Artefacts

Design for Sustainability

2009 - 2011

Editor:
Joost Vogtländer
Design and layout:
Barbara Große-Hering

Design for Sustainability
Faculty of Industrial Design Engineering
Delft University of Technology

Contact:
Mariska Nederpel-van der Ham
m.nederpel-vanderham@tudelft.nl

Editor:
Joost Vogtländer

Design and layout:
Barbara Große-Hering

Cover (bamboo mat):
Fasting fotografie

ISBN/EAN: 978-90-5155-078-8

October 2011

Table of Contents

Preface

Every year, several students graduate from the Design for Sustainability Group (DfS) at the Delft University of Technology. These students must show how to convert theory into practice: they must design a sustainable product, a so called artefact. This booklet shows some remarkable artefacts over the last 3 years.

Artefacts are of crucial importance on the road towards a sustainable society. They not only show that a better world is possible, they often show that consumer preferences, behaviour, and lifestyle can change.
Artefacts convey the issue of sustainability in a better way than stories and theories: they send a clear message.

The DfS group hopes that the artefacts in this booklet*) will inspire other students who face the challenge of eco-efficient value creation. They can support the aim of DfS in the strongest way: stimulate and support the transition towards a sustainable society.

Prof. Dr. Ir. J.C. Brezet, chair of Design for Sustainability

*) The artefacts together with accompanying text of this booklet have been copied from the original graduation reports. We were not able to reach everybody for approval of the copy right. Please contact us when you do not agree with the publication of your work, or you want to alter the presentation.

The DfS Group

Mission, Vision and Structure

Mission statement

The development of sustainable products, services and systems, which bring quality of life for the end-users, by:

- Development of knowledge and methods (tools) for sustainable design and communication
- Design of sustainable artefacts (blueprints, prototypes, and demos)
- Valorisation in the industry
- Education of students

Vision

DfS must contribute with sustainable product designs to the well-being of their users:

- Saving the P of Planet (the environmental issue)
- Contributing to equality of wealth and access to resources (the Base of the Pyramid issue)
- Focussing on "Well-being" instead of "having" (counteract hyper-consumption)

DfS is dedicated to have impact:

- Applying various design strategies, rather than one dominant and a priori philosophy
- Contributing to a fast global diffusion of sustainable design approaches
- Being among the top-5 of DfS-type of industrial design engineering schools in the world

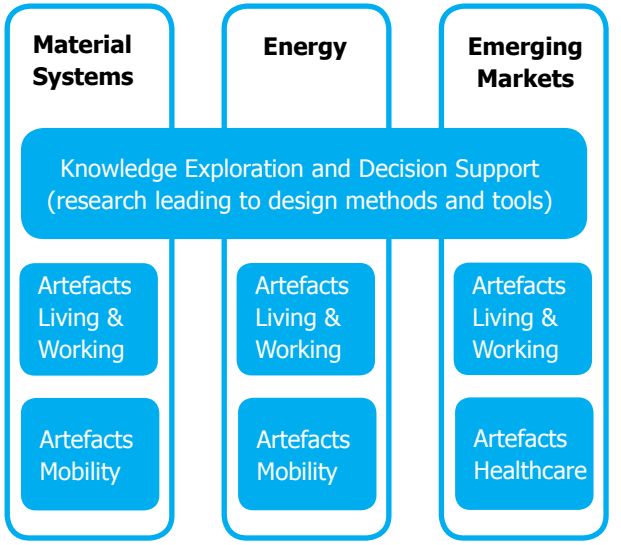
Structure

Within DfS, three fields of R&D are distinguished:

- Selection of Material Systems (material system selection in the fuzzy design stage, C2C systems, use of natural materials, use of local materials)
- Energy with regard to artefacts in the Living and Working environment
- Design Research for Emerging Markets (DREM), related to the Base of the Pyramid issue

In all these fields, the focus is on:

- Knowledge exploration and Decision Support, leading to methods and tools for designers
- Design of Artefacts (blueprints, prototypes, demos, software, books, etc.)



Artefacts of Master Projects

Gabrielle van Leeuwen April 2009
Company: Unesco-IHE

Arsenic Household Filter

In Bangladesh 35 to 55 million of rural people are drinking groundwater that is contaminated with high levels of arsenic. Even small doses of arsenic cause short and long term health problems and can even lead to death. Unesco-IHE develops absorbent based family filters, and has made several prototypes for testing. These prototypes, however, showed flaws in performance and lack of acceptance.
The graduation assignment is a redesign of the current prototypes. The result is a filter system which features comfort in use, click-on systems for easy cleaning and maintenance, and low production costs. The filter is marketed as a Product Service System, so the users do not have to buy the system and do not run the financial risk of the maintenance of the filters.

Marijn Bijleveld July 2009
Company: VelopA

Wooden Bicycle Rack

The Wooden Bicycle Rack is one of the many redesigned products for Velopa BV (a manufacturer of street furniture). The aim of the research project is to make the full product range more sustainable.
Material use is the dominant factor in the environmental load of street furniture products. Since the sustainability issues can be resolved by selecting alternatives, the main focus of the project is on how to obtain a low EVR (Eco-costs Value Ratio). A good option to begin with is to select materials that have a low 'own EVR', being the ratio between the material's environmental load (Eco-costs per kg, including the necessary treatments like coating) and selling price (obtained from the cost price per kg).

For the design of the new wooden bicycle rack, Accoya wood is selected to avoid the use of tropical hardwood. (Accoya is environmentally friendly modified European softwood with a durability better than Teak).

Arno Scheepens July 2009
Company: Cartesius Institute

The Rebicycle, a C2C production system

The assignment is to design a bicycle production system with an optimum Cradle to Cradle performance (measured according to LCA). Using local natural renewable resources from the local biosphere is the main design strategy to achieve a maximum sustainability level, because there would be no need for non-renewable materials, no transport, no external energy source (energy comes from wood-waste and saw dust), and no industrial waste. So the closed production system (e.g. 1 km2 of land) should be fully self-supporting.

Using local naturally renewable materials has been achieved for 70 weight weight percentage of the Rebicycle. In the future approx. 87 weight weight percentage might be possible.
Functionality, ergonomics, aesthetics and manufacturability all were integrated in the design.
Closing the cycle combined with the use of local natural renewable materials resulted in an eco-cost reduction of approx. 75 % (compared to a standard steel bicycle) with the potential of 90+ % due to future developments of bio-based Polyurethane and Epoxy.

Ernst-Jan Mul October 2009
Company: Eco-Movement

Bio Inspired Design of a Scooter Body

An electric scooter body is developed, applying the Bio Inspired Design method for Industrial Design Engineers.

Bio Inspired Design means making products fit in their environment by:
1. Taking inspiration from the way nature builds and works to generate design solutions.
2. Evaluating these solutions by the same rules that apply in eco-systems

In eco-systems everything is interconnected. To be sustainable in such an environment, products have to be connected as well. Eco-systems are always subject to change. To remain connected, products should adapt to these changes. Products have to be made adaptable to fit in their environment.
Based on observations of mature eco-systems, principles can be found that apply like rules to all organisms. With Bio Inspired Design, these principles are used to both generate and evaluate ideas.

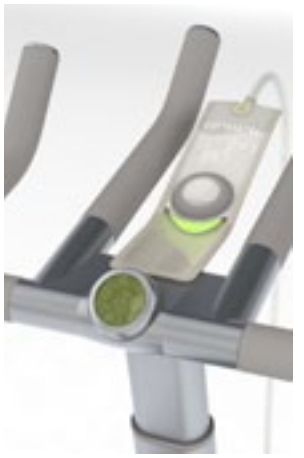
The body is designed to adapt to the changing needs of the user: the modular frame exists of 15 equal Thixo-moulded Magnesium parts, bolted together. Parts can be attached under various lengths and angles. The textile body is mass customizable. Different scooter types can be made out of one frame part all adapted to the length of the user.

Remi Veenman October 2009
Company: Creditz

Electrical Power from a fitness bicycle

The main aim of this MSc project is to reduce the energy needs of fitness clubs by utilizing human power.
Two strategic product directions have been determined:
1. Retrofitting existing cardio equipment, especially cross trainers and cardio bicycles.
2. Development of a new framework design that is a best-in-class in utilizing human power from fitness equipment, which is the selected direction.

This fitness bicycle combines the advantages of a cardio and a spinning.
The result of the design process is a fitness bicycle that can compete with existing equipment in terms of the environmental impact for production, but that can produce electricity and supply this to the power grid with an efficiency of 65%.
Because the produced energy is not converted into heat – as it is with normal equipment, requiring additional air conditioning – the returns of the fitness bicycle are increased by a factor 1:1,45.



Shribalkrishna Pati November 2009
Company: Procter & Gamble

Washing Machine for Emerging Market

Today there are more than 4 billion people in the world who still wash their clothes manually, using a time consuming and backbreaking process. The majority of these people are from the emerging markets like India, and have a low income. A wide range of washing machines of different machine manufacturers already exist in this market. But there are many accessibility barriers to washing machines that need to be addressed, like lack of space, irregular access to water and electricity, unaffordable price of entry etc.

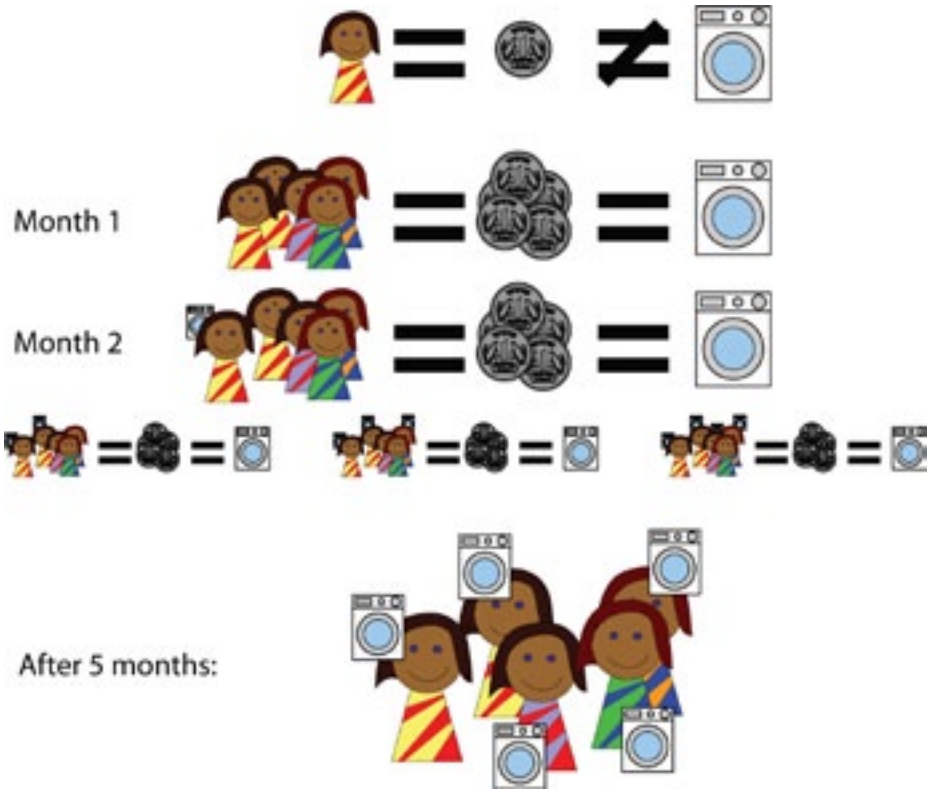
The proposed project endeavoured to design and develop a menu of new concept for low cost washing machine which will address the low income market opportunity in India, whilst considering the synergy with the laundry detergents and overcoming the current barriers in accessibility. The project attempts to investigate, conceptualize and develop solutions to present it in the form of a product to the Indian market using Industrial, Product and Mechanical Design processes.

Joris Kramer November 2009
Company: Procter & Gamble

Automatic Washing for Emerging Markets

P&G sees huge potentials in the developing market of India. The detergent market is one of these big potentials: the Indian detergent consumption per capita is very low compared to other countries. Most washing nowadays is done by hand due to cultural and infrastructural reasons. Hand washing is a time consuming and backbreaking activity, done mostly by women. Offering access to automatic washing is an opportunity: if P&G could make the Indians switch to automatic washing, this would unlock a new market.

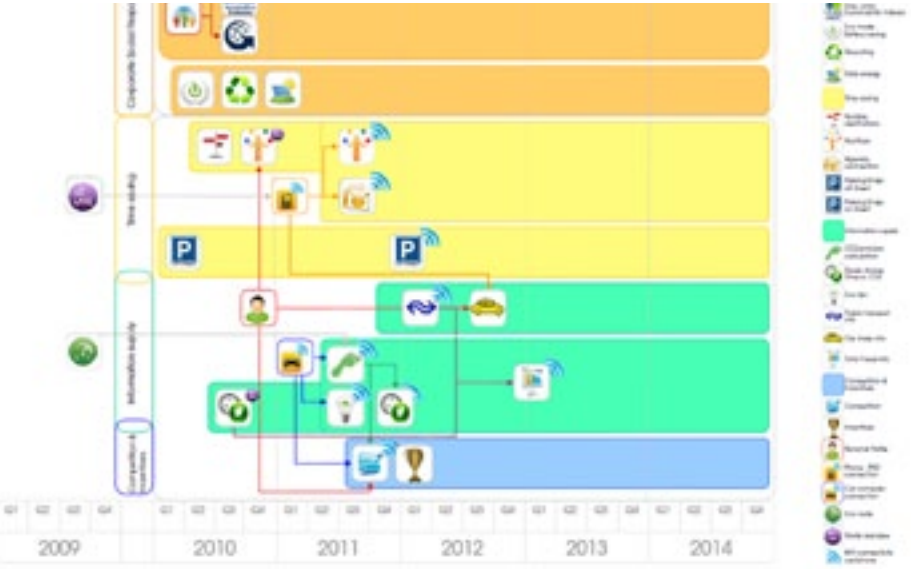
Six ideas have been evaluated. The Tide Chit Fund is chosen, because it complements the parallel project conducted by Shri Patil, a colleague-student, researching personal low-cost washing machine design that performs best in the researched context.
The Tide Chit Fund is a business model that enables personal ownership for low-income consumer; using a paying scheme with multiple women buying the washing machines together. It allows women to buy a washing machine within their budget, and receiving help in the adaptation process of automatic washing; allowing them to fully benefit from the capacity of the purchased machine.



Gabriëlle Muhring November 2009
Company: TomTom International BV

A more sustainable TomTom Portable Navigation Device

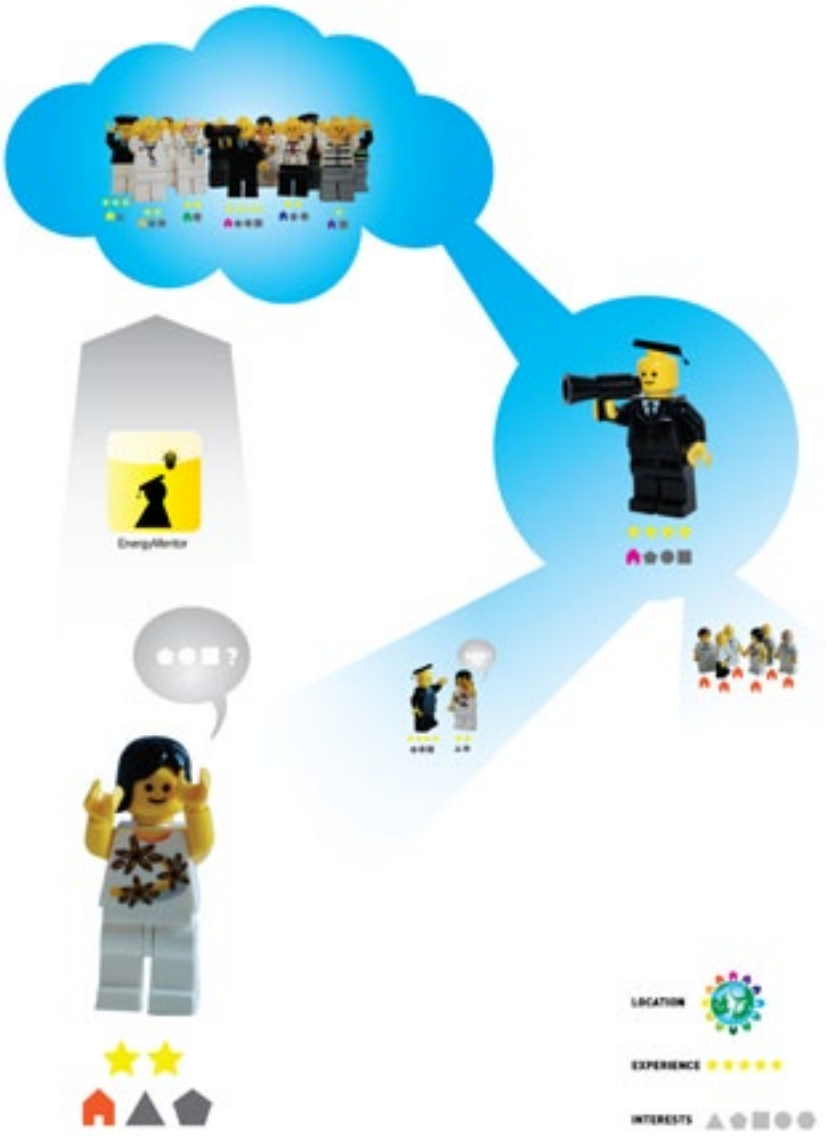
TomTom is one of the leading firms in navigation devices. As climate change is now an undeniable problem, environmental conscious behaviour is growing among consumers and, with that, also their support for sustainable products and practices.
Producing eco-friendly products will become more and more a necessity for companies. As a result of the changing consumer demands, as well as demands of governments, new product strategies within TomTom emerge.
This MSc project explores how sustainable TomTom is today and how they can improve their sustainability in the future.
The degree of sustainability has been determined by using a carbon footprint calculation by means of a Life Cycle Assessment (LCA) for one single PND. Additionally, a carbon footprint comparison of the energy reducing services of a navigation device has been assessed.
Based on these analyses and a product benchmark with the main competitors, services and functions were developed to improve the energy reducing capabilities of a navigation device system.



Loucas Papantoniou December 2009
Stichting De Witte Roos

The EnergyMentor

The EnergyMentor is about policies and measures to cut back greenhouse gasses attributed to households, aim to do so mainly by increasing the use of renewable energy (solar, wind, biomass, geothermal) or by improving the energy efficiency of houses and households.
The latter is the main subject of this project, focussing on the consumer's behaviour as a significant determinant on the household's environmental impact.
To achieve a more eco-efficient lifestyle, the concept of the EnergyMentor was developed, which aims to help fill the gap from awareness to action. The EnergyMentor might be an App. It is social software that brings together people that want to learn or teach alternative ways of conserving energy and minimizing their environmental footprint. The EnergyMentor is complementary to an energy meter. It transforms the sterile indications of the energy meter into rich suggestions and tangible actions. The EnergyMentor creates a network of experts that can be called upon at a moment's notice to answer questions about energy and sustainable living. By integrating the EnergyMentor in people's existing cell phone or a computer, one can easily and quickly ask questions and get personal answers. Listening to real stories of people that have already taken on the challenge to minimize their energy consumption can be fascinating. People can chat to each other or even send a video of themselves.



Anna Raetsen December 2009
Company: Esprite Nomade

Luxury Tent Line: for enhancing nature experience

This project is conducted for Esprite Nomade, based in Bali, Indonesia. Esprite Nomade is a design studio, designing luxury travel and lifestyle products for wealthy travellers and luxury hotels.
A new luxury tent line had to be designed, with tents to be used for events, like parties, picnics and meditation, and a tent to be used as a private guest house.

In an explorative research the vision of travellers and general managers of luxury hotels on nature experience, luxury and environmental conservation was examined. From this research can be concluded that travellers' awareness of the environment can be increased by positive nature experiences, information and participating in nature projects.
Based on the previous information the most important design themes for the project are 'Nature Experience', 'Luxury', 'Environmental Friendliness', 'Customization' and 'Easiness'.
The final design is composed of bamboo and cotton-based fabric. The new luxury tent line can enhance the user's experience of luxury and nature by, among other things, providing a feeling of spaciousness and wide outlooks on nature.

Leonard Schürg January 2010
Company: DfS internal Research Program

A low cost solar refrigeration system for Emerging Markets

Worldwide large need exists for off-grid refrigeration, above all to cool food and medicaments.
Different cooling options have been reviewed and, through several phases of design, a new concept of a low cost solar sorption refrigerator has been developed.

The design proposal is an innovative product for the solar cooling market. Its unique feature of being detached from the cool-box makes it flexible in use. The essential parts of the product are produced as continuous profiles and assembled at the destination region to a refrigeration system. This approach hosts an unseen freedom of different refrigeration products for the most versatile uses. The price is estimated to be around 145€ for the basic solution, without cool box.
Improvements are suggested on the environmental impact as determined by Life Cycle Assessment. The product has adequate properties for recycling and reuse, but certain materials need to be reconsidered.
Conclusively the product fulfils the initial idea and shows promising opportunities.

Riekes Beelen February 2010
Company: Don Cristián Sepúlveda Cortes

Brand and product development for sea salt

The product is sea salt from Chile, which provided a good source of income in the past decades. In the last years, however, the price of salt is under severe pressure. Only the gourmet market gives the opportunity of a good income. So a brand has been developed to position the salt as a luxury and culinary product. In this market niche, the presentation is as important as the product itself, so a packaging form is chosen that support the luxurious image. The design is a ceramic pot with "flor de sal", closed by a cork lid. An elegant etiquette seals the pot and attaches a handmade spoon. A small folder visualizes the salinas and the "salineros" and explains the product, the salinas and the cooperative.
For tourist that visit or pass the salinas a cotton bag with 250 grams of coarse salt is developed, this product can entirely be made by the cooperativa itself.
A strategy is determined in which step by step the cooperative grows to company that has a 5-10% share of the Chilean market of human consumption. A brand is developed which can be used for all future products and is used in the development of two products that are ready to profitably be commercialized. In the future a situation has to be created that the "salineros" can focus on the production and that the cooperative can hire employees that do the sales and organization.

Ernst van der Wal March 2010
Company: Sustainable Dance Club

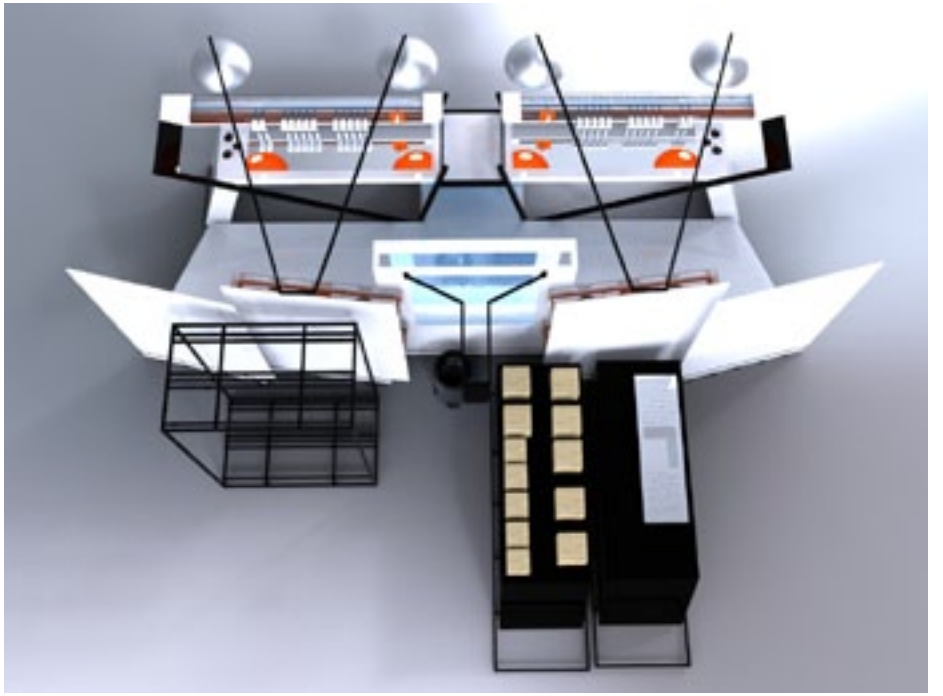
Zero-Waste bar

Sustainable Dance Club (SDC) develops and offers products for events to become more sustainable. Their first product is the Sustainable Dance Floor (www.sustainabledanceclub.com)

As an add-on to the product portfolio a Zero-Waste bar package is designed, which minimizes the environmental impact. The package consists of components that are already on the market.
The first bar designed with the help of the package is a mobile bar for high-end applications, called H2O by SDC. Besides a lower environmental impact the bar features more sustainable elements. The sustainable elements focus on water in different ways:

- Processes in the bar using water are made visible, such as the cooling and water as an ingredient of the drinks
- Water is used to increase interactivity between bar and visitor in two components, placed on the rear part

One component is Watersound. Watersound elements amplify sound, and produce water waves. The waves are made visible with the help of LEDs to produce an interactive spectacle.
Another component is Waterprojection, which is a projection screen, made from waterdrops. On these water drops a projector is able to project whatever the client wants.



Onno Sminia March 2010
Company: Vrachtfiets

The “Vrachtfiets” for Ameland

The European Coastal Islands around the North sea are joined together in a project that stimulates sustainable development. Within this ‘Cradle-to-Cradle Islands’ project, Ameland was selected for the development of a device for transport: the “Vrachtfiets”. A Vrachtfiets is a modular electric-assisted, two person, cargo-bicycle. The design of the Vrachtfiets includes a Product-Service System (PSS) as an integral solution to both the local transport needs and the transport needs to and from the island Ameland. Currently, the majority of the tourist families take their cars to the island (by ferry), since the hassle of carrying luggage is too much to use the public transport system (local busses). For these tourists, a PSS has been designed that provides them with an alternative to transport themselves, their family, and their luggage, between the ferry and the holiday park without a car. This reduces the amount of cars on Ameland, saves tourists their money and creates a unique experience and fun.
Eco-costs and the Eco-costs/Value Ratio (EVR) have been used to assess the sustainability of the Vrachtfiets PSS. It can be concluded that approximately 90 Vrachtfiets movements can be made for each car movement in terms of Eco-costs. EVR calculations indicate that the value based eco-efficiency is around 16 times better, compared to tourists using cars. PSS and C2C aspects were taken into account.

Loek Janssen April 2010
Company: Philips Lighting

Design Rules for a LED Spot Light Module

Currently an application guide is available for down lighting modules and outdoor modules and drivers. This does not fulfil all the needs of a spot light fixture builder (OEM). Therefore the goal of this MSc research is to provide the additional design rules that are necessary for a spot light fixture builder.

During the design phase, the design requirements of the track lighting application are clarified. From the general requirements several concepts are developed. This to align with the trends that OEMs have to deal with in their new fixture portfolio; flexibility, transparency and compact with LED.

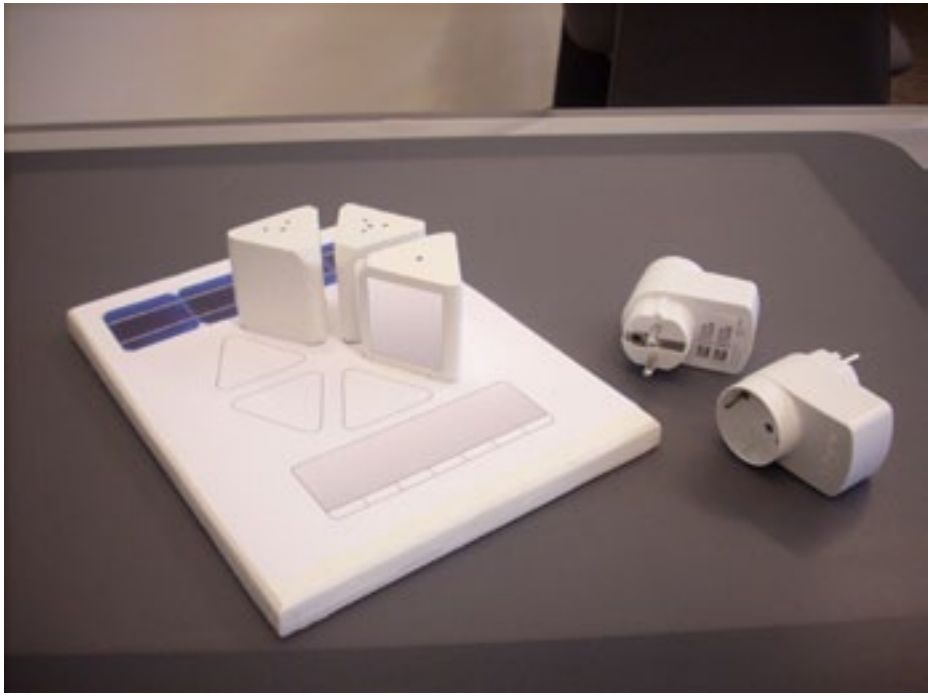
One concept is chosen to develop into a reference luminaire, based on the following objectives:
(1) Provide guidance to prevent luminaire builders to make standard mistakes, (2) Give direction towards the market, (3) Make a practical example of the feasibility of the module.

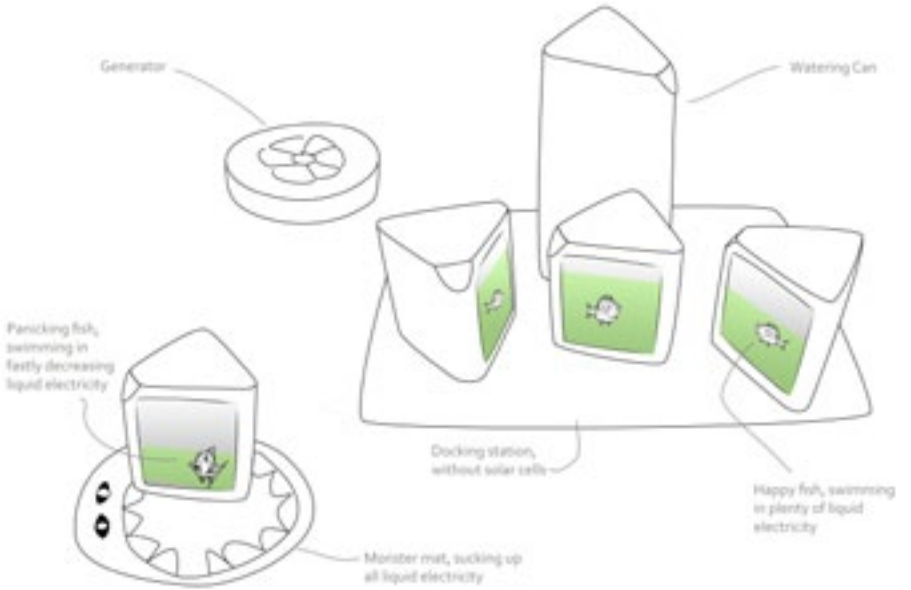
Two other concepts that fit the goal of the application guide the best are transparency and flexibility. The biggest difference between these concepts is the use of respectively a passive and an active cooled heat sink. Passive cooling scores better in terms of sustainability.

Tine Lavrysen May 2010
Company: Philips Research

Saving Energy Through Family Fun

In this project, the interactions between parents and their children, while performing daily activities were researched, as well as their opinions on energy saving and playing games together. Using these insights, a product had to be designed that fits within the current activities at Philips and that brings together parents and their children in their attempts to reduce their energy consumption. The focus for this product was on a fun activity that parents and children could do together. The design had to be evaluated, in order to assess its effectiveness to support behaviour change and family fun, but also to gain more insights in people's needs and wishes towards sustainable family fun through future Philips projects.

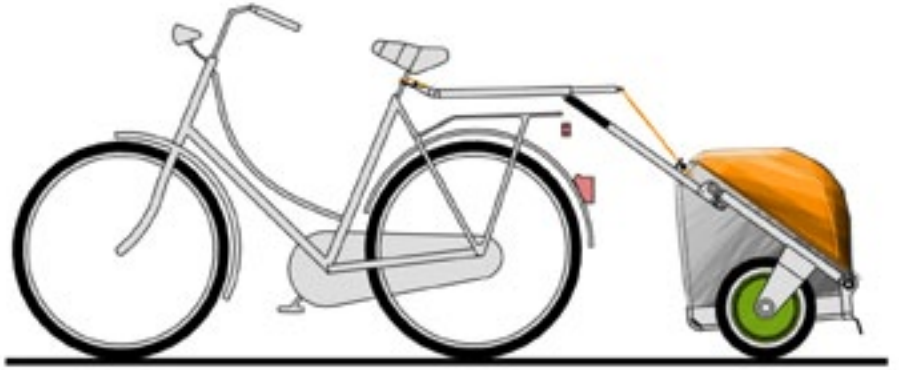




Louis-Pierre Geerinckx May 2010
Company: Vrachtfiets

Bicycle Transportation

When travelling, people are going to a shop by twenty percent. Nearly all of these trips are within a very short distance. For dense urban area's people travel nearly two kilometres to a shop, less dense areas take only three kilometres. Remarkably fifty percent of the Dutch customers use the car to carry their purchases. The bicycle is a fast and practical means, capable to carry loads up to one hundred fifty kilograms and a lot environmental friendlier. The idea is to stop using the car for shopping and we can save point four million tons CO2 annually. This report evaluates the design solution called the "Vrachtkar" as an alternative for car use.



Nicolas Verhulst May 2010
Company: KICI kleding inzameling

Recycling of second hand clothes to bio-based plastic composites

One of the solutions for recycling of textile is making a composite out of worn textile materials. This has never been tried before, however, it appears to be a promising possibility. Strength testing of composite samples revealed that composites based on Acrylic textile perform equally or better than the main competitor: non-woven hemp based composite. A Life Cycle Analysis (LCA) showed that the eco-cost of such a material is lower than glass fibre, but slightly higher than the hemp composite. The eco-cost is largely determined by the choice of resin. Most commercially available resins consist entirely or partly of oil based monomers. Better are the so-called bio-based resins that are under development: they will reduce the impact of composites considerably. An estimation of the material costs revealed that the non-woven textile composites are slightly more expensive than the non-woven hemp variant but the composites with woven textile fibres are cheaper, while offering better tensile strength.
A new indoor collecting container for second hand clothes was chosen to demonstrate the material. NPSP, a composite manufacturing company, has shown interest in such a product in the form of a counter for a clothing shop.
In combination with the other KICI innovation projects, such as the pressed non-woven sheet material and the development of the Identitex automatic sorting machine, the textile based composite can provide the needed stimulus to increase the value of the recycled clothes.

Bram van der Grinten June 2010
Company: dienst Sport en Recreatie, Rotterdam

Re-creation in Rotterdam

The MSc research leads to the vision of sustainability as a natural phenomenon of prosperity: the possibility for people to experience the retention and enjoyment of nature by adding value to the surroundings trough rest, re-creation and togetherness. From this vision, four recreational functions of the facility have been deduced:

- a communal living room
- a self-suffi cing food garden
- a co-workshop
- Fort Feijenoord

These functions have been elaborated in five concepts. The chosen product is a fitness fountain which uses human power to purify or aerate water. It offers the possibility to add value to the environment through an enjoyable activity.

The product is designed to have a minimal environmental impact in production and disposal, and an eco-effective impact during use. A playground based on fitness fountains is a gift to its surroundings, in Feijenoord and other parks.

Recycling Plastics in Costa Rica

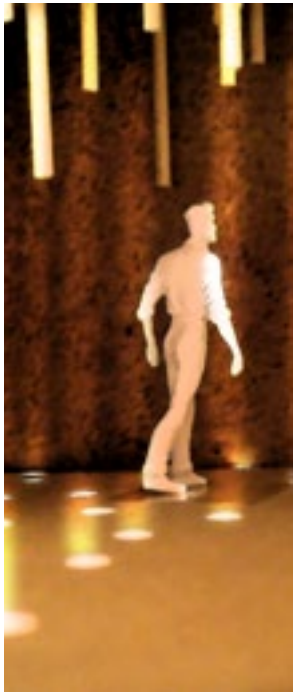
This Master thesis shows how to create environmental awareness through the use of strategic brand and product design in the country of Costa Rica.
An adaptation of the Delft Innovation Model has been constructed to determine the strategy for a new company. Using this model, the external factors (environment) can be analysed and the internal factors (company) can be adapted hereon. A product (portfolio) can be designed using the results of the external analysis and the company structure can be adapted to the production and marketing of the product (portfolio). At the end of the external analysis, a business model is constructed that incorporates all the vital elements, such as the company vision and mission and the branding strategy, to clearly determine the strategic direction of the company in the future.
In this project, two products have been designed:
1) a 'green' guide, made from a recycled polypropylene cover with a content printed on recycled paper
2) a waterproof wallet, made from recycled polyethylene plastic bags.

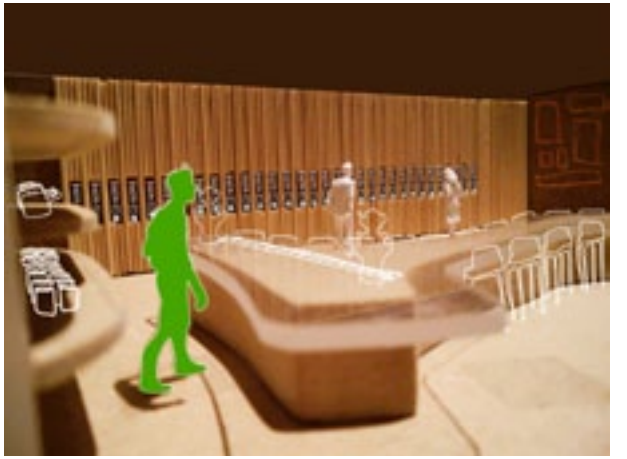
Janüska Dawood June 2010
Company: Dilmah - MJF Group

Dilmah brand and product experience environment

The tea market is currently dominated by players like Lipton and Twinings, serving low quality and cheap tea to the mass of people, supported by huge marketing budgets. Due to their mass marketing campaigns, they provide consumers with incorrect information when it comes to the quality of tea, whereas consumer's perception of tea is being negatively influenced.

The outcome of the project is a concept named D.Scape standing for a natural landscape within an urban context wherein Dilmah facilitates a moment of reloading and personal discovery while offering their unique context of quality tea. The following concept theme is being described based on strategic design research:
The Dilmah experience will be an urban getaway with an authentic, crafting, natural and personal character, told through the 'crafting eyes' of the Tea Maker. The experience will deliver an atmosphere of individual and/or collective tranquillity, enabling people to meet over a cuppa or crouch back to a more private getaway to fulfil in both individual as collective needs. The passion of the Tea Maker will be emphasized to enhance the driven and sincere personality around the brand towards visitors. The space will therefore enhance interaction between the Maker en the Drinker, while being guided by the Tea Maker through a personal discovery of Dilmah teas.

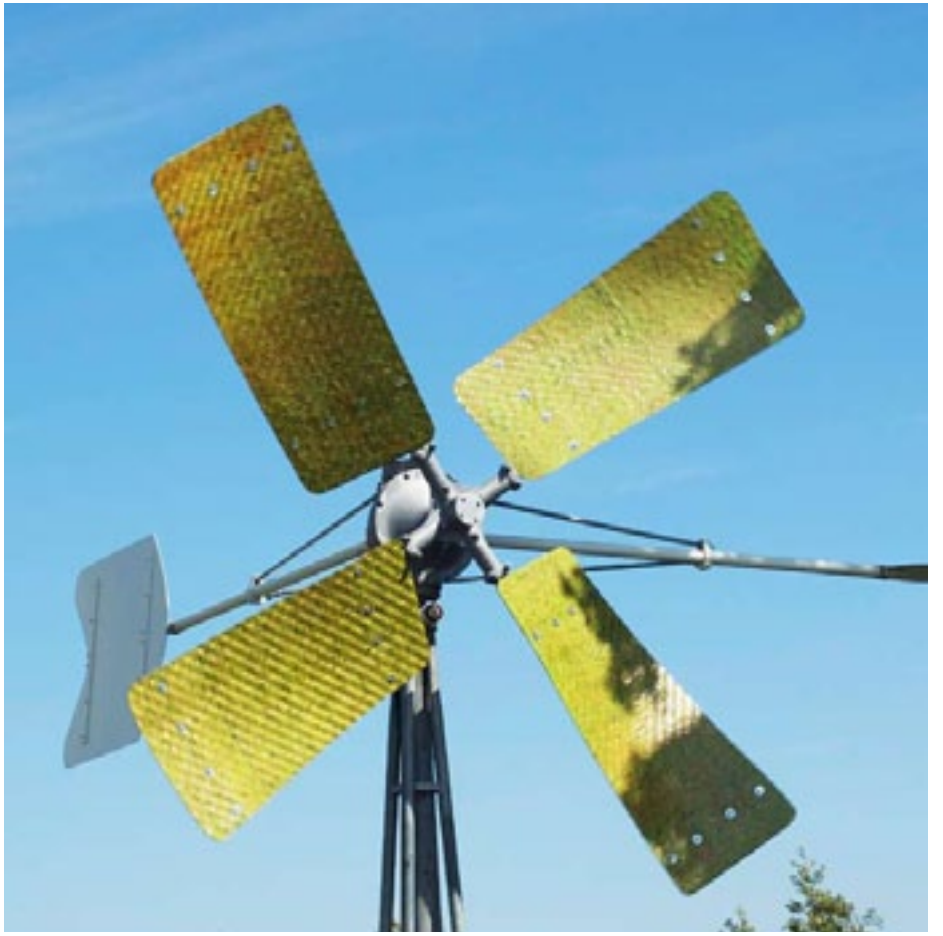


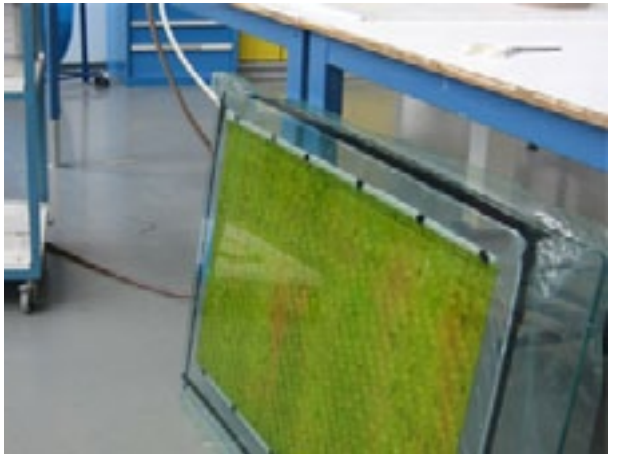


Gijsbert Koren August 2010
Company: EvenDimmen

New Bamboo Product for the Global Market

Bamboo is a versatile material with very good mechanical properties. Bamboo has been used for thousands of years as building material and for craft products. The income of tribal craftsmen in India from weaving bamboo products, is decreasing because of the competition from cheaper materials. The products (mainly baskets) that they currently make from bamboo slivers are of a relatively low value. It is a challenge to find new and high value applications of handwoven bamboo.
Wings for a simple windmill are such an application. The steel wings of the Bosman windmill - of which the original design dates from 1929 - are replaced by bamboo wings, being lighter in weight and several times cheaper. The bamboo wings improve the efficiency of the windmill and lower the cost price. Besides that, it gives this renewable energy generator even more a green image!
The wings can be produced by tribal craftsmen in India, using a hand lay-up moulding production technique. The wings are currently in testing phase in the Netherlands.





Lisanne Dölle August 2010
Company: Dierenpark Emmen

Trash to Treasure

The aim: turning waste into sustainable and enjoyable applications for Dierenpark Emmen in the Netherlands.

The current zoo of Emmen will move to a new location in 2015, so plans are being made to realize a new park that will be highly sustainable.
In this graduation project a vision is created on how the 'material flows' in the park can become as sustainable as possible. This vision was used to generate product ideas for the new park.
Finally three ideas have been worked out into prototypes; 'Dierbaar furniture', a lively entry ticket and the 'Trash to Treasure Tree'. Basis material for all three ideas is fibre from hippo dung. The 'Dierbaar' furniture was evaluated using the Eco-cost / Value Ratio and the product turned out to have negative eco-cost, which makes it a very sustainable product.

Eline Persyn September 2010
Company: The Ubuntu Company

Where fashion meets responsibility

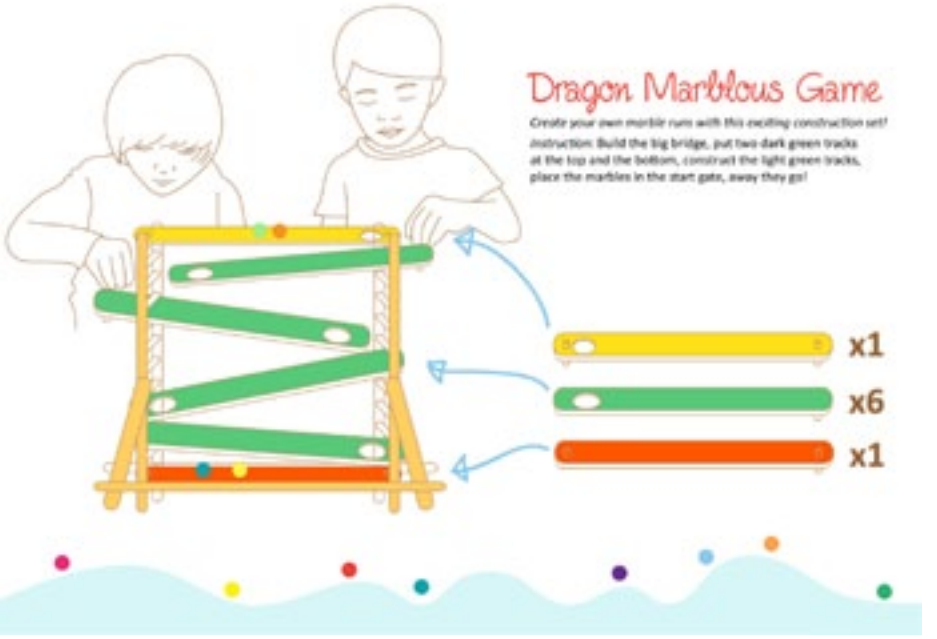
The purpose of this graduation project is to advise TUC (The Ubuntu Company) on how their future as a sustainable company can be guaranteed. Therefore it is important to place the brand Plakkies good on the market and to create a strategy which will lead TUC towards a healthy and responsible company with a clear future vision. Plakkies (first product of TUC) is a social minded flip-flop fabricated by TUC's factory established near the slums of Durban in South Africa. All the profit returns for 100% to children's projects in SA.

During TUC's first business year, TUC was mainly product-focused. As Plakkies was so strongly supported by its stakeholders, it was on the market, without knowing if TUC was a still an NGO-project or already a company. From the start, they were missing a 'shared understanding' about what their business model actually is, which is crucial for any company. An elaborated strategy, called the 'three-phase strategy', which will lead TUC towards a healthy and responsible company with a clear future vision, is created.
The consumers' perception will make the difference more than before. In communication, transparency is one of the strongest differentiation elements for a humanitarian fashion brand. Brands will have to make more efforts, both for total customer perception and for Corporate Social Responsibility, in order to keep on deserving the consumers' trust.

Yu-Fang Teh September 2010
Company: Tre Vang Ho Chi Ming City

A sustainable Bamboo Toy for Preschool Children

This MSc research has been done for a small scale bamboo factory in Vietnam, with the great love for the nature by producing bamboo products and creating employment with production of fair trade for the Western market. The bamboo toys are especially very rare and new for the Western market. The objective of this project was to design a bamboo toy that can be produced by craftsmen at Tre Vang in Vietnam for preschool children in the Netherlands, creating both sustainable production and play. The final design is an improved Marbulus marble toy made from solid bamboo, Tam Vong, in a set of play mat (with packaging and manual) presented by a usage scenario. Marbulus is a construction game which can be played in group. Children learn to build the bridge, put the tracks in the right slot with different slopes. They create their own marble runs with this construction set which can stimulate their creativity and reasoning. Besides, assembling the tracks in configurations suited for children's understanding are also a way to learn and practice their hand-eye coordination. Solid bamboo crafted design makes the play set attractive and durable for years of educational and fun play. Moreover, it is not an industrial product but handmade product. Handmade products can create more appreciation and connection between the consumer and the product and can also create a closer relation between the user and producer.



Willemijn Elkhuizen November 2010
Company: Kamworks

Solar lantern rental in rural Cambodia

Approximately one million households in rural Cambodia still use kerosene lamps. The use of a kerosene lamp has a lot of disadvantages: It provides very poor light quality, is difficult in use and poses a fire and health risk. A substitute for kerosene light can be found in the provision of lighting through solar powered lanterns. A solar lantern can overcome the problems of kerosene lamps and provide a sustainable lighting solution in rural Cambodia.

The up-front investment of a solar lantern is the most important barrier for the poorest rural households in Cambodia to adopt the technology. Providing a 'rent-to-own' service for the solar lantern to the customer can overcome this barrier. Rural villagers can rent a solar lantern from a local entrepreneur for a period of 12 months for the small daily fee of $0.06 USD (total $21.70). After one year the ownership of the lantern transfers from the entrepreneur to the customer. It is estimated that the entrepreneur can make a profit of $253 on an investment of $750.

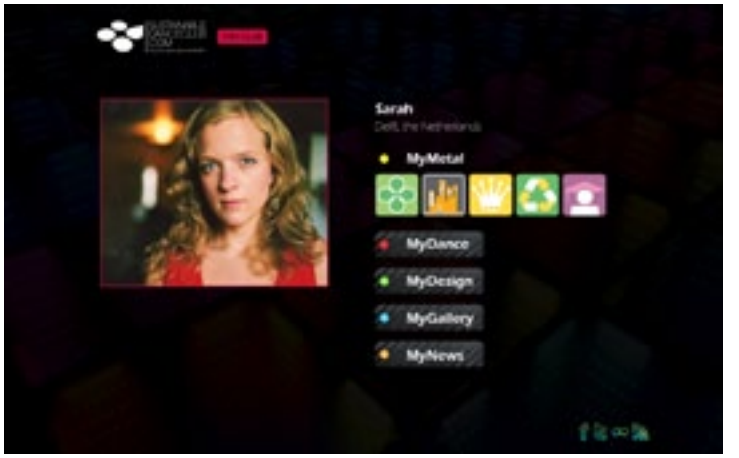
The project produced the following results: List of requirements for the solar lantern; a product-service system design; product distribution plan for the company; a marketing plan to market the scheme; business model for the entrepreneur and the company; expansion plan to expand business from one region to the next; and suggestions for new product development that is necessary for the product-service system.

Mei Mei November 2010
Company: Enviu

Communication Platform for the Sustainable Dance Club

Sustainable Dance Club (SDC) develops and offers products for events to become more sustainable. Their first product is the Sustainable Dance Floor. (www.sustainabledanceclub.com)

The aim of the project is the design of a new brand image and a new communication platform for SDC. Design aspects are the awareness of sustainability and the user experience of the target group.



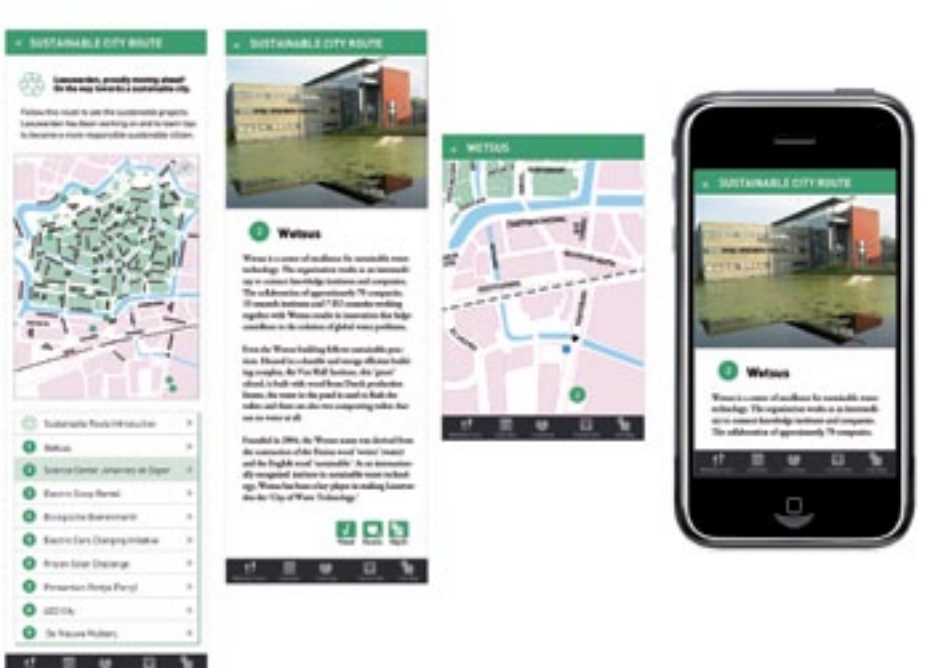
Robin Elwick December 2010
Company: Gemeente Leeuwarden

Leeuwarden City Tours: A Mobile Connection

Using Leeuwarden as a starting point and focusing on the city's existing infrastructure and distinctive characteristics, a smart phone application was developed to connect water tourists with city information.

The application allows visitors to access interactive city tours using their mobile phone as a guide. The project goal was to create a connection with the user in order to share information, help bring water tourists into the city center and further to integrate sustainable aspects as well.

Some of the main advantages of this project are the low implementation costs and the opportunity of reaching a larger target market—in addition to water tourists—all tourists in Leeuwarden could utilize the application, offering a greater chance of success.



Guido Kisman February 2011
Company: Kamworks

Low power television for rural Cambodia

In this master thesis, a television is designed which re-uses second hand LCD screens from discarded monitors, forming a high quality, low cost, low power LCD television. It is specifically designed for rural Cambodia, where people normally use a car battery as a power supply. Conventional colour televisions draw a lot of power; with this television it is possible to watch for twice the hours on the same battery.
During the project, the market, target group and technology was investigated to come to a design. A functional prototype was built which was used in user evaluations on location.

Daan Lans February 2011
Company: VePA

Office Storage Systems

The aim of the graduation project is twofold:

- Assist the company VePA in setting up guidelines for sustainable design of their products (office furniture)
- Design a prototype product to demonstrate the opportu-nities in practice

Comparisons of existing steel and wooden products were made of the products of VePA as well as its competitors. In general, wood scores better than steel in terms of eco-burden.
The prototype of an office storage system showed that, even compared to the existing wooden products, it is possible to develop an environmentally friendlier particleboard-based office storage unit using current technologies. Minimal adaptation is needed. Changing the product structure and using the materials more efficiently, by far the most influential environmental impact factor, can result in significant improvements in Eco-costs, ReCiPe points, Carbon Footprint and Cumulative Energy Demand. The product details are still under embargo.

Emina Kovacevic March 2011
Company: Uma Design

Green Retail Strategy

The main goal of this project is to investigate the best ways a new sustainable focus can be introduced in Uma - an interior design company located in Hanoi, Vietnam. In near future sustainable interior products developed in the company are going to be introduced to the Vietnamese market through Uma's shops with the help of the new green retail strategy created in this project.

Concept 1: green wall

To include the store staff into the design process and increase their knowledge about sustainability the concept of Green Wall is developed. It is a communication platform where the staff will receive information about Uma, new sustainable products and other issues that will increase their motivation and feeling of belonging.

Concept 2: green line

The Green Line Concept consists of elements that lead the customer through the store and help them find to the sustainable products. It gives information on products characteristic and also separates the sustainable products from the non-sustainable ones.

Concept 3: green packaging

The concept focuses on the improvement and development of the packaging elements such as bags, present papers, sign-plates, and other information material. As a web element, a Facebook application gives the clients a possibility to share and involve others in the issue.

Isabel Ruis Almeyda April 2011
Company: van Gansewinkel, Spykstaal

Binkie

Binkie is an innovative electric vehicle (prototype) designed to collect and transport trash, produced by Spijkstaal. This trash picking EV has a total maximum capacity of 2 tons, and a Gross Vehicle Weight Rating in the order of 7.49 tons. It is designed to collect trash in inner cities (one typical day of operation is depicted at the gps map of page 73).
Binkie is operated in the city of Rotterdam by Van Gansewinkel in coordination with Roteb.

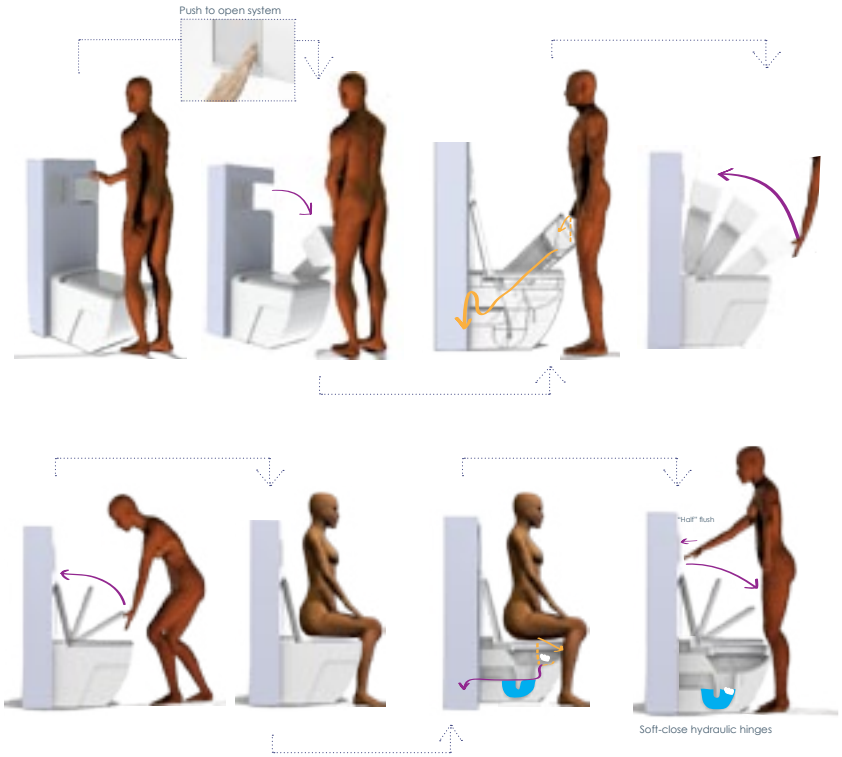
The development of the Binkie is in line with the “Rotterdam climate initiative”, an action programme to bring the city of Rotterdam in a leading position with regard to the reduction of CO2 emissions, triggered by a visit of Al Gore.

The involvement of the Delft University of Technology, in close cooperation with the Hogeschool Rotterdam, is the Cradle-to-Cradle optimization by means of Life Cycle.
The production phase as well as the use phase (the operational logistics) have been analysed and improved.

Jose Genoves, July 2011
Company: European Union ('Living Green')

Natura:
a water efficient toilet

Standard toilets use 15 times more drinking water per day than a human does. The proposed concept is a toilet based on the waste separation principle. Considering that each type of human waste requires different amount of water to be flushed away, the new toilet adapts to male urination, female urination and defecation, discharging the right amount of water for each one of them. The new design integrates a urinal and a separating bowl. Natura's urinal saves 30% of the water used by a standard toilet. The separating bowl is equipped with an extra eco-siphon which will dispose urine with only a half liter of water. Combining this solution with the male urinal, more than the 60% of water is saved.



Gil Nachmany August 2011
Company: IKEA

RONI, a toy for children

RONI is a toy that addresses the aspect of social responsibility. The challenge is to enhance the knowledge of children on the sustainability of products and services by playing this game. RONI proposes an innovative environmental approach to playing, being joyful and experiential.

Identifying the importance of the environment is one of the essential skills that children (in particular) will need, in order to move one step closer to tackling the environmental challenges of today and tomorrow. The aim is to teach children how to create more value with less environmental impact.

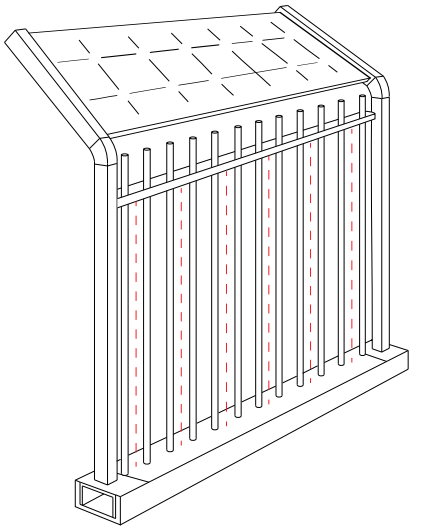
The material is bamboo.
The product design is still under embargo.
For more information gi@hotmail.com

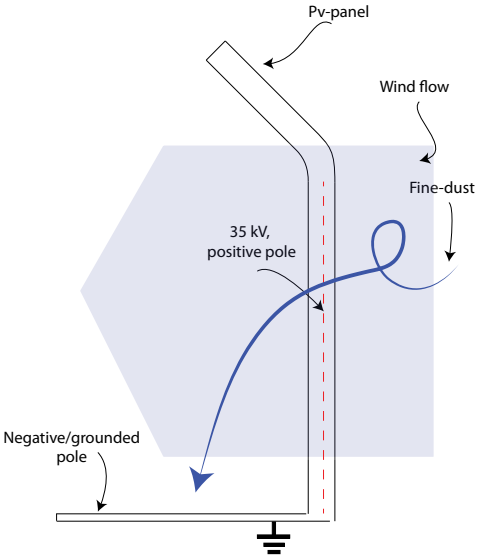
Bastiaan Tolhuijs November 2011
Company: Heras

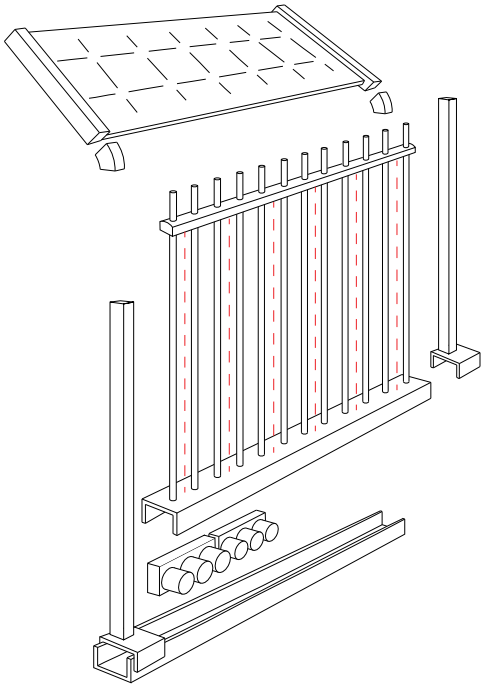
Sustainable fence

To implement sustainability in a fence there has been focussed on three aspects, the production of the fence, the implementation of modularity, and an additional secondary function.
The most environmental disadvantageous steps in the production process of a fence are the material itself, galvanization, powder coating and the foundation.
The implementation of modularity in a fence offers the client and the manufacturer possibilities in terms of offering refurbishment, re-usage, easy and cheap replacement.
Many additional functions are possible to add on a fence, solar, wind, heat, piezo electricity, water and green add-on possibilities have been investigated on their added value.

The final concept describes a modular fencing system combined with the additional function of a fence that reduces fine dust from the air using a static electric field between a positively charged (30kV) wire and the negatively charged fence itself. The system is powered by a PV-panel and the energy is stored in the batteries integrated in the fence panel itself. This type of fence can be of an added value for building companies that need to reduce their fine dust emissions, highways and car-parkings. The PV-panels can power more electrical peripheral equipment that belongs to outside security, such as gates, electric wire, IR-sensors, and remote cameras.
The product details are still under embargo.







Swen van Klaarbergen November 2011
Company: Province of Friesland (Cradle-to-Cradle island project)

Picnic Set for Ameland

The Cradle-to-Cradle picnic set is a product service system, where the food is bought and the set is rented. It allows the users to experience local products in a way that matches with the activities they currently undertake, such as hiking, cycling and visiting the beach.

The picnic set will be produced and recycled on a very small scale, using local labour in the winter period. The used materials are mainly from the biosphere, since recycling on a small scale in the technosphere is usually a very inefficient and expensive process.

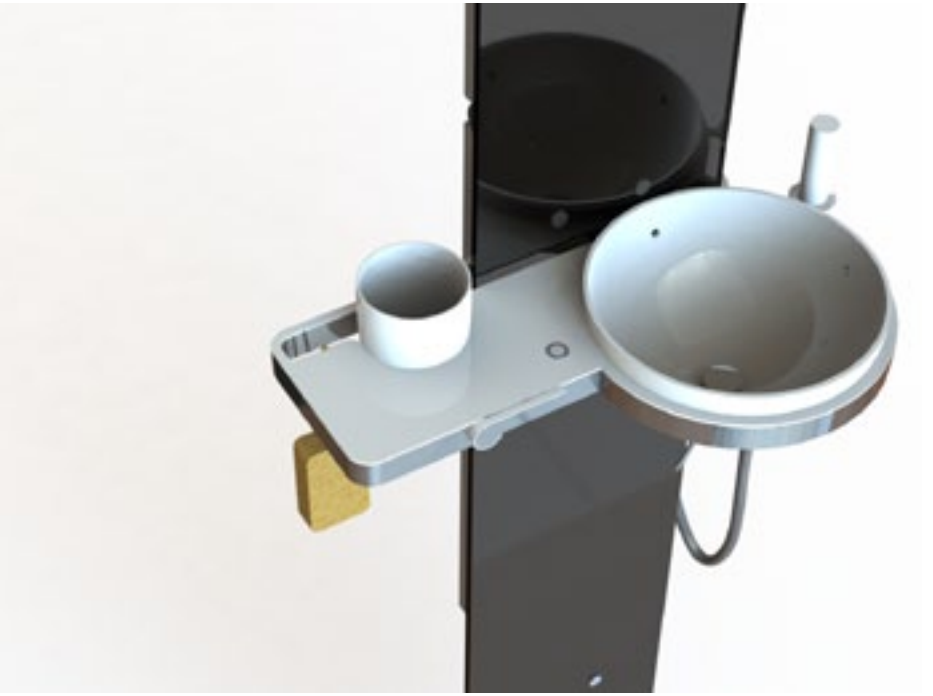
The content of the set consist of local foods, such as: Ameland beer, local cheese, bread, fish, meat, potatoes and jam.

Linus Knupfer Novemver 2011
Company: European Union ('Living Green')

Alternative Bathing Practice

The graduation assignment is to design a product that makes effective use of water a normal thing to do and that can be retrofitted in existing private homes.
The design is inspired by Japanese and Indonesian bathing practices where water reservoirs are used for bathing. About half of the amount of water is used compared to an average showering session (64L).
The new product aims to make the practice of washing oneself with a water reservoir more attractive and acceptable for users living in northwestern Europe. Main features that address the acceptability of the product are:

- The design facilitates a broad spectrum of user needs (e.g. get clean, get warm, refresh, relax, have a quick session, have a private moment).
- The design facilitates additional actions next to washing one's body and hair (e.g. shaving, brushing one's teeth, applying a mask or a scrub).
- The product can easily be installed in existing showering spaces without the need for renovation activities. As can be seen in the visuals, several elements are pre sent that help to facilitate the user needs and additional actions. An infra red heating panel, a water basin, a scoop, a sponge, a hand shower, a foldable seat, a mirror and a storage space for a towel and showering products.



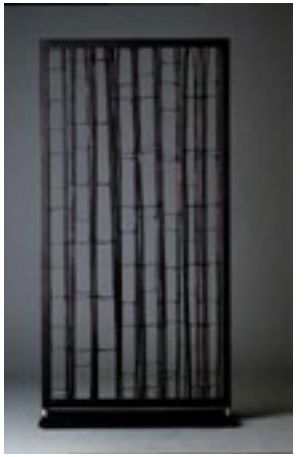
Artefacts of Phd Research

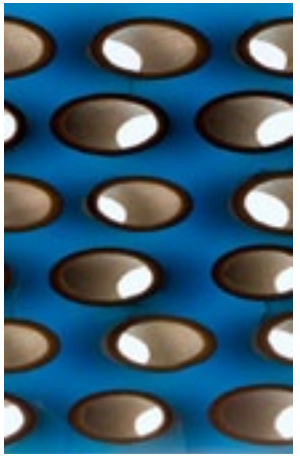
Pablo van der Lugt
www.bambooteam.com/pablo
Company: INBAR

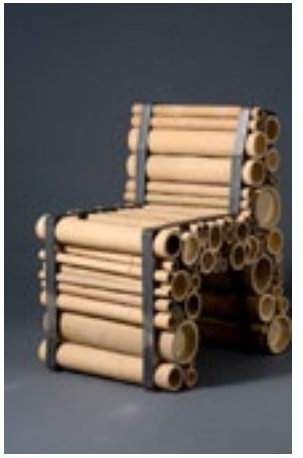
Dutch Design meets Bamboo

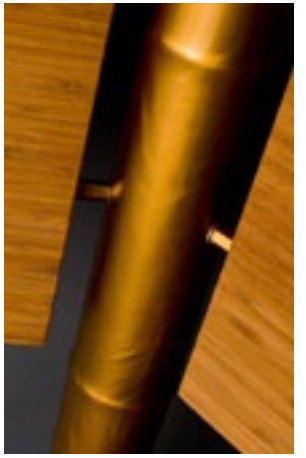
Bamboo is an environmentally friendly alternative to hardwood. It is fast growing, hard, strong, and flexible. In spite of these qualities, bamboo has a bad image since most bamboo products are produced in developing countries without awareness of the wishes of the Western consumer. As a consequence, the potential of bamboo for product development remains (as yet) unused.

The PhD research was focussed on the introduction of bamboo in Western Europe. It was realised that design plays a crucial role. Together with Design Platform Eindhoven, CBKV de Krabbedans, and 'De onderneming in architectuur' a Design Intervention was organized: Dutch Design meets Bamboo. After an introductory lecture, designers were challenged to use bamboo as a designer's material in five workshops.
Exhibitions of the prototype were organized, and the results were published in a special book (ISBN: 978-90-74009-49-2).





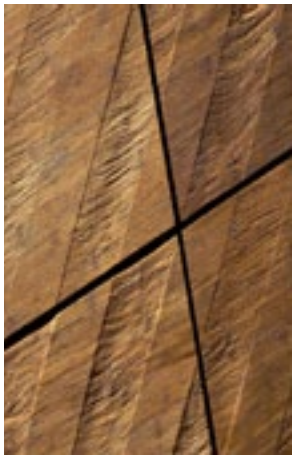




Bamboo Labs results
(List of involved designers)

Ro&Ad Architecten
Bertjan Pot
Daan van Rooijen
Ed van Engelen
Eliza Noordhoek
Lama Concept
Concern
Jacqueline Moors
Lara de Greef
Leonne Cuppen
Lotte van Laatum
Maarten Baas
Maarten Baptist
Natalie Meijer
Patrick Kruithof
Tejo Remy en René Veenhuizen
Thijs Bakker

Pictures by "Fasting fotografie"



Ane Mestre
Company: SusDesign
www.designcork.com
www.corquedesign.com

Cork Design

Cork stems from the bark of a cork oak. The main producer is Portugal, where cork oak forests play an important role in local eco-system. It is a natural, renewable material, where the tree stays intact when the cork is harvested. The cork is currently used for stoppers of wine bottles and all kinds of agglomerate applications. However, cork stoppers are replaced by plastic stoppers and screw caps, putting the cork oak forests in danger.

The PhD research was focussed on the question how cork could be introduced in other innovative products for the high end of the market (luxurious design products). The new designs should have a higher customer perceived value, combined with lower Eco-costs (such a design activity is called 'eco-efficient value creation').

The following step by step method of eco-efficient value creation was applied:

- A 'Design Intervention' was organised (like it had been done for bamboo), where designers were asked to create products with maximum value, made from cork. The result was a group of 36 products of all kinds (chairs, baskets, tables, wine bottle coolers, etc.).
- After the design process, the Eco-costs and the value were determined for each product and compared with an existing product with a similar function and quality. Products with a low value were abandoned.
- Where possible, the product designs were improved in terms of Eco-costs, under the condition that this didn't result in a lower value.
- Designs with higher Eco-costs than the existing product were abandoned, so the end result of the project was a list of 29 products with higher value and lower Eco-costs.

The results have been published in a special book on cork design, ISBN 978-972-99785-1-7. Exhibitions were held in Milan and New York. Nine design products are commercially available in luxury shops.

Pictures by Pedro Rodrigues and Paulo Andrade (IADE)

Satish Kumar Beella
Applied Research Programme Mobility

Design of an urban mobility service

One of the main perspectives of the study is to create sustainable transport modes; the project would mainly aim at creating alternative transport modes with a service design perspective. This research could be seen as an attempt to combine the aspects of chain mobility, short distance travel, portability and use of emerging technologies. The focus of thinking and orientation in this project could be from the need point of view and the functionalities of the personal travel. At the same time the solutions targeted for future are expected to be advanced in terms of technology usage and product aesthetics. The starting point of this design research project was to: "Create, design, realize, test and evaluate a Portable Electric Vehicle for the emerging short distance/soft mobility niche markets, optimized from a life cycle and sustainability perspective".

The project is a conscious process of innovation; it tries to identify gaps in existing products and to go beyond optimum design. The ambition in this process is to design and develop a service based mobility solution. The first challenge here is to combine the existing knowledge and emerging trends to come up with solutions of service perspective. The second is to manifest the design process and evaluate to reflect on the process.

The assumption set forth here is that, in the world of transport innovation, portable and light vehicles are considered to be solutions for the transport of people and their luggage in specific markets and situations. Usually it concerns niche circumstances where a quick, clean and individual transfer over a limited number of kilometres is required. Furthermore, the situation urges the mobile person involved often to situations where the concept should be easily distributed, handled and stored as own personal luggage.

The main aspects that constitute the design, listed below, would be the main elements of the study objective.

1. Functionality of personal travel.
2. Form and aesthetics for given context
3. Technology usage based on service aspects.
4. Market feasibility study as niche application and service creation.

In close connection to the design of the actual artefact and an accurate description and analysis of the design process, several research questions emerge. Particularly, the PhD study will focus on the artefact design, service design and synergy between them.

The design details and development of UMC are realized with the help of Sara Andersson, Thijs Maartense and Daan Tenwolde. The project is carried also part of applied research program mobility at IDE.

International Projects

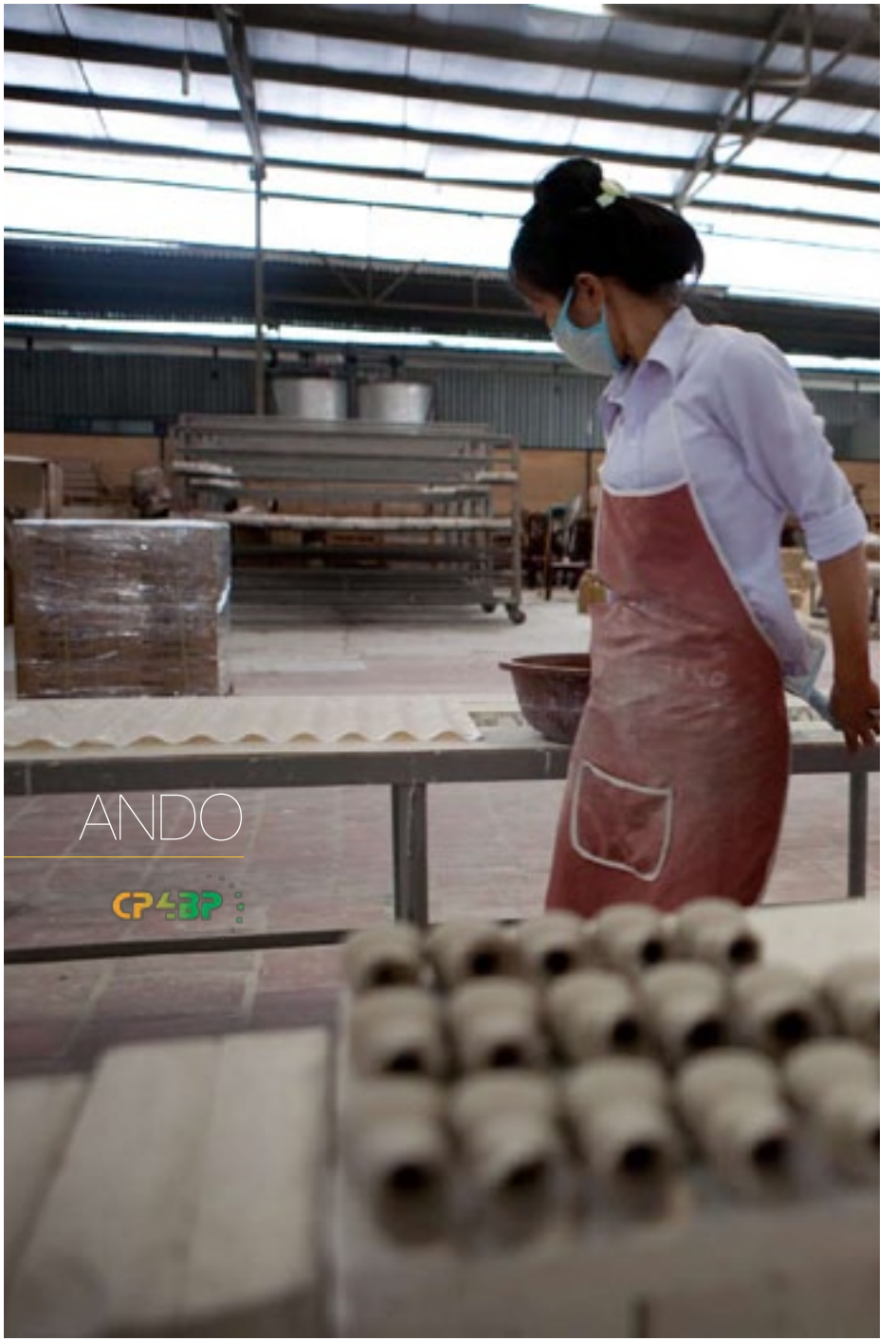
Marcel Crul, Jan Carel Diehl
European Union

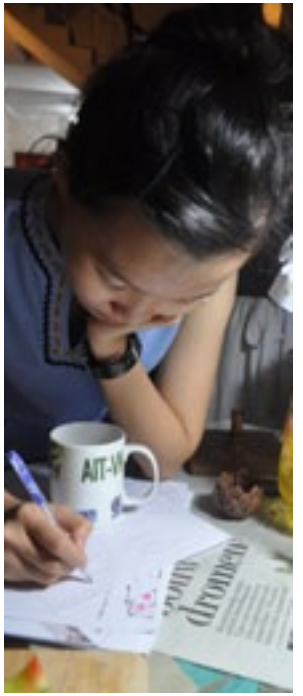
Sustainable Lifestyle Products Vietnam

Vietnam is an important producer for handicraft, furniture and ceramics products. Natural materials are important resources used, and more and more Vietnamese companies focus on contemporary design suitable for export and the growing internal market.

The Design for Sustainability approach developed at DfS was adapted for the specific characteristics of the country and companies, and introduced in several company projects in Vietnam in 2008-2010, leading to improved, more sustainable design of lifestyle products.
Next to redesign projects with a focus on less and better materials selection, cleaner production and improved product quality, also new product development projects were executed with a number of small and medium sized producers.

Long-term cooperation is ongoing, and a joint Vietnamese/DfS research office is established in Hanoi, as well as a design studio in Ho Chi Min City where co-operative Dutch-Vietnamese design teams are at work.
In the period 2011-2014 we plan to cooperate with over 500 companies and help (re)design over 2000 products.





Daphne Geelen, Sietze Meijer
European Regional Development Fund,
INTERREG IVB Community Initiative

Living Green sustainable renovation

A team of nine organizations and municipalities in five countries (Germany, France, United Kingdom, Belgium and the Netherlands) are renovating five heritage buildings in a sustainable way, demonstrating the technologies, train house owners and craftsmen in sustainable renovation practices, and develop products and services for sustainable renovation and lifestyles.
Lessons learned from the renovations and the knowledge transfer activities will be published to support households and organizations dealing with stimulating sustainable renovation.
Design for Sustainability contributes with expertise from industrial design and architecture by developing products and services that facilitate sustainable lifestyles, methods of knowledge transfer and setting guidelines for sustainable renovation. In the city of Delft the focus is on the renovation of a 16th century house "de Witte Roos" (the White Rose). Sustainable renovation techniques are applied and modern energy sources like PV solar energy are integrated in the architectural design in a way that does not harm the cultural heritage. Prototypes of the artefacts of students (see Linus Knupfer page 86 and Jose Genoves page 78) will be exhibited and tested in this house.

Duygu Keskin
European Regional Development Fund, INTERREG
IVA two Seas Program

Environmental Market & Innovation Development (EcoMind)

EcoMind project, funded by the European Union, is an intervention program that aims to address the specific support needs of SMEs who are seeking to develop innovative products and services for sustainability. EcoMind brings together a partnership of seven organizations from the Netherlands, France and United Kingdom. By assisting more SMEs to become increasingly innovative in their design the project aims to stimulate innovation in regions, increase economic growth, increase the capitalization of knowledge and therefore contribute directly to the EU agenda for Innovation and Knowledge Economy and the Gothenburg Agenda; i.e. to make the EU a world leader in sustainable development.

Between the period of January 2009 and June 2011, the DfS program of the Faculty of Industrial Design Engineering together with Enviu - a Rotterdam-based network organization - , has intensively assisted 25 SMEs in developing sustainable products, services and businesses. Some of the companies benefited from the project are DonQi Urban Windmills, Energy Keeper, Evening Breeze, Sustainable Dance Club, and Vrachtfiets (see page 40). The support has been provided in the form of workshops, visits to national and international events, one-to-one-couching, expending the network of SMEs and technical support.

Virus Free Air (www.vfatechnology.com)

DonQi (www.donqi.eu)

left:
EnergyKeeper
www.energykeeper.com

top right:
Sustainable Dance Club
www.sustainabledanceclub.com

down right:
Evening Breeze
www.evening-breeze.com

Han Brezet

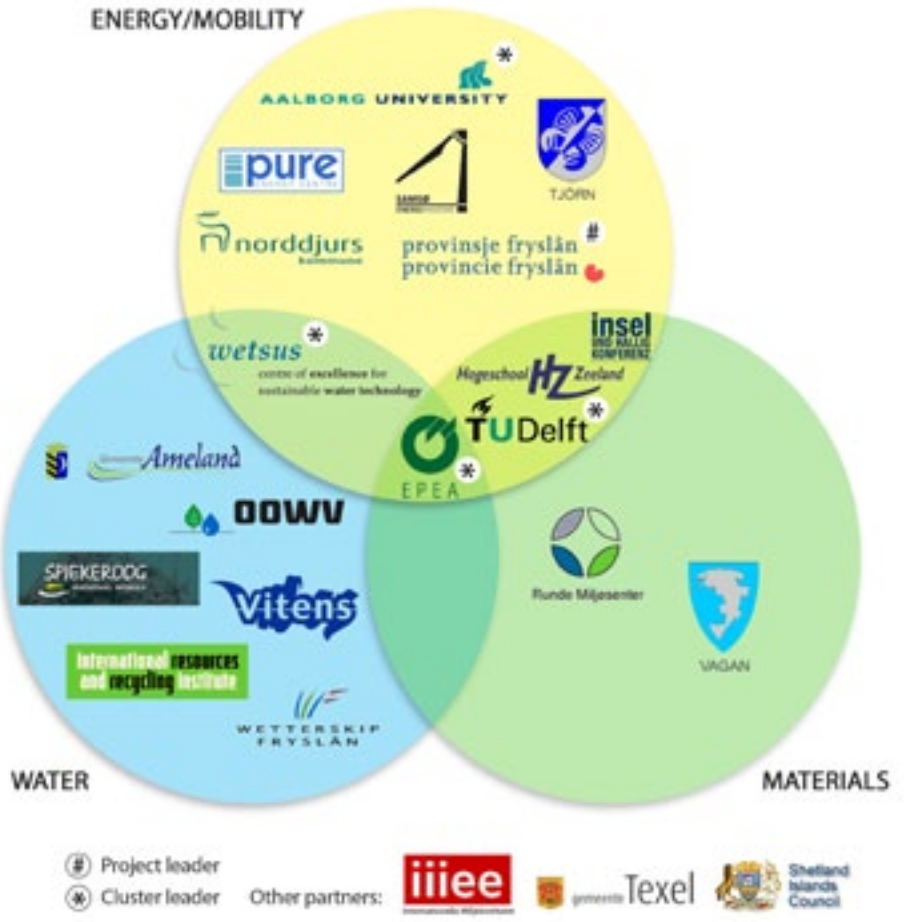
European Regional Development Fund,
INTERREG IVB North Sea Region Project
European Union Seventh Framework Programme
(FP7/2007-2013)

Cradle to Cradle Islands

Twenty-two partners from six countries around the North Sea are working on sustainable innovation (the Dutch funding partners are Province of Fryslân -Lead Beneficiary-, and the municipalities of Ameland and Texel).:

- Leading vision: islands as innovation centres that implement sustainable and Cradle to Cradle® solutions.
- Main goal: to develop innovative solutions in the field of energy, water and materials, using Cradle to Cradle® principles as a guide.

Design for Sustainability focuses on the Dutch part of the project: the Waddenzee island Ameland. For typical artefacts see the work of students Onno Sminia (page 40) and Swen van Klaarbergen (page 84).



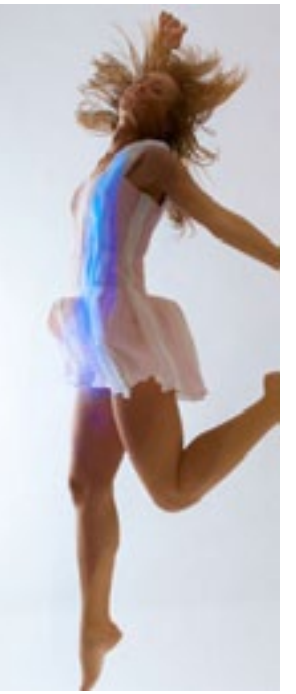
Participants of Cradle to Cradle Islands

Conny Bakker, Andreas Koehler
The seventh framework project

LCA to GO

LCA to GO develops sectoral methods and tools for bio-based plastics, industrial machinery, electronics (including printed circuit boards, semiconductors and passive components), renewable energy, sensors and smart textiles.
These sectors have been chosen, as the manufacturers show a high interest in making clear the environmental benefits of their products to customers (Green industries) and in prioritizing so they can reduce their environmental impacts.
Design for Sustainability plays a leading role in the smart textiles sector.

The examples on the adjacent page are from Cutecirquit, London



Books of DfS

Knowledge exploration and Decision Support

Books of DfS

An important research activity of the Design for Sustainability Group is 'Knowledge exploration and Decision Support', leading to methods and tools for designers, resulting in publications in scientific journals and PhD dissertations.

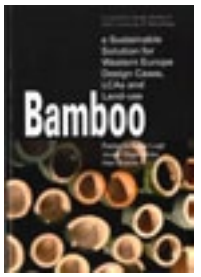
Some research, however, has been made available for a wider audience than scientists only (e.g. students, designers and businesspeople - in the Western World as well as in Emerging markets).

Design for Sustainability, a step by step approach 2009, ISBN 92-807-2711-7

A practical guide to LCA for students, designers and business managers, Cradle-to-Grave and Cradle-to-Cradle,
2010, ISBN 978-90-6562-253-2

A quick reference guide to LCA DATA and eco-based materials selection,
2011, ISBN 978-90-6562-263-1

LCA-based assessment of sustainability: the Eco-costs / Value Ratio (EVR)
2010, ISBN 978-90-6562-233-4



Bamboo, a sustainable solution for Western Europe, Design cases, LCAs and Land-use,
2009, ISBN 978-90-6562-196-2