A Study of Applying Slow Technology on Wearable Devices

Meng-Dar Shieh[1(✉)], Shu-hui Meng[1], Tzu Yu Chuang[1], Fang-Chen Hsu[2], and Chih-Chieh Yang[2]

[1] Industrial Design Department, National Cheng Kung University, Tainan, Taiwan
mdshieh@mail.ncku.edu.tw
[2] Department of Multimedia and Entertainment Science, No.1, Nantai Street, Yongkang City, Tainan, Taiwan

Abstract. This study proposes two conceptual products using wearable devices (smartwatches) for the purpose of emotional management. One is designed with Slow Technology, and the other is designed with Personal Informatics. Questionnaire survey method was used in this study. The questionnaire consists of two types, AttrakDiff and INTUI. Subjects filled out the questionnaires after watching two videos of conceptual products. The questionnaire data were analyzed by the independent sample and paired sample t-test in order to find the differences of ideas and user experience (pragmatic quality, hedonic quality, attractiveness, and intuition) about these two kinds of products. It is important to find out that the Slow Technology products are inferior to Personal Informatics products in pragmatic quality and intuition, but superior in hedonic quality and attractiveness.

This study suggests that the wearable devices can be integrated with furniture and appliances to provide a material basis of intelligent decoration transformation for users with the help of recorded information and data. Before the emotion identification technology gets mature, this study can be a pilot study for future product design strategy, preparing for Slow Technology products' going to the public to improve user's emotions.

Keywords: Slow Technology · Calm Technology · Affective computing
Wearable device · Personal Informatics · Design for reflection

1 Introduction

The wearable device is an important topic in the field of Ubiquitous Computing; people can record their own physiological data through sensors. The data can be used to further understand themselves and reflect on themselves. Quantified Self Movement is meant to record physiological data to understand all aspects of people's movements by wearable devices, which are very popular in the market in recent years. The sales of wearable devices are depended on the features and usability of the devices. The eMarketer survey found that young people are the most important users of wearable devices. The main reason for young adults interested in wearable devices is the fitness tracker curiosity.

M. Kurosu (Ed.): HCI 2018, LNCS 10902, pp. 595–614, 2018.
https://doi.org/10.1007/978-3-319-91244-8_46

It has the significance and values for this group because of the reasonable price and clear product orientation. Another exciting survey found that the initial users of wearable devices are males basically, but with the fitness bracelets and trackers releasing regularly, females are becoming the primary consumer groups because women are willing to lose weight and keep fit. Therefore, the use of wearable devices as a tool for quantified self is still a trend. The explicit purposes and the right target consumer segmentation will be the critical factors for the success of wearable devices in the market.

Slow Technology, proposed by Hallnäs and Redström, is also a topic of discussion in Ubiquitous Computing. They believed that the digital data in daily lives could be treated as interactive design information, which can be presented in some forms to allow users to absorb the information and get the aesthetic experiences in the process of interaction in order to have further reflections on the technology. Science and technology products tend to give people a quick and accurate experience, while there are few products that provide vague information, which makes people feel that it is a lousy product. However, it is rarely discussed whether the Slow Technology products have their marketability. Therefore, this study wants to discuss the ideas of users whether we can apply the concept of Slow Technology on wearable devices, smart bracelets or watches.

According to the study of science and technology development, there are two concepts of products design related to the wearable devices. The first one is the combination of the wearable device and Slow Technology concept with the support of affective computing. The concept product shown in this paper is called "Atmosphere Light." The second one is the wearable device itself supported with affective computing. The concept product shown in this paper is called "Mood Diary." This study examines the current ideas and acceptance of two conceptual products, as well as the possibilities of designing the wearable devices and home appliances, and exploring potential customers.

There are four goals of this paper.

1. To explore the ideas and acceptance of users with the two conceptual products.
2. To discuss the possibility of designing the wearable devices with furniture collocation, and studying the potential customers.
3. To explore the possibility of applying Slow Technology in Quantified Self products.
4. To investigate the obstacles and design opportunities for the wearable products using a multi modal.

2 Background Review

2.1 How Can Technology Support Reflection?

People can get insight through reflection. These reflections could help people grow in a better state in return. Reflection is encouraged to help people get more benefits in the field of education, design, and health care [1, 2]. These digital technologies could not only provide people with the opportunity to reflect but also enhance their own professional skills and improve people's quality of life. An increasing number of

researchers began to study the issue in the field of human-computer interaction. However, reflections usually do not happen naturally. Therefore, people tend to need some reasons or are encouraged to behave in a reflective way. Technology products have the ability to sense by drawing, showing and presenting exciting information to users. Technology also could give users the opportunity to experience the confusion, suspicion, and surprise, which could be used as a mechanism to trigger reflection [4]. In the field of human-computer interaction, the equipment or system is designed for meditation. Based on the degree of the process of the reflection created by designers, Baumer divided it into three kinds: Personal Informatics, Reflective Design, and Slow Technology (Table 1).

Table 1. Three types of designing for reflection

Personal Informatics	Personal Informatics is driven by data and often focuses the reflection by the user on the user himself/herself and his/her behavior
Reflective Design	Explore the use of a variety of design methods by the user and the designer to make each interactive part of an interactive system designed, which could prevent the interaction process from experiencing the possibility of unintentional or even harmful experience
Slow Technology	Slow Technology explores how technology products can be designed to allow users to be tempted to reflect when interacting with a product or system

2.2 Personal Informatics

Since the wearable device is becoming popular, people could record a lot of information about their own through a variety of sensors, such as acceleration sensors, gyroscopes, magnetic sensors and temperature sensors. For example, the physiological data includes body temperature, breathing, heart rate and blood pressure. State of mind comprises thinking pattern and mood. Location information includes environment and travel. Time information includes time intervals, performance time. People information contains people interaction. Different types of applications are generated and could be classified into the following three methods to obtain information, direct measurement (wearable device, environmental sensor), inference (semantic reasoning and algorithms, some information can be directed to other meanings), self-reporting (manual date entry) [10].

The purpose of collecting this information is nothing more than self-monitoring and self-reflection to improve ourselves, such as enhancing behavior, improving mental state or medical condition, and so on [12]. The whole movement is called the Quantified Self Movement, which is used to understand the various aspects of the various mental data recorded by the wearable device. Quantified Self could help people achieve goals in health, fitness, mood, goals, and time management. However, at present, the areas of success in Quantified self are healthy, emotional, and athletic. Depending on different focuses, Quantified Self also has different terms, such as Personal Informatics, Personal analytics, Self-Tracking, Living by Numbers, and so on. Personal Informatics, as literally, focuses on how to present the optimal visualization to users, ensuring that they do absorb information and move towards the goal.

Personal Informatics in Mood Regulation: Affection is considered the most extensive mental state, including the evaluation of feelings, for example, people feeling good or bad, like or do not like what happened today. Emotion is at the top of the psychological structure. Emotion, mood, and feeling are under this structure. The mood is considered to be a broader concept than emotions. Emotions are short, quick and direct to some external stimuli. Moods last longer than emotions, which do not need for external stimuli [5].

Today, mood tracking has received much attention in this area of research. Many applications or services related to tracking moods are trying to help users increase their awareness and understanding of factors that affect emotions. It may be useful to collect emotional information for the following reasons: The therapist usually asks the patient to keep track of their emotional state (along with daily life at all levels) to ensure that they could help them with depression or fitness. Doctors and patients are able to understand the causes of symptoms and effectiveness of the treatment through the data record.

The general public may also desire to collect their own emotional information to more easily understand themselves. People could find relevance between some things and emotion and more opportunities to find a specific way to change their habits and behavior through the data [3]. Many applications use different visual methods to present the results of the data, allowing users to understand how their mental state is affected by the surrounding or social factors and reflect the mood changes and the relationship between varieties of factors.

2.3 Slow Technology

Hallnäs and Redström proposed the concept of Slow Technology of human-computer interaction design. They believed that people living in a particular environment and the impact of the environment on people would make people respond to the situation. Hallnäs and Redström thought that we had to create a technology that allowed people to live in changing daily life. That is, the computer's needs should make changes from "purely to improve the efficiency of the tool" to "the technology products helping us engaged in any daily life" [6–8].

Hallnäs and Redström proposed three aspects of Slow Technology.

1. Reflective technology: Reflective technology is technology which "in its elementary expression opens up for reflection and ask questions about its being as a piece of technology."
2. Time technology: Time technology is technology "that through its expression amplifies the presence–not the absence–of time." It stretches time and slow things down.
3. Amplified environment: the Amplified environment is technology that amplifies "the expression of a given environment in such a way that it, in practice, is enlarged in space or time" and thus enhances the expressions and functionality of existing artifacts. Hallnäs, Redström, and others researchers further proposed eight Slow Technology examples in 2001. Not discussing the premise of the function, they enlarged the way of beauty and introduced us how to deliver the information that is filled with our life to the people [6–8].

Table 2. The expressions of Slow Technology [6–8]

Works' photo	Expressions
 **Fan House (display)**	Equipped with three by three matrix of the cabinet. The cabinet is equipped with a fan. Each row of wooden cabinets is also linked by cloth with different colors and materials. **Reading**: The movement of the cloth **Writing**: Control the degree of fan rotation with a certain amount of information.
 **Fabric Door (sensor)**	The cloth with numbers of sensors is installed in the ceiling of the room at the entrance. When people go through the door and enter the room, the information was recorded by the accelerated sensor due to the cloth disturbed by the wind. It was sent to a computer in the form of data. **Reading**: The movement of the cloth **Writing**: When people go through the cloth, the fabric could pull the sensor due to the wind disturbance.
 **Tray (display)**	There is a quadrilateral tray from the ceiling. The motor installed in the ceiling controls the line on the four sides of the tray. The ball on the plate will also show different graphics with the changing length of the line. **Reading**: The pattern of beads on the tray. **Writing**: Some information controls four stepper motors in the ceiling.

Hallnäs and Redström et al., record a variety of physical signals with a digital way by sensors, and then send this digital signal to other actuators through two computer functions. One is reading (what type of people to read), the other is writing (what information type to write to the computer). Descendants could use different materials into this form. When the user receives and starts to analyze these signals, it takes time to understand and digest [6–8] (Table 2).

Table 3. The integration of Slow Technology: The presentation film of the Atmosphere Light

Work's photo	Description
 The movement crafter [11]	**Material**: The sensor records the shaking of the needle and thread. **Form**: Put shaking the data as the animation and display it on the screen of the other side. Install the sensor to the braid. The two woven boxes could link each other in a long distance. When you are in the woven scarf, you could increase the length of the cotton thread by looking at the screen. Even if you are not in the weaving, you could feel the existence the through the screen.
 A Sound Mirror [6,7,8]	**Material**: Recording audio. **Form**: Every other time, play recorded sound by video at the different time. Installing multiple recording devices in the corridor of the office to record different moments of the sound. The recorded sound is played when people walk through the hallway. This device could create a "slow echo effect" to make people spend more time to listen patiently.
 Fading Photo [9]	**Material**: Digital photo. **Form**: After 24 hours, the color photos gradually become black and white. Digital photo frame connected to a device. This digital photo in 24 hours will turn from the bright color to dark black. The user must turn the device on the knob to restore the original photo glory.

Take the Tray as an example. The four stepper motors could be connected with the information of home appliances, such as the volume of the sound, the TV information, temperature measurement information (indoor, outdoor). When the Tray beads concentrated on one side, it represents the amount of information on the appliance is higher than the other three devices.

The core concept of Slow Technology is that Material and Form. The material is any information that people are familiar with, for example, e-mail, digital photos, music, data transfer rate, etc., Form is to convey the information to the people. When the material is translated by form, its expression will often have ambiguity. Therefore, people could not instantly understand the information to convey the real meaning (Table 3).

3 Methodology

3.1 Independent Sample T-Test

Independent Sample T-Test is that independent samples were randomly assigned to different groups and the subjects did not have any relationship with each group, also known as completely randomized design. The t-test is used to test whether the average difference between two independent samples reaches a significant level, which means the two independent samples can be achieved by grouping. When calculating t-test numbers, two variables are needed. Variable x is divided into two groups, the average of the two independent samples should be tested whether there is a significant difference. Two maternal random samples are considered after calculating all the average number of differences in the situation. Depending on whether the number of samples in the two groups is equal and whether the variance is same, there are several algorithms:

Equal sample sizes, equal variance:

Given two groups (1, 2), this test is only applicable when:

The two sample sizes (that is, the number, n, of participants of each group) are equal; it can be assumed that the two distributions have the same variance; Violations of these assumptions are discussed below.

The t statistic to test whether the means are different can be calculated as follows:

$$\mathrm{t} = \frac{\overline{X_1} - \overline{X_2}}{s_p\sqrt{2/n}}, \text{where} \quad s_p = \sqrt{\frac{s_{X1}^2 + s_{X2}^2}{2}}$$

Here s_p is the pooled standard deviation for $n = n_1 = n_2$ and s_{x1}^2 and s_{X2}^2 are the unbiased estimators of the variances of the two samples. The denominator of t is the standard error of the difference between two means. For significance testing, the degree of freedom for this test is $2n - 2$ where n is the number of participants in each group.

Equal or unequal sample sizes, equal variance:

This test is used only when it can be assumed that the two distributions have the same variance. (When this assumption is violated, see below.) Note that the previous

formulae are a particular case valid when both samples have equal sizes: $n = n_1 = n_2$. The t statistic to test whether the means are different can be calculated as follows:

$t = \frac{\overline{X_1} - \overline{X_2}}{s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$, where $s_p = \sqrt{\frac{(n_1-1)s_{X1}^2 + (n_2-1)s_{X2}^2}{n_1+n_2-2}}$ is an estimator of the pooled standard deviation of the two samples. It is defined in this way so that its square is an unbiased estimator of the common variance whether or not the population means are the same. In these formulae, $n_i - 1$ is the number of degrees of freedom for each group, and the total sample size minus two (that is, $n_1 + n_2 - 2$) is the total number of degrees of freedom, which is used in significance testing.

Equal or unequal sample sizes, unequal variances:

This test, also known as Welch's T-test, is used only when the two population variances are not assumed to be equal (the two sample sizes may or may not be identical) and hence must be estimated separately. The t statistic to test whether the population means are different is calculated as:

$$\mathrm{t} = \frac{\overline{X_1} - \overline{X_2}}{s_{\bar{\Delta}}}, \text{where } S_{\bar{\Delta}} = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

Here s_i^2 is the unbiased estimator of the variance of each of the two samples with n_i = number of participants in group, $i = 1$ or 2. Note that in this case $S_{\bar{\Delta}}$ is not a pooled variance. For use in significance testing, the distribution of the test statistic is approximated as an ordinary Student's t distribution with the degrees of freedom calculated using

$$\mathrm{d.f.} = \frac{\left(s_1^2/n_1 + s_2^2/n_2\right)^2}{\left(s_1^2/n_1\right)^2/(n_1-1) + \left(s_2^2/n_2\right)^2/(n_2-1)}$$

This is known as the Welch–Satterthwaite equation. The exact distribution of the test statistic actually depends (slightly) on the two unknown population variances.

In this study, independent samples t-test was used in the analysis of the subjects in accordance with the "gender," "whether to buy furniture," is divided into two groups to test significant surgery.

3.2 Paired Sample T-Test

Paired Sample T-Test usually has two kinds of methods. One is the "repeat number," which means measuring before and after the test, just like measuring weight before and after losing weight. Therefore, every paired data are from the same subject, and this is the most common paired samples. The other one is called "pair group method." Although each paired data from two subjects, we identify a trait they (concerned researchers) are the same intelligence of male and female students. This is not a standard comparison of paired samples. However, regardless of the first case or the

second, we would think that the two data are relevant, so we should use the paired sample t-test instead of independent sample t-test.

$$t = \frac{\bar{X}_D - \mu_0}{\frac{s_D}{\sqrt{n}}}.$$

For this equation, the differences between all pairs must be calculated. The pairs are either one person's pre-test and post-test scores or between pairs of persons matched into meaningful groups (for instance drawn from the same family or age group). The average (X_D) and standard deviation (s_D) of those differences are used in the equation. The constant μ_0 is non-zero if you want to test whether the average of the difference is significantly different from μ_0. The degree of freedom used is $n - 1$, where n represents the number of pairs. In this research, the paired sample t-test was used to analyze whether there is a significant difference between "Atmosphere Light" and "Mood Dairy."

4 Research Procedure

4.1 Research Framework

In this study, the conceptual design factors are derived from Calm Technology, Slow Technology, and Personal Informatics. Two conceptual products are proposed in the study. One is Atmosphere Light designed with Slow Technology, and the other is Mood Diary designed with Personal Informatics. Questionnaire survey method is used in this study. The questionnaire is based on two types of inquiries, AttrakDiff and INTUI, and then the subjects will fill out the questionnaires after appreciating the two product videos. The questionnaire data will be tested by the paired sample t-test and independent sample t-test in order to test the different qualities (pragmatic quality, hedonic quality, attractiveness, and intuition) of the two kinds of products. The differences and acceptability of the user experience of Personal Informatics and Slow Technology, the possibility of applying Slow Technology on quantified-self products, and the obstacles of developing quantified-self products with a multi modal will be discussed.

4.2 Conceptual Design

On the basis of science and technology of affective computing development, two conceptual products are put forward to track the user's emotional state. In the future, the Ubiquitous Computing and affective computing technology will be more and more mature. The differences of pragmatic quality, hedonic quality, attractiveness and intuition between the two conceptual products designed with Slow Technology and Personal Informatics concept respectively are studied in the research. These two conceptual products are presented in the way of photos in series and appreciated by the

subjects. After the appreciation, two AttrakDiff and INTUI questionnaires and some essential data are filled out.

The two conceptual designs use smartwatches to record the user's emotions and identify the user's emotions through heart rate measuring and emotional speech processing. When the user's emotions and the heartbeat speeds change, the recording function starts to identify more accurate users' emotions. If the heart rate changes at the moment, the users don't speak, they will only be measured by heart rate to infer the users' emotions. These recorded data are divided into two products with different presentation methods. The one is presented in the Slow Technology design concept, and the other is shown in Personal Informatics.

Atmosphere Light: It is a situation table lamp with projection function, after receiving the emotional data from the affective computing system, the lamp will judge the current emotional state, choose a proper picture projecting on the lampshade from past emotional data storages to adjust users' emotion and guide users to reflect.

Mood Dairy: It is an application which has a function of data visualization, and data is recorded by a smartwatch. The smartwatch can record users' voices of speaking and turn them into wordings as diaries. By the viewing of the recorded data, users can compare their emotional data month on month and reflect upon emotional management.

4.3 Product Represented in Films

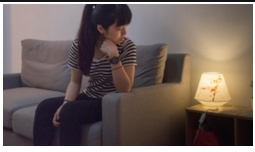
See Tables 4 and 5.

4.4 Descriptive Statistics

In descriptive statistics, 119 questionnaires were retrieved, and 16 surveys were invalid. One hundred and three valid questionnaires were used for statistical analysis of SPSS software. The method used was the paired sample t-test. The questionnaire was conducted with subjects ranging in age from 13 to 55 years. There are 3 people under the age of 18, 91 people aged between 19 and 35 years old, and 9 people over the age of 36. The male to female ratio was close to 1 to 1, with 52 males and 51 females. Among them, there are 29 people, who have industrial design, art design, interactive design related backgrounds. The remaining 74 people did not have the relevant background. There are 15 people usually use a wearable device to record their habits, and 88 people do not have the practice. There are 64 people will add some atmosphere for their home and buy furniture, while 39 people won't.

Paired Sample T-Test of Two Conceptual Products
Having "*" means that the product has a higher quality of evaluation. "**" means that the two have a completely opposite direction, which is a strong difference.

Table 4. The presentation film of the Atmosphere Light

Usage situation	Scenario description
 I'm wearing a smartwatch. It starts recording when it senses my emotional changes and records both emotion recognition and recording.	The user is wearing a smartwatch, and the watch will activate the recording function when it senses that the user's heart rate changes due to emotional changes, and the system combines the heartbeat and voice information to identify the emotion.
 As usual, I finished my day trip and went back home.	The user finished his day's trip and returned home.
 This is my desk lamp. It has a projection function, also has the capability of data processing.	This is the table lamp of the users'. It has a projection function, and can receive data from a smartwatch and calculate.
 Whenever I return home, it receives the watch's recorded emotions and audio messages, and stores and calculates them.	Whenever the user comes home, it will receive emotional and recording information recorded by the watch, and stores and calculates it.
 (There is no description of this picture.)	According to the information recorded by the user's past smartwatch, the system will guess what kind of pictures can adjust the user's emotion, search the appropriate picture from the network database and project it on the lamp.

(*continued*)

Table 4. (*continued*)

 Sometimes the pictures will remind me of what happened today. If it's impressive, it reminds me of more things.	The projected picture may remind the user of what happened today, or something impressive.
 But sometimes, maybe because I forgot, these patterns don't make me think of anything lately. I will take these patterns as the days after the inspiration of life planning.	Users may also not be able to think or reflect on anything through pictures when users can use these pictures as an inspiration for planning life.
 For example, Once after seeing the landscape, I planned a trip for myself.	The user may plan a person's trip after seeing the picture.
 Once there was a pattern of clothes that reminded me of the recent purchase of too many clothes.	Or seeing pictures of similar clothes that allow users to reflect on recent shopping and review expenses.
 Once I had a picture that made me sad, and I got a friend out for a meal that weekend.	Or after seeing the projection of pictures, the users have sad mood and then reflect, planning a dinner with friends.

(*continued*)

Table 4. (*continued*)

	For the users, the system can make users recall memories, and make them reflect on some things or provide clues as life planning inspirations.
For me, it can give me some clues about memories, or inspiration in life. I often expect what kind of patterns will appear next time.	
	Users use this system, only wearing a smartwatch, the system will automatically record the user's mood, and Atmosphere Light will have different changes every day.
As long as I wear smartwatches, the desk lamp has a different change every day, and change the room for me.	
	The users just only have to wear a smartwatch to keep the system running.
(There is no description of this picture.)	

It can be found that in the evaluation of practical items, the Mood Diary makes the subjects feel more “Practical,” “Clear,” “Manageable.” However, in the ratings of hedonic quality and attractiveness, none of the rating terms of Mood Diary is higher than the Atmosphere Light (Table 6). In the Atmosphere Light, PQ5 (unpredictable vs. predictable), is tested by linear regression analysis with HQI3, HQI7, HQS1, HQS2, ATT1, ATT2, ATT4, and ATT6 respectively. It can’t prove that PQ5 has the correlation with the above items, so we can’t explain that the property of “Unpredictable” can directly lead to the properties of HQI3 HQI7, HQS1, HQS2, ATT1, ATT2, ATT4, and ATT6.

Having “*” means that the product has a higher quality of evaluation. Through the “E_02”, it can show that the Atmosphere Light has the characteristic of making the users “feel lost,” and “G_03” is “feeling guided.” However, in the “V_01”, “V_02”, “V_03”, the evaluation of the Atmosphere Light is lower than the Mood Dairy (Table 7).

Table 5. The presentation film of the Mood Diary

Usage situation	Scenario description
	The user is wearing a smartwatch, and the watch will activate the recording function when it senses that the user's heart rate changes due to emotional changes, and the system combines the heartbeat and voice information to identify the emotion.
I'm wearing a smartwatch. It starts recording when it senses my emotional changes and records both emotion recognition and recording.	
	The user finished his day's trip and returned home.
As usual, I finished my day trip and went back home.	
	Users use smartphones to open apps - Mood Dairy.
(There is no description of this picture.)	
	By using the Mood Diary, users can know what emotions they have experienced that day. Every user who experiences the moment, if he speaks, the system will identify and then turn it into text, which helps the user to review the current experience through the application.
Through the mood diary, I can know that I have experienced those emotions that day, and each emotion has a story to explain, because the watch is brilliant to help me record each of the current voice, after identification into a text.	

(*continued*)

Table 5. (*continued*)

 I almost forgot that I lost the train ticket at 8:00 in the morning, but some warm heart people picked up and handed it to me, I hope next time I can do a good thing every day.	For example, the user forgot that he lost his train ticket at 8:00 in the morning, but some warm heart people picked up and handed it to him, so he hopes he can do a good thing every day.
 After 5 minutes, almost no sleep friends finally appeared, he looks really funny, next time I'll remind him to sleep well.....	For example: the user meets with his friend, the mood change and the words which say to the friend are recorded down.
 At 11:20, I encountered unfriendly waiter, at that moment I really angry, but later I think about it, perhaps he had a bad day today, and something makes him unhappy.	For example, the user can check the anger and the recorded text through the application. The user is able to reflect on the event and review whether there is a better way to deal with it.
 The mood journal not only lets me know all sorts of mood that day. I can also know what percentage of mood I had last month and which mood accounts for the majority.	The Mood Dairy lets users know the emotions of the day, and also lets users know which emotions are in the majority each month.
 Make a comparison between each month and examine my mood.	Users can compare themselves by month and check their percentage of moods.

(*continued*)

Table 5. (*continued*)

	Users can reflect on how to adjust their views and attitudes towards events if they make up the majority of happiness in the coming month.
I recalled many unhappy things that happened last month, starting this month. I'll adjust my views and attitudes about things and be happier next month.	
	The Mood Dairy uses smartwatches to record users' emotions, helps users understand their emotional changes and alert users to emotional management.
For me, this app, the Mood Diary can analyze emotions in my smartwatch and help me understand my short and long-term moods, and remind me to do emotional management every day.	
	This application can clearly and coherently record users every emotion by the smart phone or tablet computer to check out the information, and then reflect the mood and other related things.
(There is no description of this picture.)	

5 Discussion

From the analysis results of an AttrakDiff questionnaire, while the Mood Diary is higher than the Atmosphere Light in pragmatic quality, however in hedonic quality and attractiveness aspects, the Mood Diary is lower than those of the Atmosphere Light. The Atmosphere Light has more qualities of "Stylish," "Original," "Creative," "Pleasant," "Pretty," "Inviting" and "Pleasing." From the analysis of INTUI questionnaire, it was found that the scores of the two conceptual products have the same quality under the "Gut Feeling," "Magical Experience" and "Effortlessness". The differences are items of "E_02", "G_03", and "X_03". The difference between the average number of "E_02" item is significant, indicating that the Atmosphere Light has more nature of "…I felt lost" than the Mood Dairy, the subjects need to spend time and energy to use the Atmosphere Light to reach the desired target. The average difference in the "G_03" item is significant. Compared to the Mood Diary, the Atmosphere Light has more nature of "I was guided by feelings." The furniture and furnishings with "I was guided by feelings…" than "I was guided by reason…" characteristics, will be much proper. The average difference of the "X_03" item is significant, which means

Table 6. The comparison of the qualities of the two conceptual products (AttrakDiff)

	Pragmatic		Hedonic(identity)		Hedonic(stimulation)		Attractiveness	
Atmosph–ere Light	PQ1	Human	HQI1	Connective	HQS1	**Inventive***	ATT1	**Pleasant***
	PQ2	Simple	HQI2	Professional	HQS2	**Creative***	ATT2	**Attractive***
	PQ3	Practical	HQI3	**Stylish***	HQS3	Bold	ATT3	Likable
	PQ4	Straightforward	HQI4	Premium	HQS4	Innovative	ATT4	**Inviting***
	PQ5	**Unpredictable****	HQI5	Integrating	HQS5	Captivating	ATT5	Good
	PQ6	Clearly structured	HQI6		HQS6	Challenging	ATT6	**Appealing***
	PQ7	Manageable	HQI7	**Presentable***	HQS7	Novel	ATT7	Motivating
Mood Diary	PQ1	Human	HQI1	Connective	HQS1	Inventive	ATT1	Pleasant
	PQ2	Simple	HQI2	Professional	HQS2	Creative	ATT2	Attractive
	PQ3	**Practical***	HQI3	Stylish	HQS3	Bold	ATT3	Likable
	PQ4	**Straightforward***	HQI4	Premium	HQS4	Innovative	ATT4	Inviting
	PQ5	**Predictable****	HQI5	Integrating	HQS5	Captivating	ATT5	Good
	PQ6	**Clearly structured***	HQI6	Brings me closer	HQS6	Challenging	ATT6	Appealing
	PQ7	**Manageable***	HQI7	Presentable	HQS7	Novel	ATT7	Motivating

that the Mood Diary brings the users more Magical Experience ("…carried me away.") than Atmosphere Light. In the items of "Verbalizability," the differences of averages in the two products are all significant, indicating that subjects may think using a smartphone is more familiar with the usage and relatively more comfortable than interacting with the Atmosphere Light.

In the "E_02" item, the Mood Light has the property of "I felt lost," which means that more efforts are needed to achieve the goal of the operation. It means Atmosphere Light can give users the opportunity to experience the confusion, so it can be inferred that Atmosphere Light has the opportunity to guide users to reflect. The further study found that females had significantly different grades of two concept products than males, and females were more likely to be exposed to these types of products than males. For those willing to add atmosphere to the house, they give more positive rating rather than those don't want to buy it. People, who choose "buying," think the Atmosphere Light has more properties of "High quality", "…was inspiring" and "… was a magical experience" than "not buying." People who choose "buying" love this information recording method, and more expect the next time interacting with the product than those who choose "not buying."

According to the open questions, some respondents believe that if people want to do emotional management, the use of APP will be more appropriate. If using Atmosphere Light to do emotional management, people need to discuss with the doctor, and the product needs further redesigning. The respondents also replied, "Modern life has been quite boring, the use of this (lamps) will feel more boring, but if you do not attach importance to the Mood Dairy, just as decoration to change the mood will be good.", "I

Table 7. The comparison of the qualities of the two conceptual products (INTUI)

	Gut Feeling		Effortlessness		Magical Experience		Verbalizability	
Atmosphere Light	G_01	...I acted on impulse	E_01	...I reached my goal effortlessly	X_01	...was inspiring	V_01	...I have no problem describing the individual operating steps
	G_02	...I performed unconsciously, without reflecting on the individual steps	E_02	...I easily knew what to do	X_02	...was a magical experience		
	G_03	**...I was guided by feelings***	E_03	...ran smoothly	X_03	...carried me away	V_02	...I can easily recall the operating steps
	G_04	...I acted without thinking	E_04	...was easy	X_04	...was fascinating		
			E_05	...came naturally	Intuitive		V_03	...I can say exactly in which way I used the product
					INT_01	…was very intuitive		
Mood diary	G_01	...I acted on impulse	E_01	...I reached my goal effortlessly	X_01	...was inspiring	V_01	**...I have no problem describing the individual operating steps ***
	G_02	...I performed unconsciously, without reflecting on the individual steps	E_02	**...I easily knew what to do***	X_02	...was a magical experience		
	G_03	...I was guided by feelings	E_03	...ran smoothly	X_03	**...carried me away***	V_02	**...I can easily recall the operating steps***
	G_04	...I acted without thinking	E_04	...was easy	X_04	...was fascinating		
			E_05	...came natura lly	Intuitive		V_03	**...I can say exactly in which way I used the product***
					INT_01	…was very intuitive		

feel the Atmosphere Light is good. While its problem maybe not to perceive one's feelings, but the need for new or positive energy into our body." The Atmosphere Light, as decorations for the primary function with emotional management, will give participants living pressure. If transformed the purpose of the product into conditioning life sentiment rather than management, the concept of products will be more suitable.

6 Conclusion

In the field of Personal Informatics, data is recorded and presented by clear visualization for users, and in the Slow Technology, data is recorded and presented in a fuzzy way for users to guide users to reflect. Both of them need users to spend time on reflection. In the study, the two kinds of conceptual products designed with Personal Informatics and Slow Technology respectively are proposed. The one designed with Personal Informatics is named Mood Diary, the other designed with Slow Technology is named Atmosphere Light. These two conceptual products are presented in the way of photos in series and appreciated by the subjects. After the appreciation, two AttrakDiff and INTUI questionnaires and some basic data are filled out. According to eMarketing analysis, one of the reasons for the decline in the number of sales of smart bracelets and smartwatches is that users don't know the exact cause and what the way the devices are used. If the change of the decorations is based on information derived from the wearable device, the Atmosphere Light has the opportunity to attract people who are willing to buy decorations to purchase the wearable device.

References

1. Baumer, E.P.S., Khovanskaya, V., Matthews, M., Reynolds, L., Schwanda Sosik, V., Gay, G.: Reviewing reflection, pp. 93–102 (2014). https://doi.org/10.1145/2598510.2598598
2. Baumer, E.P.S.: Reflective informatics: conceptual dimensions for designing technologies of reflection. In: The Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, Seoul, Republic of Korea, pp. 585–594 (2015)
3. Cena, F., Lombardi, I., Rapp, A., Sarzotti, F.: Self-monitoring of emotions: a novel personal informatics solution for an enhanced self-reporting. In: The Proceedings of the 2nd Workshop Emotions and Personality in Personalized Services (EMPIRE 2014) at Conference on User Modeling, Adaptation and Personalization (UMAP14), Aalborg, Denmark (2014)
4. Chetty, M., Banks, R., Harper, R., Regan, T., Sellen, A., Gkantsidis, C., Key, P.: Who's hogging the bandwidth: the consequences of revealing the invisible in the home. In: The Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Atlanta, Georgia, USA, pp. 659–668 (2010)
5. Gray, E.K., Watson, D.: Assessing positive and negative affect via self-report. In: Handbook of Emotion Elicitation and Assessment, pp. 171–183 (2007)
6. Hallnäs, L., Redström, J.: Slow technology – designing for reflection. Pers. Ubiquitous Comput. **5**, 201–212 (2001)

7. Hallnäs, L., Jaksetic, P., Ljungstrand, P., Redström, J., Skog, T.: Expressions: towards a design practice of slow technology. In: The Proceedings of Interact 2001, IFIP TC.13 Conference on Human-Computer Interaction, 9–13 July 2001, Tokyo, Japan, pp. 447–454 (2001)
8. Hallnäs, L., Redström, J.: From use to presence_ on the expressions. Comput.-Hum. Interact. **9**, 106–124 (2002)
9. Krogh, M.: Exploring slow technology in the home. (Master), K3 Malmö University (2015)
10. Marcengo, A., Rapp, A.: Visualization of human behavior data, pp. 236–265 (2014). https://doi.org/10.4018/978-1-4666-4309-3.ch012
11. Pschetz, L., Banks, R., Molloy, M.: Movement crafter. In: The Proceedings of the 7th International Conference on Tangible, Embedded and Embodied Interaction, Barcelona, Spain, 393–394 (2013)
12. Rapp, A., Cena, F.: Self-monitoring and technology: challenges and open issues in personal informatics. In: Stephanidis, C., Antona, M. (eds.) UAHCI 2014. LNCS, vol. 8516, pp. 613–622. Springer, Cham (2014). https://doi.org/10.1007/978-3-319-07509-9_58
13. Sengers, P., Boehner, K., David, S., Kaye, J.J.: Reflective design. In: The Proceedings of the 4th Decennial Conference on Critical Computing: Between Sense and Sensibility, Aarhus, Denmark, pp. 49–58 (2005)