Fighting pneumonia

Philanthropy by Design

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This booklet illustrates how Philips Design's Philanthropy by Design initiative can use its design expertise to support the fight to save children's lives. It describes the brief and the process used in creating the 'Breath Counter' – a device that supports a pneumonia detection procedure to save children affected by the disease.

Contents

Philanthropy by Design | 4
Fighting pneumonia | 6
Current issues | 8
Design brief | 12
Creative process | 14
Initial design concepts | 16
Feedback on the initial concepts | 18
Design propositions | 19
Selected design solution | 20
Final remarks and acknowledgement | 22

Philanthropy by Design

The philanthropy principle

An increasing number of companies choose to help communities by donating their products or expertise to special projects. Known as ‘strategic philanthropy’, this approach is driven by the desire to combine social responsibility commitments while supporting the company’s objectives to enhance brand image, strengthen employee engagement, increase trust and customers loyalty, and even develop new ways of working and innovative solutions.

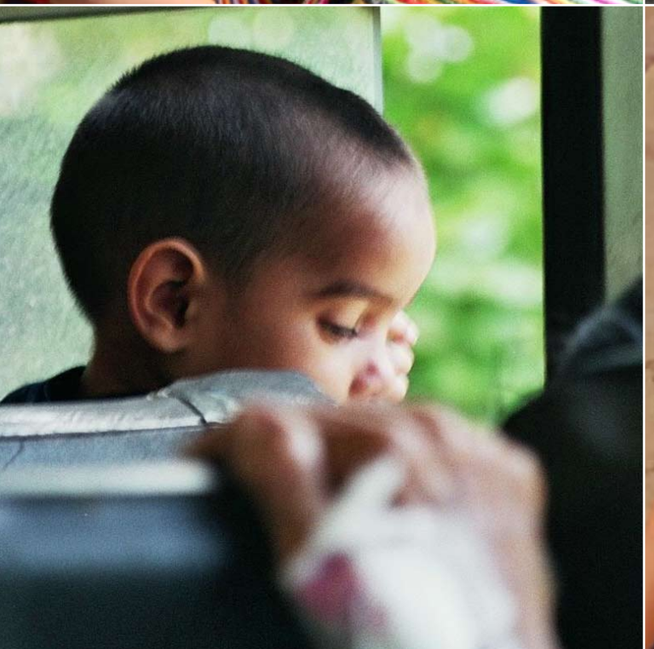
Philanthropy by Design

Back in 2005, Philips Design initiated the Philanthropy by Design program with the vision of philanthropic giving through donating creativity to design meaningful solutions that empower some of the more fragile categories of society. The program launched with a workshop entitled ‘A sustainable design vision – design for sense and simplicity’, in which NGOs shared some of their biggest challenges with Philips Design.

The Philanthropy by Design program aims to create and deploy humanitarian propositions addressing social and environmental issues. Leveraging Philips Design’s creative expertise and socio-cultural knowledge, the program channels design talent to develop meaningful and sustainable solutions that can contribute to a better future for all. It also opens up new perspectives in co-creating value through cooperation with ‘unconventional’ partners such as international organizations, public bodies and social players with complementary expertise and values.

The breath counter

One of our projects addresses pneumonia disease. Pneumonia is one of the world’s leading cause of fatalities in children under the age of five, claiming more than two million children’s lives every year. A ‘fast breathing test’ is used to diagnose the disease.



Fighting pneumonia

In 2008, Philips Design's Philanthropy by Design initiative focused on supporting the pneumonia classification test procedure.

Known as the forgotten killer of children, pneumonia is often overlooked although there are many touch points where changes can be made to improve tools and conditions during testing for diagnosis. Philips Design set out to develop a concept to save children's lives by providing a supportive device to increase accuracy in pneumonia detection.

In order to provide relevant, context-specific design solutions, a deep understanding of issues surrounding the disease and its diagnosis is required. Supported by specialists from various international organizations including Save the Children, WHO, and Nepal Family Health Program and others, the process of identifying the issues – which are significant and challenging to the designers – was initiated.

> " Over 2 million children die from pneumonia each year, accounting for almost 1 in 5 deaths in under-fives worldwide"
>
> *Pneumonia: The forgotten killer of children*, 2006, UNICEF and WHO

Current issues

The necessary steps that need to be taken in order to reduce deaths from pneumonia in children under five seem simple at first glance:

1. Recognize a child is sick.
2. Seek appropriate care.
3. Treat appropriately with antibiotics.

(Source: *Pneumonia: The forgotten Killer of Children,* UNICEF and WHO).

However, there are various obstacles to overcome before completing these three steps. One of which already occurs at the first stage; recognizing a child is sick. A symptom of child's pneumonia is fast breathing. In order to measure this, care givers follow a 'fast breathing test' procedure by using the Acute Respiratory Infection timer (ARI timer).

Using the ARI timer:

1. The ARI timer is used by the care giver counting the number of breaths a child takes for 60 seconds. The timer indicates when the count is finished.
2. If this result is inconclusive, the count is repeated two or three times.
3. To classify pneumonia the results are compared to the pneumonia classification numbers, which differ depending on the child's age.

By collecting input from organizations such as WHO, Save the Children, and Nepal Family Health Program, and understanding the fundamental requirements to reduce deaths from pneumonia, Philips Design challenged the issues in this pneumonia fast breathing test procedure.

International organizations and NGOs have identified two issues when using the current ARI timer:

1. Inaccuracy in counting.
2. Short lifespan of the device.

Inaccuracy

Focusing on counting the breaths taken by a child for 60 seconds is not as easy as it sounds. The current ARI timer makes ticking sounds every second which users find distracting when counting breaths (they begin to count the ticking sound rather than the breath). Inaccurate results can be also caused by non-registration of the count.

To confirm results, the count is repeated two to three times for each child. However, the current device is unable to record any previous count made, so that care givers often forget previous count results.

Short lifespan

It is recognized that maintaining a reliable diagnosis is currently hampered due to the short lifespan of the ARI timer. The current ARI timer does not provide any indication of the battery life, with the result that it can stop working without any warning. Organizations and NGOs using the device would like it to last as long as possible in order to reduce the number of children being assessed without it while a replacement is found.

However, the lifespan of the device is shorter than expected because batteries are not replaceable and in hot, humid countries the device needs to be stored in a cool dry place (refrigerator storage is recommended, although in developing countries, refrigerators are not usually available).

Although the manufacturer claims the device has a two or three year life span, Save the Children has received reports from the fields that the timers last only one year, due to battery failure. It does not allow easy replacement of batteries, requiring a small screw driver – not usually available in a household in the developing countries. Nepal Family Health Program reported that they tried to replace the batteries of many devices by opening them, but after the replacement none of the devices worked for very long – probably because the replaced batteries were also not in the ideal condition causing power to be lost.

Once the device has stopped working, it is thrown away and a new unit is sought to replace it. The cost of current device is US$ 3.51 with a lifespan of 2-3 years. However, it has been reported that the device has a shorter lifespan, challenging ecological sustainability to minimize the impact on the local environment.

Design brief

By identifying the issues on the current ARI timer, the design brief was developed to inform, inspire and engage designers. The main challenges are:

- Accuracy: to reduce errors in the pneumonia classification test procedure, minimizing false classification.
- Longevity: to increase reliability and lifespan of the device.

To address the issue of inaccuracy, errors in the pneumonia classification test procedure need to be reduced to minimize false classification. False classification is incorrectly diagnosing a child as negative (leaving the child untreated) or positive (causing a child to unnecessarily be treated with antibiotics, building resistance to the drug).

The second challenge is to ensure longevity, reducing the number of occasions the timer fails to work due to no battery power. In addition to the issues identified by the international organizations, other fundamental requirements were identified.

Acceptability

First of all, during the classification test procedure, the child needs to be at ease and can not be crying, agitated, or excited as this has an affect on respiration and causes inaccurate results. Therefore, the device should not intimidate a child and physical contact often causes the child to become agitated.

Affordability

The second requirement is that distribution of the device should be affordable. Devices should cost less than first line equipment such as a stethoscope (US$ 8). Therefore, the devices should cost less than US$ 8. The proposition should have a functionality-cost-lifetime ratio that can compete on value. (For example, if it just counts 60 seconds but costs more than US$ 3.50 it should last longer than 3 years).

Sensitive to environmental issues

Another challenge to our designers is the consideration of eco design strategies, which are sensitive to environmental issues emerging in specific contexts of use. The following four requirements were set:

1. Reduction of material usage (reduction in weight and volume, to reduce transport volume, production, transport and purchase costs).
2. Optimized distribution system (using less or reusable packaging to reduce transport volumes, production and purchase costs).
3. Reduction of environmental impact during use (use of clean energy source or no battery to reduce maintenance costs and resist power failure).
4. Optimal initial lifetime (modular / easy to assemble, disassemble and reassemble to reduce production costs, support repair and maintenance).

Creative process

Experience flow of current stakeholders

The experience flow helped the creative team understand how current stakeholders – child, parents and care givers – experience the pneumonia classification test procedure.

During the workshop participants examined how, where and when the device is used and by whom, highlighting issues raised and how each stakeholder experiences the procedure.

Green cards

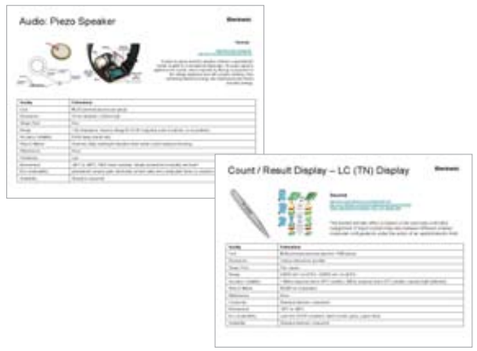
'Green cards' show the examples of products and services which fall under the four selected eco-design strategies along with 'rules of thumb', which explain how these strategies are applied.

This makes designers familiar with existing eco-products and services and helps understand links between the strategies and solutions. The most interesting and applicable cards to the design brief were selected during the workshop.

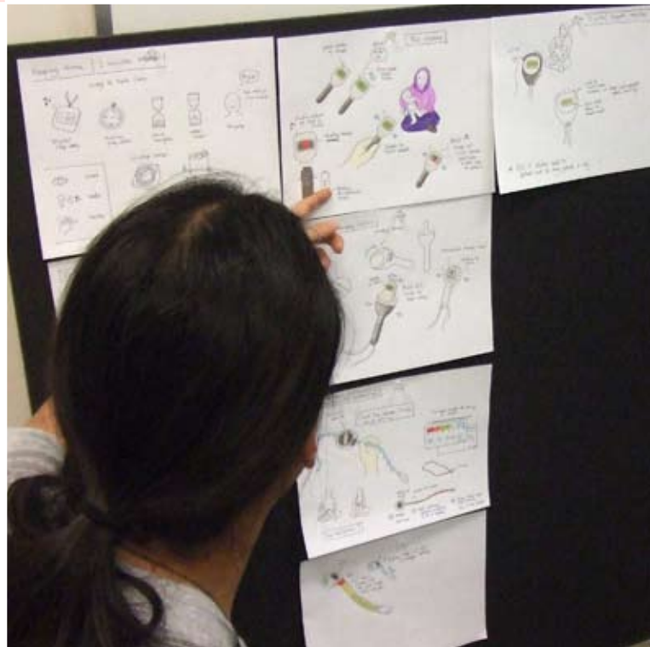
Current ARI timer Tech directory

Through research and analysis at Philips Design, technical directions of four main components were explored: the timer and it's control, audio and power storage. This established which kind of components might best support the design brief regarding: accuracy, longevity, availability, affordability, acceptability, accessibility.

In the workshop, some technical components were highlighted as references to the designers.



From top left clockwise:
Stakeholders experience flow, Green cards, during the workshop, current ARI timer Tech directory



Initial design concepts

A

Pen style device that provides a function to register breaths ergonomically using a LCD display to show the count results. Three results are shown in the same size. Its shape allows normal AA or AAA batteries or a Faraday shaking generator mechanism as an energy source.

B

Round shape device with a similar format to the existing ARI timer with mechanical counting dials around it to register breaths. Like the current device, the timer function is embedded in the middle.

C

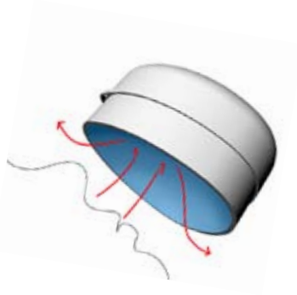
Rattle shape with tilt sensor that registers breaths by shaking it. Energy solution can be with AA/AAA battery, Faraday shaking or other kinetic renewable energy mechanism.

D

Pendant style with an indent button to register breaths. Battery options are AA/AAA battery, rechargeable AA battery, Faraday shaking generator. Display solution is to indicate 'red zone' when the count results exceed the classification numbers.

E

Similar format to the existing ARI timer with an LCD screen and a breath registration button, supported by solar cells for longer lifespan eliminating troubles of battery down time. For recording purposes, the display enlarges the latest counting result while previous counts displayed as smaller.



F

With a wind detection system, automatic breath registration is provided for 60 seconds. The device needs to be placed in front of the child's mouth.

Summary of initial concepts

With the exception of design proposition 'F', each concept requires a physical action to record the breaths taken, addressing the design brief on accuracy. This helps care givers engage with the counting and prevents miscounting. Most of the propositions have a display to indicate consecutive counts.

Addressing the challenge of longevity, the propositions cover different ranges of solutions from AA/AAA battery to renewable energy sources, such as Faraday shaking and solar cells. The packaging is also an issue when considering longevity. The packaging proposal includes a reusable clamshell packaging, which can be used for shipping, is easy to open, and can also be used for storing the device.

Feedback on initial concepts

The following points summarize the feedback received from the international organizations:

Physical interaction

- Registering breaths by pressing a button is a large improvement.
- An audible sound at the start of the test, after 30 seconds and 60 seconds are sufficient indicators. However, an indication that the device is working during a test is prefered.
- It is necessary to have a time lag between the device being switched on and the timer is starting.

Interface – displaying the results and other screen elements

- The count results – a maximum of three numbers – need to be the same size to avoid prioritizing any particular number. Each number should be presented as being equally important.
- Indicate that the device is working prior to and during the test.
- Indicate the battery level if any battery is used.

Classification

- Device should not show the analysis and anything beyond the count results. This means it should not show any color coding or icon for the 'red zone' to support classification as this task should only be carried out by the care givers. Guidelines and training are provided by local organizations and cut-off numbers for the classification vary in different regions.

Shape

- Combining features from concepts A (pen style) and E (stopwatch) could be an ideal solution because the pen style works ergonomically and the stopwatch is an object familiar to the local people.
- The device should look like a piece of medical equipment and not like a toy, supporting the iconic status, authority and pride of the care givers.

Packaging

- Reusable packaging is recommended.

Energy source

- AA battery is recommended. AAA battery is less easily available, and rechargeable batteries cannot always be charged as many local places do not have access to a power supply.
- Renewable energy solutions with solar cells and Faraday shaking generator are ideal power solutions.

Design propositions

Following the validation session, design concepts were re-addressed and a technological analysis of the renewable energy solutions were carried out.

The proposal takes three different formats accommodating two different renewable energy sources – Faraday shaking generator and solar cells.

Because the Faraday shaking generator is not an established generator or used widely in different applications, solar cells were chosen for the energy solution direction. Analysis showed that solar cells can provide enough energy to support all electronic components on the proposed design solution – an LCD screen, audio speaker, timer, and a microprocessor for the counting and recording. It is a proven technology and used as an established energy source for longer than 30 years in various industries – and manufacturing costs are cheap. Unlike the Faraday shaking generator, no moving parts increase its durability. Therefore, concept 3 using solar cells was selected as the final design solution.

Concept 1

Pen style with Faraday shaking generator solutions; LCD screen, counting button and reset button are all clustered in one functional zone and recessed to avoid scratches and pressing them accidentally.

Concept 2

Pen style with a smaller LCD screen with Faraday shaking generator. The breath registration button is recessed to prevent it being pressed accidentally. The screen is recessed to avoid scratches and located at the bottom making it visible during counting.

Concept 3

Front press style with solar cell energy solution; angular shape at the top to collect maximum light while holding the device and making the LCD screen visible to the user.

Selected design solution

The basic function of Breath Counter is to register the number of breaths taken. It can be operated easily, by pressing the top button to start the timer and pressing the center button to register each breath taken for one minute, the result is displayed on the LCD screen. The count result is recorded and if necessary, it automatically sets up for the second and third tests for the same child. It supports the procedure, providing count results that are as accurate as possible, but allows classification of pneumonia to be carried out by the care giver.

Powered by solar cells, a renewable energy source, it is always ready for use when a child needs to be tested. The device can also be used as a 60-second timer if the care giver chooses not to use the breath registration function.

Breath Counter, is developed thanks to input and feedback from international organizations, and offers the following value:

Simple way to register breaths

To register each breath a child takes, the care giver simply presses a button. This is continued for 60 seconds after which two beeping sounds indicate the test is complete.

Clear view of the end result

The count test result is shown on an LCD screen.

Easy consecutive tests

The device keeps the record of the last count result and automatically sets up for the second and third tests for the same child.

No battery concerns and environmental benefit

As it is powered by solar cells, it does not require any battery and lasts longer than the current ARI timer. It is always available when a child needs to be tested.

Simpler device

For those who have difficulty recognizing the numbers shown, the device has the option to be used purely as a 60 second timer with audio signals.

Product longevity

The product has a much longer lifespan. The necklace, should it become worn out, is easily replaced.

Personal status and community trust

Since the device has a “medical” design style, it gives the feeling of commitment and contributes to this important role of care givers.

Instruction

To support the use of Breath Counter, easy to understand instructions for use have been provided. These visual instructions are without text and can be used by care givers unable to read.

Solar cells

LCD screen:

Shows a maximum of three count results. The timer indication displays the progress of the 60 second timer.

Top button:

Switch on: top button turns on the device.
Reset: use the top button to reset a count while still recording previous results.

Center button:

This button registers the breath count. Press this button with each breath taken.

Necklace

"With the proposed new functions, the Breath Counter will have a big impact in helping health workers assess children for pneumonia, and saving lives in high mortality settings where few children have access to doctors or hospitals. Through the creative process, limitations of accuracy and longevity of the current device have been effectively addressed. The solar power solution is ideal for this product, which is required for this critical procedure."

Eric S. Starbuck, DrPH, MPH. Public Health Advisor, Humanitarian Pandemic Preparedness (H2P) Initiative, Save the Children

Final remarks and acknowledgement

Delivering solutions to people living in 'non-familiar' contexts of use is always challenging. In this project, we gained knowledge about the users – both the care givers and those receiving treatment, as well as information on the sociocultural and environmental conditions in which testing is carried out.

Specialists from organizations working in the local field provided us with specific insights and inspirational photos of local care givers carrying out the pneumonia classification test procedure. The information they provided were a source of inspiration to designers throughout the process. They gave insights into real user needs, context-specific challenges and helped address the issues from a user's perspective.

Next steps

Our aim is now to work together with the organizations involved so far to further develop the proposition and, through design, help save children affected by pneumonia.

Acknowledgement

Our thanks to the technical specialists of international organizations and local experts who provided us with vital information, their time, and enthusiastic support in helping make this project a success.

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