Both volume and sensitivity levels are indicated by playing a beep-sound at different sound levels. This eliminates the need for a digital display.

The power-on indicator is a soft-glowing green light when the device is idle. This green light turns to a yellow light when a sound signal is picked up, pulsating according to the intensity of the sound signal. The light is located around a button in the centre of the device, which has the function of turning the device on or off.

The baby unit only has a power button and a small power-on indication light. Also, the baby unit serves as a docking station for the parent unit, thereby removing the need for an additional docking station. The parent unit can be charged by connecting it to the baby unit.

6.4.3 *Quality and durability*

The overall durability of the product is improved by removing parts that are sensitive to breakage or failure, such as the digital display, and the temperature and humidity sensors.

To improve the durability further, the AA-batteries were replaced by a rechargeable Lithium-Ion battery. This type of battery has a superior energy-to-mass ratio, no memory effect and a slow loss of charge when it is not in use.

Because of their longer lifetime, their overall cost is lower than that of AA-batteries. Also, the technology behind Li-Ion batteries is still improving rapidly, and recent discoveries show ways to improve the charge of these batteries tenfold. (Chan, C.K., et al., 2007)

6.4.4 *Pure and honest materials*

The original baby monitor is completely constructed with Acrylonitrile butadiene styrene (ABS) injection moulded parts. The new design incorporates wooden panels to form the front of the baby unit and the back of the parent unit. Wood provides a proper protection for the sensitive parts inside the encasing, and is considered to be an honest and pure material, which is fully renewable. Only FSC-certified wood will be used to ensure that the sustaining of forests is not hindered.

For detailing, such as the belt clip, stainless steel is used. Stainless steel improves the lifespan of the belt clip, needs no extra protective coating, and is fully recyclable.

Where necessary, ABS injection moulded parts will be used. This is the case with the front of the parent unit, and the main encasing of the baby unit. Both these parts need more complex shapes for the circuit board and the button connections. A future possibility is to use bio-based plastics rather than fossil-fuel based plastics, but at the moment there are still too many issues concerning these bio-based plastics; they need complex composting programs to be set up, and may contaminate current recycling programs. (Institute for Local Self-Reliance, 2008) Another possibility is to use

plastics that already have been recycled, such as RHDPE or RPP.

6.4.5 *Loveable and friendly products*

The product was made to look friendly by avoiding dark colours and sharp corners. Most corners are filleted with small radii to enhance the friendly appearance.

By using wooden panels, the product gets a warm character and the wood can be subject to 'positive wear'; the strengthening of the bond between the user and the product induced by wear on the product, a form of passive individualisation that makes the product loveable and more attractive to the user during continued use. (Eger, A.O., 2007)

Furthermore, the use of round shapes for the buttons and soft glowing lights in soft colours behind the buttons improve the friendly character. The product is humble, servient and unthreatening to the user, for there is enough clarity in interaction.

6.4.6 *Think about the future*

Most of the parts in the new baby monitor design are fully recyclable or already recycled. The wood and stainless steel can easily be processed for use in other products, as can most of the ABS parts.

The construction of the device is very simple and allows for easy disassembling. Each of the parts is made of a different material and does not need to be separated before recycling.

Also, the components on the circuit board can be completely reused in other appliances. The shape of the circuit boards is a general rectangle, so the chance it will fit another product is high.

The placement of the lights behind the buttons and the battery were not specifically defined during the design process, but they would need to be easily replaceable when failure occurs. This can be reached by making detachable connections between the parts, rather than solid connections.

6.4.7 *Consider the user*

The wishes of the user specified before, are all met in this product design; the DECT-technology makes sure that there is a continuous connection between the baby unit and the parent unit without interference, up to 330 metres; the volume settings also include a vibrate function, supported by a light alert when a sound signal is picked up; the appearance of the product fits the sustainable aesthetic achieved by following the sustainable design criteria and the use of wood and stainless steel, as well as its simplicity, make it a timeless design; finally, the baby monitor fulfils the primary and most important secondary functions as well as other baby monitors, making it no less appealing than more advanced baby monitors

with a large number of redundant functions. The simplicity and clarity is very likely to make this baby monitor the more attractive option to the consumer.

6.4.8 Consider the company

As described, Philips is looking to design products that genuinely help improve people's lives. Their motto is 'sense and simplicity'. The newly design baby monitor fits the company philosophy for it is primarily based on the sustainable design criteria, which include simplicity guidelines. Also, using not only sound but light and vibration as well, more senses are addressed, giving the user a feeling of comfort and closeness to their child.

Philips also aims to create sustainable products, but thereby not contradicting optimum usability. The baby monitor design does exactly that, and is not less appealing than an equivalent baby monitor that was not designed according to sustainability guidelines.

6.5 Resulting design

The final design as described is shown in figure 1 and figure 2 as respectively the parent unit and the baby unit, and combined in charging or docking position in figure 3.

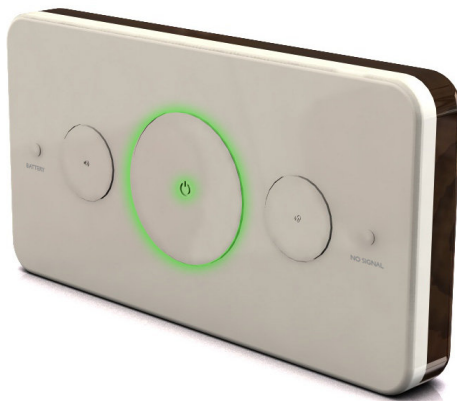


Figure 1. Parent Unit

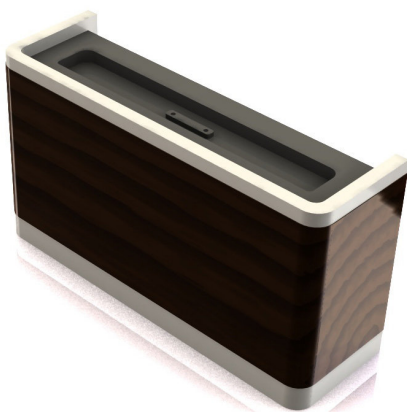


Figure 2. Baby Unit



Figure 3. Combined in docking position

7 DISCUSSION

The designing of products combining both real sustainable values and manually implemented sustainable aesthetics very easily contradicts itself. The forcing of a sustainable aesthetic onto a product just to make it appealing to a target group consciously caring about sustainability can just as easily have a bad impact on the real sustainability of the product, as it can have a good impact. Only when this sustainable aesthetic already flows from using sustainable design criteria, the findings about conceptions of sustainable appearance can be used to strengthen the sustainable aesthetic of that product.

The sustainable design criteria on their selves often contradict each other as well. The designer is always forced to find a balance between the criteria, for it is almost impossible to fully satisfy one without jeopardizing the other. However, the very act of considering the criteria will help greatly in designing more sustainable products. Also, the case study shows that following sustainable design guidelines does not have to come at the cost of the neglecting of user or company needs and values, but that it can in fact strengthen them when applied properly.

Lastly, it is important to realize that sustainable design does not have to be the opposite of commercial design. Designing sustainable products can help manufacturers save a lot of money in the long run, for example by designing for easy assembly, disassembly or reuse, and by equipping quality and durability as a tool to strengthen the customer loyalty.

8 CONCLUSION

By following just a couple of simple design rules during the process of creating new or improved

products, the overall sustainability can be greatly improved.

Sustainable design helps both the consumer and the manufacturer, contrary to popular belief. Products can genuinely be made better than their current equivalents by using sustainable design techniques.

The use of a sustainable aesthetic can improve the overall sustainability appearance, but should always flow from the use of sustainable design guidelines, after which they can be exaggerated or amplified. The implementation of sustainable aesthetics can never come at the cost of a lowered sustainability of the product.

9 RECOMMENDATIONS

When designing for sustainability, the designer must always be aware that every decision to improve sustainability at one point may reduce sustainability somewhere else. Finding the right balance is essential.

The case study described was a short project to test the application of the main sustainable design criteria combined with sustainable aesthetics. Would the product be further developed, a lot more sustainability guidelines could be taken into account; there are more design rules that can be used to improve sustainability on only one or two of the facets of sustainability. While not affecting all facets, these 'smaller' guidelines like i.e. modularisation, weight reduction, or integration of disposal instructions can help improve sustainability even further, when all the main criteria have been met adequately.

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