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# The Ténéré: Design for Supporting Energy Conservation Behaviors

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## **Overview**

We present the Ténéré, electric power extension cords, designed to support people's energy conservation behaviors. The focus of design solutions was to provide appropriate energy awareness information in meaningful and emotional ways while products are being used. A narrative of tree was used to indicate energy use. The Tree of Tenere was the most isolated tree in the world. The tree is dead now and replace by a tree-like sculpture. It symbolizes the environmental consequences of human activity. When users overuse electricity, the graphics of the tree is transformed to the sculpture. This interactive graphics on the product encourages sustainable behaviors. Users are expected to be impressed and change their energy behaviors. Also we verified narrative-embedding approach is considerable method for industrial design field.

## **Keywords**

Ambient Display, Behavior Change, Energy Consumption, Interaction Design, Narrative

## **ACM Classification Keywords**

I.3.6. Methodology and Techniques: Interaction Techniques. J.4. Social and Behavioral Sciences: Psychology.

## **Objectives**

Interactive electronic products have strong relationship with energy consumption. Interaction design can change people's energy conservation behaviors. It is important to support appropriate energy awareness while products are being used. The environmental impacts and energy consumption should also be understood easily by users.

To motivate sustainable behaviors, it is also important to provide emotional and meaningful interaction. To date, researches of interaction design have largely been focused on usability and efficiency. Meaning, pleasure, and emotional aspects have gained attention to enrich human experience. This can be effective in changing people's interaction behaviors influencing energy consumption.

Although technologies develop many new products with higher energy efficiency, ordinary people often misuse the products. People have difficulties to associate the environmental consequences with their energy consumption conducts. Energy behaviors become habitual. When once people's behaviors formulated, behavior pattern lasts long and difficult to change. Little consideration has been given to the ways to support the energy awareness and emotional meaningful interaction.

The objective is to support people's energy conservation behaviors. The focus is to help people easily understand the link between their everyday interaction and environmental impacts. It is also aimed to encourage people's energy conservation behaviors by meaningful and emotional interaction.

## **Process**

To achieve the objectives, we conducted a design project of a power extension cord family: a power extension cord and a power wall tap. The power extension cords are directly linked with electronic energy consumption. They have high relevance to energy consumption because they are ubiquitous and linked with many electric products. Also they can monitor power use with simple circuit.

The design process had four phases: literature review, setting up design directions, concept deployment, and design embodiment. The process was iterative and repetitive.

### *Literature Review*

Theoretical review was conducted to form a theoretical basis. He and Greenberg searched psychological and social psychological theories on what does and does not motivate sustainable energy action in the home [3]. Brewer found out narratives support mental imagery more successfully than other text genres [1]. Gustafsson and Gyllenswärd designed Power-Aware Cord that visualizes electric current [2]. Holmes planned developing consumption indicating art in public space [4].

### *Design directions*

Two main design directions were identified. The first was to be informative. Information techniques provide the information to the existence of problem, and necessary steps to solve the problem [5]. The information helps people be aware of where their actions take effects on. The information must be as close as possible to people's action without time lag.



**Figure 1.** The Ténééré; Extension Cord Type



**Figure 2.** The Ténééré; Wall tap Type

The information must reflect the amount of consumed power.

Design should deliver a meaningful and emotional link between energy use and environmental impacts. Meaningful and emotional interaction motivates active energy conservation behaviors.

#### *Concept Deployment*

The initial design is display embedded power extension cord. Display shows a virtual world inside of it. The world changes by the balance of *energy wastes* and *energy savers*. Plug-like tree grows by energy consumption and creates amoebic energy wastes. Created energy wastes interacts each other and pollutes the virtual world. But moderate power use keeps the world clean. Its narrative implies environmental cost of energy use. And polluted world and growing trees inform the amount of power use.

Our final design, the Ténééré, is a power wall tap and a power extension cord. They connect end products to energy source. They measure and indicate the power use.

#### *Design Embodiment; 1) Design Overview*

The Ténééré is a family of power extension cord products: a power extension cord and a power wall tap. It transfers power from energy source to many electric products. It indicates each product's power use in emotional way and it shows negative image when plugged products have used excessive power.

The energy use is displayed on the products with a narrative. A story of a tree was employed for the design narrative. *L'Arbe du Ténééré*, known in English as The

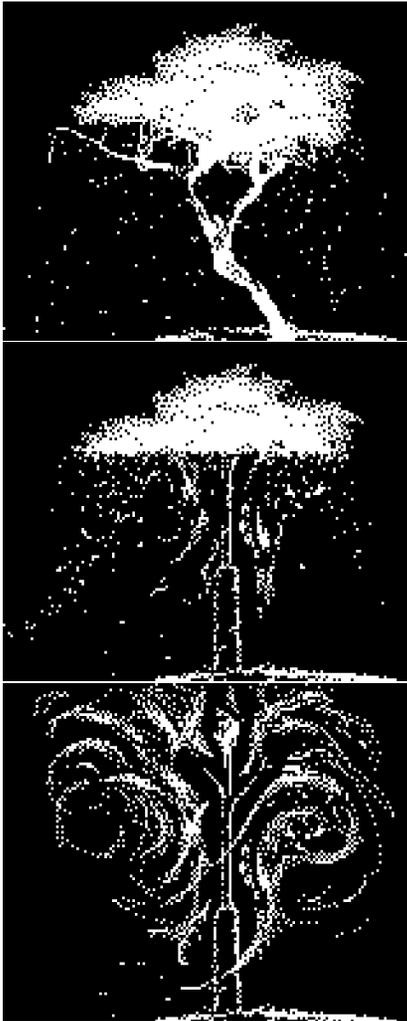
Tree of Tenere, was the most isolated tree in the world [6]. The tree was the last tree of a group of trees since the desert was not parched than today. The superstitious tree stood for decades alone, but eventually be killed by an unfortunate accident in 1973. Now it is replaced by a sculpture symbolizing thin tree with few branches.



**Figure 3.** the Past and the Current of the Tree of Tenere.

#### *Design Embodiment; 2) Main Feature Hardware*

Display screen presents the narrative of the Tree of Tenere. Blue colored LEDs show which outlet is occupied and blinks depends on electric current. *Extension cord type* will be used on floors. (See figure 1.) Eight holes are located with even distance so that any two adjacent holes can supply powers to at most four plugs. *Wall tap type* will be inserted in a wall outlet. (See figure 2.)



**Figure 4.** 160x 124 Screen Transition  
 – The tree dynamically changes and the particle shows current power use.

## Software

The Ténére has an Organic Light Emitting Display (OLED) with resolution of 160 x 124 pixels. The screen shows dynamic graphics from the Tree of Tenere to the sculpture. (See figure 4.) It operates only when power is being used. The particles from the tree drop faster at higher power current and the tree turns into thin and grotesque sculpture. Outlets inhale the electron-like particles. The abundance of the tree and poorness of the sculpture make a contrast between the past and the future. Also the sculpture is surrounded by a flame-like stream animation in order to present power use rate and negative impression

### *Design Embodiment; 3) Implementation Details*

The Ténére uses AC power source so you need no battery. OLED was used for display medium because it operates in low voltage and power. It is seen in same color with every direction. Although it does not show diverse color, its color sense is unique and clear.

## Key findings

Some issues are raised after the design. In order to display, interactive display device is attached for the power extension cord. This device cause additional electric usage. The ways to minimize the additional electric usage should be considered. In order to be more meaningful, the narratives of the tree should be acknowledged by users. Long term usage may reduce the effect of meaningful and emotional appeal. Ways to maximize the experiential value should be considered.

## Results / Impact

We designed a design prototype to change people's energy consumption behavior pattern by supporting

feedback from their energy use. Although we minimized the prototype's power use, it is critical to its symbolic meaning. We are planning to acquire feedback from end users. Video observation and post-interview will give us some idea about a gap between usage scenario and real.

We verified a notion that narrative-embedding is a considerable method for designers to appreciate existing products. It produced higher product value and philosophy. The result also arouses people's attention to their everyday energy behaviors in which a problem they do not aware of is.

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