HabitStar: An Interactive Ambient Lighting to Help Users Improve Habits

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CHI'15 Extended Abstracts, Apr 18-23, 2015, Seoul, Republic of Korea
ACM 978-1-4503-3146-3/15/04.
http://dx.doi.org/10.1145/2702613.2732782

Abstract
In this research, we suggest an interactive ambient lighting called HabitStar that helps users improve habits. HabitStar is a star-shaped lighting that can connect with the HabitStar mobile application. The lighting is synchronized with the app by the network server. The user can interact with both the lighting and the app to manage their habits. It helps the user recognize their goals by making them self-record their trials. It also encourages minimum approach for changing habits by providing the norm data as an indicator for practical goals. The lighting can help the user stay motivated by its ambient visualization.

Author Keywords
Habit; Minimum Approach; Motivation; Visualization; Ambient Display;

ACM Classification Keywords
H.5.2. [Information interfaces and presentation] User Interfaces – Interaction styles

Introduction
Our competitive society forces us to set maximum goals for improving our habits. However, such maximum approach easily prevents us from changing our habits by demotivating ourselves. Unrealistic high goals make it difficult for us to pay attention to

changing habits. Keeping us motivated is mostly important for improving habits.

HabitStar helps the user consistently stay motivated by interacting with the star lighting. The star symbolizes a specific habit. Therefore the brightness of the star visualizes how much the user is improving one's habit. HabitStar suggests a minimum approach that can lead to change of our habits.

Related Work

A number of studies have been carried out to identify and expand Casual Information Visualization(Casual Infovis). Casual Infovis means the visualization of information using computer mediated that are useful for users in everyday life[2]. Casual infovis includes ambient information visualization[3], artistic work that visualizes information, and social visualization[4]. The main purpose of Casual Infovis is to visualize information through ambient display. The visualized information can be personalized, flexible, consolidated, and accurate. It does not analyze or create information, but rather focus on the usefulness, enjoyment, and introspection for the user by designing the visualizing system. Ambient Room, Ambient Orb which displays stock information, Artistic work, InfoCanvas, and social infovis are some examples of Casual Infovis.

However existing researches on Casual Infovis cannot improve people's habits, because those focused on the external information (weather, stock, etc.). We wanted to develop Casual infovis into a tool to help us make change rather than a mere information visualization tool. Therefore we designed the UX/UI of HabitStar to serve the purpose of helping us improve our habits.

According to Charles Duhigg, the awareness of one's behavior, the signal to trigger one's habit, and the appropriate feasibility of one's habit can be helpful to make a habit. We formed hypotheses that we need based on these conditions.[1] We made hypotheses based on prototyping.

Actually Rayoung Yang emphasizes the need of designing "Eco-Interaction Technologies" to save energy in the Nest system. Eco-interaction is the design of features and human-system interactions with the goal of saving energy. She proposes that designing spontaneous, enjoyable interactions might be a valuable direction to explore. Our study can be one of the suggestions considering this kind of need for interaction. [5]

Hypotheses

From the advanced research, we formed three hypotheses:

The first hypothesis is that self-recording private data such as one's daily achievement of goal will make users conscious of their goals. Previous ambient information visualizations in other previous research 'just' received and processed external information. However, the process of self-recording becomes inevitable to display personal data. We suppose that the self-recording process itself will help the users to perceive their habits.

Also we hypothesized that displaying the data through an ambient signal(ex: brightness of light) can let the user focus on the current state. We cannot guarantee if the visualization of the goal will positively or negatively reinforce the user's behavior. However it is clear that visual signal reminds people of their habits. [1]

Furthermore we suppose that people can set more feasible goals by providing the norm data before setting goals. The term "norm data" refers to the average value of actual practice (ex: 20 min.) collected from all users with a specific habit(ex: running). This data is not the average value of the goals set, but that of the goals actually practiced by other users. Impractical goals cause demotivation. Therefore we anticipate that providing an indicator helps users estimate feasible goals.

Design Requirements

We focused on the following design requirements:

Firstly an interface suitable for recording private information is required. The way how the device receives private data should be designed differently from the way how existing works received already-refined external data. Recording private data will result in helping users to become conscious of their performance.

Another requirement is the appropriate way of reminding users of their goals. Ambient lighting is required to act as a reminder rather than mere information delivery system – its past usage. Ambient lighting is estimated to be able to remind us of our habits. Whether the ambient lighting is effective or not for a reminder should be demonstrated and supported by further studies.

From our previous hypothesis, further requirements would include an appropriate way of suggesting the minimum goals to the users. Referring to the norm data for each category of habits collected from all user data is estimated to help users set minimum goals.

System Design

HabitStar is composed of three main components: star, network server, and application (Figure 1).

The star consists of a star-shaped lighting and a controller. The user triggers the star by pushing the button at every trial and the star lighting visualizes the user's trial (practice). The controller is connected to the star and processes the star information. It exchanges data with the network server by wireless communications.

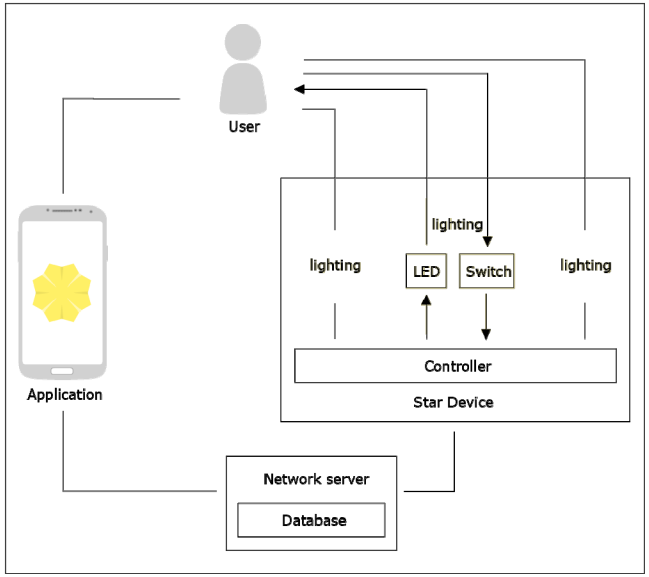

Figure 1. HabitStar is composed of three components: Application, Network Server, and Device.

The network server saves the users' personal information (information from the app, goals, color of

star, trial, etc.) and the device information (configuration, address, etc.). The network server synchronizes the controller with the application in real time. Users can check the state of their stars and interact not only with the star device but also with the application.

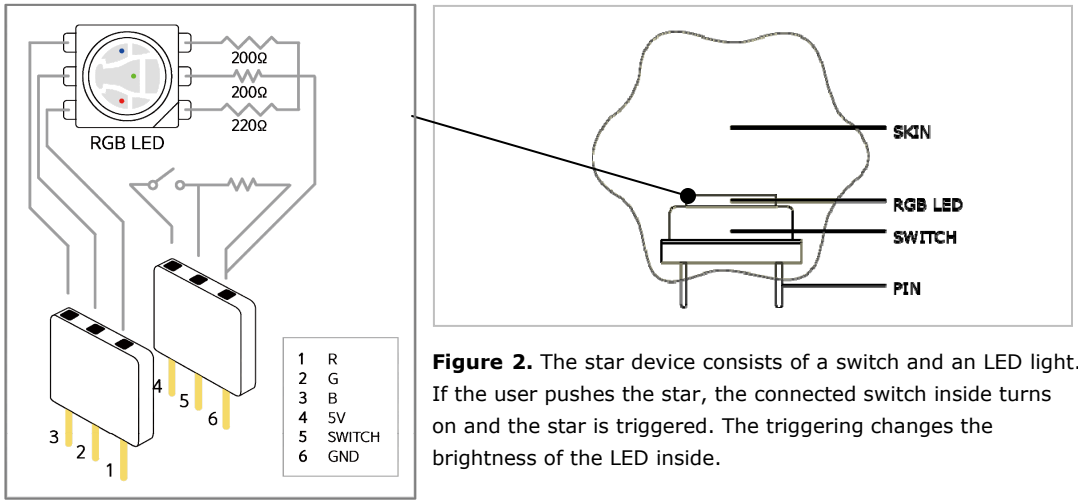

Figure 2. The star device consists of a switch and an LED light. If the user pushes the star, the connected switch inside turns on and the star is triggered. The triggering changes the brightness of the LED inside.

With the HabitStar app, users can set daily goals for improving their habits. They can refer to the norm data provided from the app so that they can set relatively realistic goals for themselves (Figure 3-d, 3-e). The goal is set on the star device registered on the network server. The detail information of the goal such as the address and color of the start will be saved in the database of the network server. Users can assign different colors to each star. Each color can represent a specific habit.

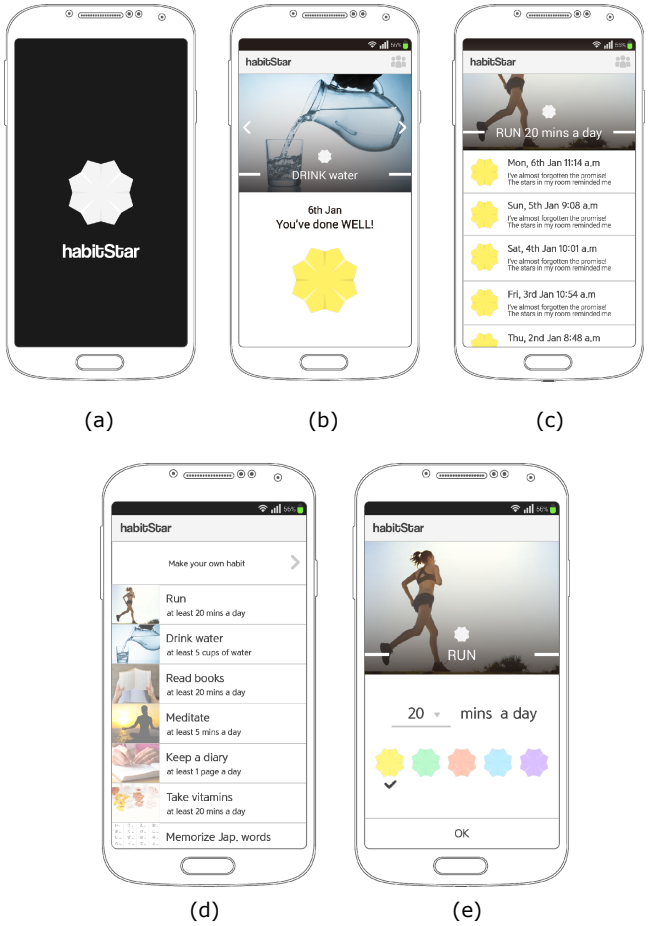

Figure 3. HabitStar Application GUI. (a) Splash page, (b) Daily recording page, (c) Timeline of past records, (d) Categories of habits, (e) Initial setting of a star

Once the users set their daily goals, users can make interaction with the app or the star. The star lighting is composed of a star-shaped skin, RGB LED, and a switch. It attaches or detaches with the controller with its pins (Figure 2). Users simply record their trials when they reach the daily goal by directly pressing the star or by tapping the star icon on the app(Figure 3-b). The star device and the star icon serve the same function. Those are synchronized to each other, reflecting each other's change of state. The act of pushing or tapping changes the brightness of the LED in star.

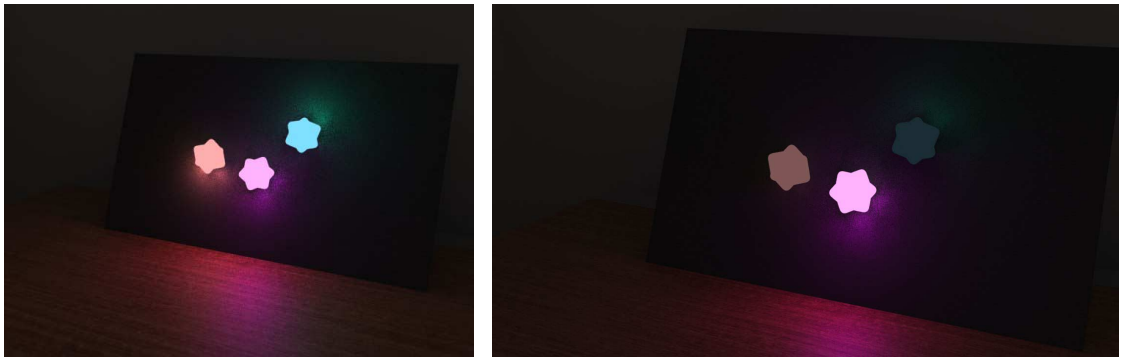

Figure 4. The brightness of stars depends on the user's trial. The brightness when all three daily goals are achieved(100%).

The star visualizes the received data by the change of brightness. It shines in maximum brightness only when the user records the trial(success in fulfilling their daily goal). From the maximum value, the brightness decreases in a constant rate over the next 4 days. If the star receives a next trial within the next 4 days, it brightens to the maximum brightness again. If the user fails to record trial for 4 days, it finally reaches the minimum brightness. When it reaches the minimum brightness, it flickers weakly as if the star is about to die. It keeps flickering until the user inputs the next trial.

For example, if the user fails to record for a day(24 hours), the brightness of light dims to 75%, and if the user fails to record for two consecutive days(48 hours), the brightness dims to 50%, and so on(Figure 4, Figure 5). If the user fails to record success for four(96 hours) or more days, the light darkens to minimum brightness and keeps flickering. Therefore, the starlight of HabitStar acts as an ambient reminder for the user.

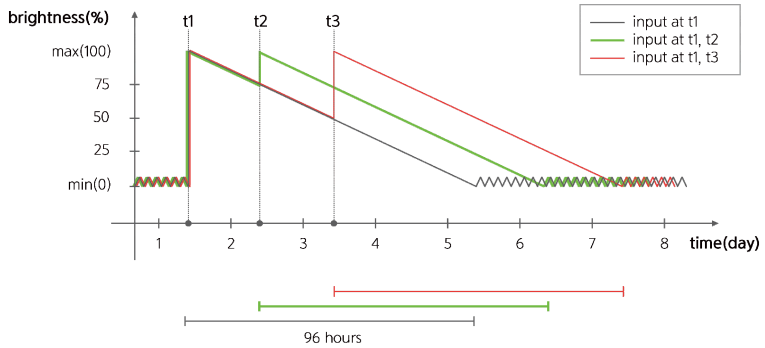

Figure 5. The brightness of stars depends on the user's trial. (Left) The brightness when all three daily goals are achieved(100%). (Right) The brightness when the user failed to perform the daily goal for 2 days(pink star, 50%) and 3 days(blue star, 25%).

Evaluation Plan

We formed hypotheses about self-recording private data, ambient visualization, and providing norm data to help users improve habits. To evaluate the validity of our hypotheses, we will conduct actual experiments in

further studies. Accordingly we have to verify three of the following correlations: First, the correlation between self-recording of one's progress and recognition of the user's goal. Second, the correlation of how efficient ambient visualization is for motivating the user towards the goal. Third, the correlation of being aware of the norm and its effect in user's practice/goal.

Compared to the first two hypotheses that are quite clear, validity of the third hypothesis is relatively unclear. Therefore we need to verify the relation of providing the norm data and users' behavior in setting the goal. By investigating and analyzing the effects of norm data, we will help users get moderately motivated by presenting them with the norm data.

Conclusion

Until now, we have been carrying out the study on HabitStar to help users improve habits. Through pilot studies, we developed ambient lighting which traditionally visualized external data into a smart light that helps practice habits. Charles Duhigg claimed that perceiving private data, reminding the user of it and helping to set moderate goal will help user to improve habits.

Based on this theory, we developed three hypotheses to help users improve their habits. The first hypothesis is that recording private data such as one's daily achievement will make users conscious of their goals. Also we hypothesized that displaying the data through an ambient signal can let the user focus on their current state. Furthermore we suppose that people can set more feasible goals by providing the norm data in advance.

We must carry on with our research by further investigations. Our future research will focus on how HabitStar can bring about practical difference in the users' behaviors. Also we will study further to figure out whether the change is consistent or temporary.

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