

# “moodumbrella” – a concept of a self em-powered device for people’s well being

Andrea Suter & Florian Weil  
Master Students at University of Art in  
Linz  
Hauptplatz 8  
4010 Linz, Austria

## ABSTRACT

The “moodumbrella” project is an attempt to brighten up the dark, gloomy and rainy days of northern Europe. Be aimed to design a self-sustainable device for improvements of people’s mental health. During this paper we are describing our design approach towards sustainability as a whole. Sustainability as whole we consider from production to application over to recycling.

## Keywords

Light therapy sustainable design fashionable mobile technology

## 1. Introduction

The central as well as northern parts of Europe are characterized by frequently rainy weather. Especially, the winters can be very dark and grey in these regions. These dark periods do make People suffer. The metabolisms of their brains influence their mood in a negative way. These dark winter periods, due to less sunlight, can cause (winter) depressions. Additionally, the stressful lifestyle also adds a negative impact on the psychological health. Light therapy can improve people’s health, especially during these gloomy, dark and often rainy days.

The umbrella as an object has been widely used within an artistic context. The umbrella represents something that is protecting us if we are feeling weak in distinct circumstances. Usually the umbrella is protecting us of something that is coming from above. The umbrella protecting us of something that is coming from above can also be used symbolically, in a sense that the umbrella is giving us shelter of something that we are not in control of and that may intrude our personal life’s. At the same time though the umbrella also protects us so that it renders our personal space into a bubble, it encircles us from the other outside world and it also renders a possible noise down to us like a bubble.

Rihanna’s umbrella song[1] featured in her third Album “Good Girl Gone Bad” released in 2007[2] has pitched the idea of protection, in a sense that one might feel weak and needs the help of a friend. Hiroshi Ishii[3] made an umbrella that indicates a possible user with a glowing handle and sticks when to pick up the umbrella since it is raining outside[4]. Hence indicates a possible user when the protection available is needed and should not be forgotten. Here we might want to remember that the umbrellas in “Blade Runner” (1982) by Ridley Schott [5] also had

glowing handles and sticks[6]. Pau DeMarinis, with his piece “Rain Dance” (1998) uses umbrellas as loud speakers[7], letting a possible audience have their own sound bubbles. Others have used the umbrella as a networking device itself[8]. Of course there are more projects that have been using the umbrella either as a metaphor and / or as an object. However, we feel like that the above choice represents a good range of such project.

However, it seems as if most artistic or design projects using the umbrella as either a metaphor or the everyday object have either not attempted or intended to deal with the effect the rainy weather has on our mood, health. We attempt to introduce greater happiness into the gloomy, dark and rainy days and hope to create design that is transforming these days into more enjoyable sunny days. All of the projects above, aside from Hiroshi Ishii’s umbrella, have not really yet dealt with the idea of inside and outside and what the subsequent effect on our health might be. Hiroshi Ishii is the only one really dealing with the weather, with indicating when the umbrella is actually required. Since our project indents to transform the mood during the rainy days. Of course the combination of Hiroshi Ishii’s idea combined with our indent would be perfect.

That is why we are proposing the “moodumbrella”, which intends to make people happier on dark, gloomy and especially rainy days. People can go outside and don’t have to sit still inside in front of a lamp. The human is conditioned to move, move about outside to fulfil the human body’s desire and need for light. The human body’s consumption of light is based on light sources deriving from the sun, the sky. This light, amongst other things, helps the human body to produce serotonin, a hormone that helps us to stay happy. Usually we don’t feel like going outside on rainy days and staying inside somehow does not make us happy either. These are some of the reasons, which made us decide to design an umbrella to help natural light consumption. The umbrella is an everyday object, which can be used without further explanation, and it does provide the perfect space to mount the appropriate light sources.

Aside from the design of the “moodumbrella”, one of our main focuses was concentrated around sustainability and autonomous power supply and management. The device has to autonomously choose which available power source is the most appropriate and can be used. In our opinion mobile objects should work as autonomously as possible. Our definition of autonomous energy consumption of a device is, that a device works without any

physical power connection to an external network. The mobile object can connect to a network or device via a wireless network, but a connection via cable or a plug is not allowed.

During this paper we will elaborate further the design of the project including technical details and their sustainability.

## 2. The umbrella metaphor

The umbrella is an everyday object, which is easy to use (works without further explanation), and offers space for our additional life improving system. Firstly, humans are using umbrellas to protect them against rain, snow and sometimes sun. The umbrella also creates a sort of private subspace inside a public space. The parabolic form of an umbrella creates a surface that is visible for the public but an inside space, which is almost only visible for the carrier. Hence, it does support possibilities for personal communications devices as well as services to improve life quality. The exterior surface can be used for communication between the public environment and the carrier. The inside space to improve the carriers personal life. However, further is interesting how the umbrella relates to the human body. The umbrella always stays in direct connection to the human body. Human contact exists through the hand, the shoulder, or just on the head and the umbrella always moves in relation to the movement of the carriers, the protected person's body. Commonly, the umbrella is used to walk from a point A to a point B during a rain shower.

As previously mentioned, the movement of the Body is as vital as natural light consumption for humans. The "moodumbrella" is used during days where the light conditions can not supply the human bodies need. Subsequently our "moodumbrella" is working to improve the human condition, against the problems mentioned above. Body movement encourages the human metabolism, and the light therapy improves the metabolism inside our brains.

The construction of the object allows us to mount the light sources directly underneath the umbrella surface. Once the umbrella is opened, the system will start. The strength of the light source depends on the heaviness of the rain as well as on the environmental light intensity.

## 3. The light therapy

Light therapy has since a long time been used to treat depression and sleeping problems. It is an established medical approach towards the above problems. Light stimulates the production of Vitamin D as well as the production of the hormone Serotonin. Vitamin D protects us of disease like blood pressure, muscle pain and so on. The Serotonin in our blood improves the mood and can protect us from depressive periods. Furthermore light therapy can decrease the production of Melatonin. If the amount of Melatonin in our blood is too high, disturbances of memory and sleep can occur. These three phenomena influence our mood permanently. These are the reasons, why our "moodumbrella" is not an esoteric oriented artefact. It is based on scientific research results.

Every medical treatment is applied according to conditions occurring in order to improve the conditions. Commonly, a patient is sitting between 30 and 60 minutes in front of a lamp to improve human health. The light is aligned above the head or directly in front of the face. The distance between face and lamp is

approximately 30 to 100 cm. Duration and distance depend on the strength and the size of the lamp.

In our case the patient uses the umbrella more then once during the day. It is possible that the umbrella can be used more than one hour per day. On this account we decided to use a weaker light source. Strong lamps are producing approximately 60.000 Lux. At the end the patient would have consumed approximately 10,000 Lux with a distance of 50cm. Our chosen lamp "Lichtdusche LD 72" [10] produces 2,500 Lux and needs 72 Watt (220 Volt – 50/60Hz). The recommended consumption time for the maximum strength (2,500 Lux) is approximately two hours. The distance should be about 50cm. The distance between the head and the lamp matches with the distance of the umbrella surface and the head very well. The parabolic form of the umbrella is advantageous for the light therapy. The form can collect the light rays and alignes them directly to the center point of the head. This results is a very efficient way of light consumption.

After all the positive aspects of the light therapy lamps inside an umbrella, the power management is still a key problem. The next chapter presents various approaches of how this problem could be solved.

## 4. Energy resources for mobile devices

Nowadays we are using electronic devices as part of our everyday life, our everyday activities are much depending on mobile electronic devices. These devices come with storage space but also use much external energy. Previously, to these electronic devices, we have used devices that worked without energy supply. Only machines / devices which had enough space to store an engine as well as the energy source (eg. cars) were used, constructed. They were "independent" of external power supply. Nowadays, we use devices / smart tools (smart phones) that depend on external energy sources, supply opposite to the old craft tools like a hammer or a screwdriver, which were truly independent of external power supply apart from human force. Our devices today are tools that are multiple tools, more than one in one tool like a Swiss knife but also like a smart phone. However, the electronic generation of tools have one big disadvantage compared the old mechanical tools. They do need a power source and storage in order to work accordingly. If a smart tool is defunct of energy or storage it seizes to work and becomes totally useless. Subsequently, a great map and localization application fails to work without power and network connection in comparison to an old traditional paper map. The paper map does not need an external energy source in order to fulfill its purpose.

These are the reasons why we strongly believe, that the future devices must work independent of external power supply. Concluding, the smart device must meet the requirements below.

1. The device is not allowed to physically connect to an external power supply or network
2. The smart device is only allowed to physically connect to an independent power source. This power source is not a part of the common power supply network and must be transportable.

In the following chapter we are presenting three different kinds of power sources. These power sources are explained in relation to our "moodumbrella" project. At the end of the chapter we will

discuss some sustainable issues about the production of electricity.

## 4.1 Natural power resources

Nature is full of various forces, energy. Using natural energy forces already is a big topic since several years in the media industry. This chapter discusses the most common natural sources and the possibilities of how we could possibly use them for the “moodumbrella”.

**Solar energy** has always been around us. We are since several years attempting to use this energy appropriately. However, it does in some countries with more sunny days like Spain, make more sense to use this resource, than in other countries which may have less sunny days. Some big umbrellas for the balcony or the terrace already use solar panels as power source for their LED lamps. They store the energy in a battery during day time, and use the power of the battery at night. For mobile devices as smart phones and digital cameras it does make sense to use this resource. The industry already produces some usable products [11 and 12]. However, in our case the solar energy is not really an option, since the “moodumbrella” will most likely be used during the rainy days when we are deprived of light. Exactly the same condition exists for the unused state of an umbrella. The umbrella is folded together and no surface exists for the solar panels. For this reason we have decided against solar energy.

**Wind energy** also is always around us. Regions like England and Ireland have much wind. Some Do-It-Yourself products to charge the batteries of mobile devices do already exist [13]. However, a big problem in order to use wind energy for mobile devices is the size of the wheel. Most transportable wind wheels need a stationary place in order to work. One suggestion to solve that problem could be to use the vertical windmill approach[14]. Hence, it would be nice to integrate a vertical wind wheel into the stick of the umbrella. Unfortunately the vertical windmill approach would not produce enough energy, but it could support the charging process of the battery.

**Water energy** also is always around us but may sound odd. Of course a river or a rivulet is not mobile. However, on behalf of our particular project we are thinking about another resource of water, the rain. The rain can be a very helpful resource. We will be using the piezoelectric approach [15]. The rain has a certain pressure when it falls down on the umbrella surface. This pressure activates a piezoelectric actuator and translates the mechanic power into electric power. The design concept LightDrops by Sang-Kyun Park [16] uses this PVDF approach for an umbrella with involved LED light. The whole surface of the umbrella is a conductive membrane which generates the power for the LED light. The obtained energy is not big, but it is enough to provide energy for LEDs and sensors.

## 4.2 Body as a power resource

Our body needs energy. Water and food in various forms are the medium of our energy. Our body produces heat and kinetic energy. Why not use this directly available energy of our body?

The Fraunhofer Institute from Germany published a project “PI Energy Harvesting” [17] which uses the **body heat** to produce low voltage power. It also uses the already mentioned piezoelectric approach. But in this case the vibration is caused by temperature difference [18]. It works like a thermo generator. The

body heat has the certain temperature around 35.8° to 37.2°. Usually a difference between body temperature and the ambient temperature exists. The bigger the temperature difference, the easier it is to generate the mechanic power. Components do already exist [19]. It would be very interesting to test these components for their appropriateness on ordinary clothes and it could be especially interesting and challenging to test such, on lesser flexible places like the upper leg, the chest, or the back.

All **body movement** produces **kinetic energy**. It is a waste of energy if we are not using it. Tremont Electronic tried to solve this problem with their product the nPower PEG[22]. The vibration of walking or cycling is directly translated into electronic energy. This kinetic power generator can produce the power for hand-held devices like smart phones or mp3 players. Zhong Lin Wang from the Georgia Institute of Technology[21] has through a completely different approach, but still using kinetic energy created the nanowire[20]. The nanowire can translate the mechanic energy of our body movement into electronic energy. These nanowires could be integrated in cloth, shoes or elsewhere. Even the MIT Media Lab [23] developed such kind of material. However, unfortunately this approach cannot produce a high amount of energy. At the moment the aim is to produce enough energy for low-voltage components like sensors and other electronic components.

Until now we have only discussed the body as a direct power resource. A more traditional method lets the body work so to produce energy. Many humans are using a bicycles to move from one to another place. Exactly these means of transport offer to be equipped with electric generators. The bicycle can produce the power for the lights entirely by itself. Why not we use this generated power for our electronic devices? Instructables offers tutorials [25] to build this particular kind of charging system. The traditional dynamo system still seems to be the reliable source. Zzing [26] provides a system with more comfort. This system consists of a charger, which is connected to a hub dynamo. Yet another advantage is related to the hub dynamo. The hub dynamo has a better force / power transmission. It produces always electronic power without feeling a real resistance. The most exhaustive way to produce electricity is to use our muscles. The company Freeplay offers two useful muscle driven power supplies. Freeplay Weza generates electricity by stepping with the foot and Freeplay Freecharge 12V [27] generates electricity by hand. Freecharge 12V fits in every back bag and generates enough electricity for low-power devices (mobiles etc.). Freeplay Weza[28] is much bigger and generates enough electricity for starting a car battery. The last mentioned chargers are not exactly useful for our “moodumbrella”, since it is far to big and too heavy. We could only use it for charging the battery of our “moodumbrella”.

## 4.3 Artificial power sources

Currently all electronic devices do need external power supply. This chapter will not be able to change this problem, but it will reveal new developments of power supply for electronic devices.

**Rechargeable batteries** are not really a new topic, but technologies do become smaller and smaller. Communication technologies have transformed from a stationary medium to a mobile medium. This evolution of communication technologies needed new kinds of batteries. Lithium ion battery [29] already

represented step forward. Lithium ion batteries solved the memory problem. Today we can recharge our battery at every state of the battery. Nevertheless the lifetime and the storage capacities of common batteries are still not satisfying. Science and industry, both are working hard on these problems but improvements are slow.

Because of that, some researchers have decided for another approach. The grand idea is, that the power source should be available everywhere. Nikola Tesla [30] had already experimented with **wireless power transmission** at the end of the 19th century. Nowadays this topic attracts attention again. Researchers have stopped to aim at a transmission of electricity over big distances without cable. But electricity can be transmitted without cable over short distances (0-30cm). Intel calls their technology Wireless Resonant Energy Link (WREL) [31 and 32]. The MIT in Boston finished their research and founded the company WiTricity. WiTricity [33] now tries to make their research results available for the mass market. Actually a ready to buy product exist on the US market. It is called Powermat [34]. However, all these wireless power suppliers work the same way. They are creating a hotspot space inside an environment. Everything inside this hotspot space can use the electricity and recharge the batteries. In our case one hotspot could be at the cloakroom. Usually that is where the umbrella is stored. During this time the batteries could be recharged. The user hence would not have to worry about the power state of the umbrella. The device itself would decide if it needed charging or not.

#### 4.4 Sustainable aspects of power sources

Sustainable design has become an important topic during the discussions regarding our infinite consumer society. We are all fascinated by the abilities of plastic and synthetic materials. We however are rarely thinking about the cost of production (not the costs measured in money) and the cost of waste management. Sustainable design should and is dealing with all of these aspects. We want our “moodumbrella” to be a device that meets these requirements. The “moodumbrella” should use its own generated power. But using these alternatives power resources is still more difficult than expected. Solar energy still has the problem of the manufacturing costs and the costs of the waste management are still far higher than the real output. To buy solar panels however is quite easy and it will produce enough electricity for your home and you will be saving money. But if we were to consider all the wasted energy for the production, the lifetime management, and the waste management, the outcome would be depressing. Even the promising solar energy is not efficient enough compared to traditional power resources. Frustratingly the same outcome is applicable for the presented power resources for our “moodumbrella”, described during our paper on electricity from rain, body heat as well as body movement. These are the reasons being which do not yet make these technologies entirely useful! Nevertheless, they are improving. Hopefully soon these days they will be good enough to produce enough sustainable electricity for sustainable design.

#### 5. Conclusion

The focus of this paper was on creating a life quality improving device without changing human behaviour. Improvements should exclude additional effort from the user and the device must be easy to handle. Some new electronic devices provide

improvements for our daily life, but they also depend on our economical means as well as other circumstances. As an example may serve the smart phone, which in order to use such a device, the user has to take care of its battery’s state. If suddenly the battery power is gone, the supposing life quality improving device creates frustration rather than pleasure. In our opinion it must be possible to design everyday objects that are as a whole sustainable and self-sufficient.

The “moodumbrella” project has been a good experiment, which emphasizes on problem solving of a possible design object inside sustainable design. Technically the “moodumbrella” can be realized if we combine the presented technologies. Unfortunately, the device would right now, from an economic point of view, become far too expensive. Furthermore, the “moodumbrella” is not yet going to meet the requirements for sustainable design we set at the beginning of the project. It could possibly though efficiently function during its life time, but the costs for production and the waste management are totally out of range.

Nevertheless this project has been a wide inspiration for future projects as well as their sustainability and made us be more critically aware. We gained greater insight into how we are using smart devices and what power supplies are being used or could possibly be used in the near future.

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