Supporting unwinding and stress reduction in everyday life with glow light

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Abstract
Light, in any form and role, is an influencing element on emotions and behavior on human. [16] A part of research into this field is on the effect of light, as a visual element in the surrounding, on people.
Daily life is mainly formed of two groups of activities: work and family. In general, the two mentioned factors support each other to have a fluent, pleasant and enjoyable life, while they can influence each other due to the relevant conditions. Work space, work pressure, business communication, etc. influence people which can be reflected in home atmosphere. Now, the question is how to leave the stress of job and outdoor activities behind the door and to start home activities with a calm and suitable feeling.
This paper focuses on how glow light, embedded in a tangible object, can support unwinding, calmness and stress reduction in the transitional period of daily life, the period between stop working and start of a home or family activity.

Keywords
Glow light, tangible user interaction, calmness, unwinding

Introduction
Light has an extended application in inspiration and emotions can be controlled and lead with light effectively. In this field, the form of light is important. Ambient light plays relatively different role than glow light in a tangible object and interactions are different in gestures, feedbacks and inspiration. [16] On the other hand, dynamic activity is another approach to increase or decrease the level of emotions in human. [17] Existing technologies such as small, cheap and powerful sensing and control electronics present possibilities to incorporate interactivity, dynamism and intelligence in tangible light-embedded objects.
Increasingly application of lighting objects in daily environment such as decorating objects, games and warning systems has created a role beyond their defined tasks in everyday life.
This paper focuses on human interaction with a light-embedded tangible object to increase the level of calmness in user in the transitional period of switching from mentally busy and stressful work atmosphere to calm home atmosphere. Form and tactile experience, light and visual experience, and tangible interaction are the three main focus points in this research. Our focus on interaction entails that which properties and qualities of form, color, movements and gestures support the process of unwinding and stress reduction.

Approach: Psychology of form, light and color
Psychology of every used element in this research and evaluation of the psychological effects of them in different levels make the main body of this research.
As the first step, we reviewed the psychology of forms and explored the user interaction with different forms. The outcome of this step was a group of form prerequisites to support the target emotion: calming. Such a process is done for form and color as well. We used resultant of these steps in further processes of the research.

Calmness and its requirements
Calmness is a mental state of being free from agitation, excitement, or disturbance. Some synonyms can present a clearer meaning of calmness: tranquil, placid, serene, and peaceful. Stable. Trustable and in-control situation are the calming environmental supporting factors.
We have tried and explored these three factors in the current research and in this process, the speed of interactions and the forms of feedbacks are considered as influencing elements in making a calming design scenario.

A research-through-design process
In this research-through-design process [1][19] the actual tangible light-embedded artifact is designed, prototyped and developed and evaluated in every step to reach an optimum level of interaction which can fulfill the requirements of calmness and unwinding in form, light and color. The first step was arranging and combining design requirements with calmness and unwinding requirement, regarding the design context. The requirements are established according to the flow of a design scenario. The reference of interaction process is the Norman's action cycle [3] and the approach in this

research is based on the seven stages of this action cycle, adapted with this research:

1. Forming the goal
2. Forming the intention
3. Specifying an action
4. Executing the action
5. Perceiving the state of the world
6. Interpreting the state of the world
7. Evaluating the outcome

Inviting and motivating are the two first requirements of the design to start the scenario. The rest of requirements are formed of two groups: the first group which support the quality of an interactive design as being interactive, simple, motivating, understandable and trustable in interaction, and the second group which are the requirements of the state of calmness as stability and being trustable emotionally.

To fulfill the requirements, psychological principles, natural calming elements and situations as nature, everyday activities that people do to unwind [4] as reading books or watching film and classic methods as Tai Chi and Yoga are investigated. [15]

The influencing factor to specify the target group in this research is the category of activities generally. By grouping users to three main age groups, 0-18, 19-50, 50+, and reviewing the activities we decided to work on people between 19 and 50 years old, because this target group is involved in work market more than other age groups and they have more directions in their mind simultaneously. In addition, the majority of this age group is mostly engaged and has children and they should manage more tasks than other age groups.

Form exploration

As the second step, through user test, we explored which forms can support calmness and unwinding and the mentioned requirements were reviewed in twenty tangible artifacts with different forms and properties (fig 1), but in a same neutral color, a same surface hardness, and relatively same size [1] to avoid the influence of uninvolved factors in the test. Regarding psychophysical investigations, perceptual representation of 3D shapes is likely to be primarily based on qualitative aspects of 3D structure that can be determined reliably from visual information. [8]

The first interaction with an object happens visually and this is the step, where an inviting and motivating design succeed. [11]

In the user test, the participants were asked to come into the test location, to pick up the artifacts according their own preferences, to remark the reasons and their feeling in interact with their selected artifacts. The recorded video let us know which gestures were often used on which forms.

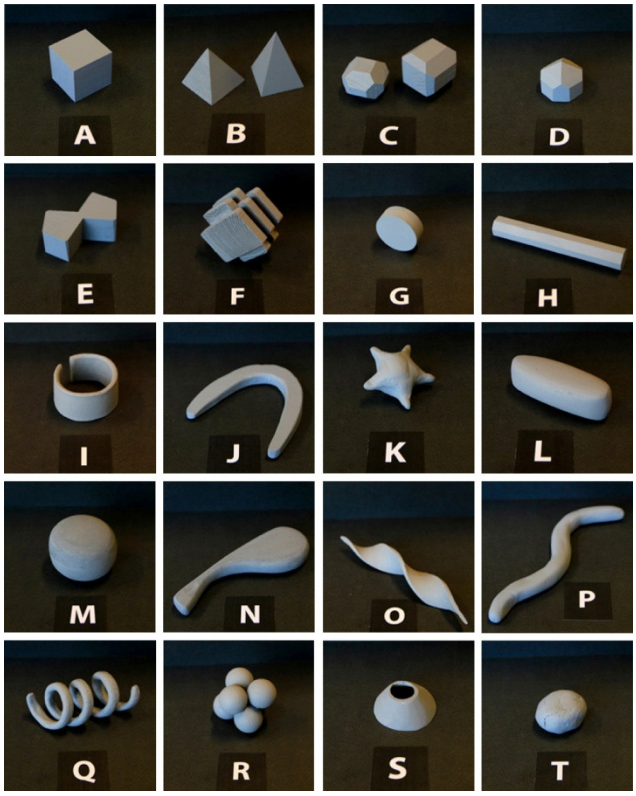

Figure 1. Tangible artifacts with different shapes and properties to explore visual and tactile perception and interaction possibilities.

The result of the user test was a set of form properties which can support the design to be inviting, motivating, simple, stable, understandable and trustable.

As the conclusion of the user test:

- There is a short distance between the level of simple and complex shapes in invitingness, but the complex shapes can not support unwinding and calmness in the process of interaction effectively. Such shapes may even add stress mentally to the user in solving and understanding the complexity.
- The forms with round shapes and edges are more trustable in keeping on the interaction, while the sharp edges inspire the user danger and warning.
- The size of the artifacts should be so that user can scan it in one glance. Big and complex artifacts make the user looking for different sides and edges and it reduces the value of stress reduction of the design.
- Complex artifacts require more gestures and interaction possibilities. It makes user confronted with a wide range of tests and movements which bring a busy mind for user.

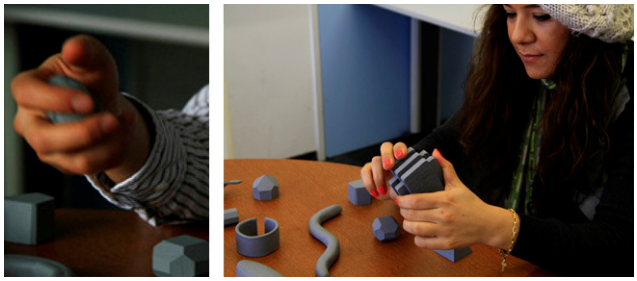

Figure 2. User interaction with tangible artifacts was explored in user test with 20 different artifacts.

The basic selected forms, as the outcome of the form exploration, were ball, short round stick (pipe) and donut-shaped pipe. We did the final selection through user test. Stability and being in control were the reviewed criteria in this test. Regarding the feedbacks of users, the ball was changed to a reversed bowl and used as the final form for the following step of the research.

Light exploration

The third step was light exploration. In this step, the focus was on color and dynamism and interactivity of light. [5] The combination of these two properties provides a wide range of possibilities to make scenarios in feedbacks in the process of interaction. Our approach in this step was reviewing everyday methods of calming such as reading book or newspaper, classic methods of calming such as relaxation exercises, and calming elements in surrounding, like colors and sounds. Then, we derived the common elements and qualities of these activities and visualized them in the forms of feedback scenarios of our design.

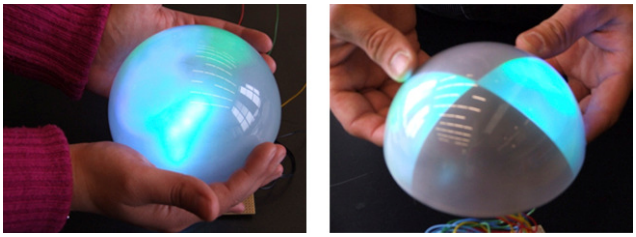

Figure 3. Tangible form and electronics of the prototype.

Concentration, slow but controlled movements and continuous process were the most common approach to calmness and stress reduction.

The colors green, blue and violet are the most calming colors, but in the range of secondary and tertiary colors. Primary colors are not as effective as combined colors on emotions. [7] [13]

We conducted a user test to explore what the feedbacks of users on the forms of glow light are. In this user test, we performed 10 scenarios with different light properties and qualities and asked users crossing on a bar to remark their inspiration between Stress and Calmness.

The light scenarios included different light appearance and movements with different colors and speeds. In this test, we asked user to simulate each light scenario with gesture.

Tangible prototyping

In this step, we made an interactive working prototype. The space in the bowl-shaped form is divided to four spaces to make more possibilities for light flows and travel. Each space is lightened with 24 RGB LED's in three physical levels. Four distance optical sensors are installed on the four sides of the cylinder body of the prototype to detect gestures and hand movements of user. The LED's and sensors are controlled by a programmed Arduino Uno.

Each scenario is defined regarding the gesture as the input

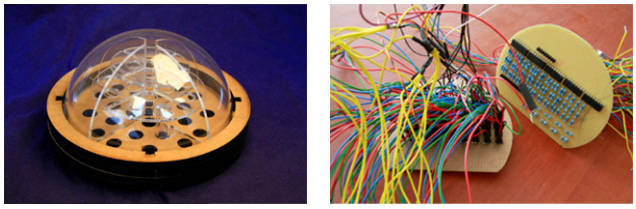

Figure 4. Tangible form and electronics of the prototype.

of user and tested and developed in user test. For instance, if the user moves his/her hand from one quartile and keep it close two one sensor with a changing color, the light flow starts from that quartile and travels into the other three ones; if he/she does the same gesture but with two hands close to two sensors in front of each other, light travels from one quartile to the other one in front of it with changing colors. In total, there were fourteen possibilities in activating the sensors.

As nature, as the origin of human and emotions, has very effective calming and stress reductive elements as colors, movements, sounds, forms, landscapes and etc., the scenarios are inspired from natural general events. In the basic scenario, we programmed the LED's to simulate water flow with blue, green and lily colors.

User Test

We conduct the user test in three groups of five users, in a living room with a couch and a table in front of it. The users were asked to interact with the light-embedded design as the main calming object and as an object next to the usual calming activity that the user does.

In the user test, we reviewed and analyzed the results of the test with each group and developed the scenarios for the following group. In the user tests with each group, we explained the test generally and asked users remarking their emotion and perception of the feedbacks and

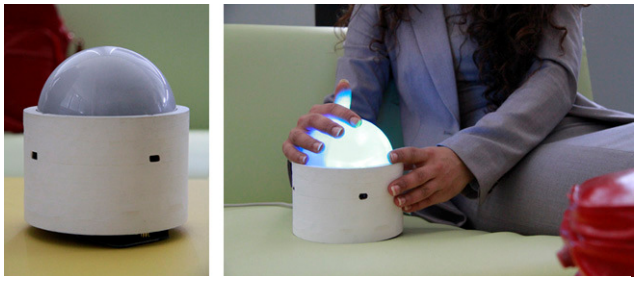

Figure 5. Final form of the prototype used in user test (left), and a user interacts with the design (right).

interaction process with the design, the properties and qualities of the glow light and the scenario, such as color, brightness, speed, and flow, which has inspired the emotion and perception. The properties were asked in the form of choices that user could cross one of them or more and the level of each quality could be specified on a bar. Then, we asked what they do usually to unwind and to reach calmness, if this design fulfills what they achieve in their own approach to calmness, how effective they found the design in this process, and how. All users believed that such a tangible light-embedded artifact is interesting and 12 of 15 users liked to have such a design at their home, 11 of 15 users believed that it loose its attractiveness after a while, but all 15 users prefer to have it embedded in a home device or as a device with some more practical functionality.

Conclusion

The psychological calmness principles and methods valid on light as well, but the main issue is visualizing and simulating calming activities in a light scenario. In other words, inserting a light embedded object into everyday life, with no need to define new activities or gestures for the design interaction far from what daily do. In this perspective, inserting the design into devices in the surrounding creates a calming atmosphere, while people interact with light to fulfill their usual needs.

Tangible forms with round edges, small to grab and control in neutral color can support unwinding in an interaction process, but it is more effective and efficient when it support a calming activity instead of being the main tool to reach calmness. On the other hand, glow light has two functionalities: showing up itself and lightening its surrounding. It happens when the ambient light in the location is on a low level and it happens usually in unwinding period of switching from work to home.

Blue, green and violet in the range of tertiary colors, which is the combination of primary and secondary colors, are the most effective colors to support calmness and unwinding, while the scenario and light flow should be continued.

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