7Y-06

# A Smartwatch Application that Motivates Exercise Procrastinators Based on Fogg's Behavior Model

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## 1 Introduction

Nowadays, the COVID-19 worldwide outbreak is forcing us tostay at home. Furthermore, the number of people that are living an unhealthy lifestyle is increasing, mostly due to lack of exercises. To improve people's heallth condition by encouraging daily fitness activity, it is required to promote regular exercise habits to everyone.

Despite most consumer wearable devices having sensors to track users' health data, many fitness application tracks food intake or workout time to presume their calories burnt. It requires too much hassle for the users to manually input names of the food and exercises for every single day. Instead, measuring a user's metabolism by using the value obtained by smartwatch sensors is considered much more reliable.

This research aims to improve people's health condition by encouraging daily fitness activity. To accomplish this aim, we developed a smartwatch fitness application that consists of a motivational enhancement feature and target calculation feature to provide motivation for exercising to everyone and eventually make exercise a daily habit for them.

## 2 Related Work

A work that is relevant to our research is regarding development of fitness tracker called FitSight. The smartwatch application encourages children to increase time spent outdoors. Currently, myopia is considered serious health problem among youth in worldwide. One of the biggest reasons is due to major environmental influences for instance child spending too much time on reading texts or excessive use of mobile phones.

Developed application uses light sensor mounted in smartwatch that records light illuminance levels, and it calculates the time spent outdoors when the light illuminance level is above a predefined threshold[1]. Then, feedback on time spent in outdoors sent to parents via bluetooth communication. Due to researches done, children needs to be in outside especially in green spaces for ideally at least three hours in a day. As a result, the FitSight Fitness Tracker application has been developed to reduce the incidence of myopia, and majority of children wore it throughout school days and holidays indicating the acceptance of user friendly software and hardware.

## 3 Methods

Our application is based on two models: one is Karvonen Formula to identify if the user performed an enough exercise or not, and other is Fogg's Behavior Model to motivate people to exercise.

### 3.1 Karvonen Formula

Karvonen Formula is a mathematical formula that helps determine target heart rate zone. It will be implemented to provide objective in any sort of exercise. Formula consists of user's age, resting heart rate, and exercise intensity to output target heart rate.

$$\textit{Target heart rate} = (220 - \textit{Age} - \textit{RHR}) \times \textit{Exercise Intensity} + \textit{Resting heart rate}$$

According to American College of Sports, Table 1 is the list of intensity level and perceived exertion that is used among American hospital. In our fitness application, a value between two numbers which is mean value is chosen to calculate target heart rate.

Table 1: Exercise intensity scale

| *Intensity level (%)* | **Mean Value (%)** | **Exertion** |
|---|---|---|
| *20 to 30* | *25* | Easy |
| *30 to 40* | *35* | Moderate |
| *40 to 50* | *45* | Hard |
| *50 to 60* | *55* | Very Hard |

The method to evaluate user's workout quality is by using calculated target heart rate and average heart rate. At first, user's average heart rate is required to compare with target heart rate. If average heart rate exceeds the target value, user has done the effective exercise. On the other hand, if target heart rate is higher than the average heart rate, exercise was not effective enough.

### 3.2 Fogg's Behavior Model

Fogg's behavior model asserts that for people to perform a target behavior, they must have sufficient motivation, sufficient ability, and an effective trigger[2]. These factors must be simultaneously present, otherwise behavior would not happen.

Figure 1 shows the visualization of MAT model. It explains how the relationship of three factors work together to perform behavior and decision making. If motivation is high enough but the ability is low, the trigger will only be effective if the complexity and difficulty of the system are reduced to support users. If the ability is high but motivation is low, system needs to provide some form of incentive to improve motivation to make the trigger effective[3].

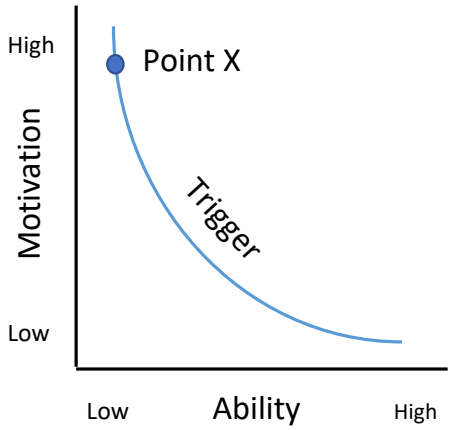


Figure 1: Visualization of MAT model

Our application displays a quote when user finishes the workout. We believe that most people become happy when they receive positive motivational quotes. It is because the positive quote is constructed by inspirational words that awaken happiness and many other positive feelings. However, our application requires two different patterns for a motivational quote. One is praising the user for outperforming the target heart rate and the other is comforting the user for underperforming it. Here is the example.

**Outperformed:** Well done, You are Stronger than You Think
**Underperformed:** Do not stop until you are Proud, Almost there to be Proud

### 3.3 Implementation

As shown in Figure 2, this diagram illustrates the process of users going through our fitness application. The processing flow begins with a menu screen with "Start Exercise" and "Setting" button. By pressing "Setting" button, it leads to the screen that asks their age, resting heart rate, exercise intensity, then the calculated target heart rate will be shown. When all the values needed for Karvonen formula are collected, exercise finally begins by selecting workout activity type. When the workout begins, users can swipe right to access the pause, resume, and exit button, so that they can take a water break at any time. Finally, when the user presses the exit button, a summary screen including a praising and comforting quote with emoji, total duration, average heart rate, and target heart rate will be shown. If the user is ambitious enough to go for the second lap of exercise, pressing a done button will automatically lead back to the screen where the user has to select activity type.

## 4 Evaluation

An experiment is conducted to collect feedback regarding implemented features, and results obtained suggest that the novel features may enhance user's motivation on exercising. Feedback about the application was obtained


Figure 2: Application Flow Diagram

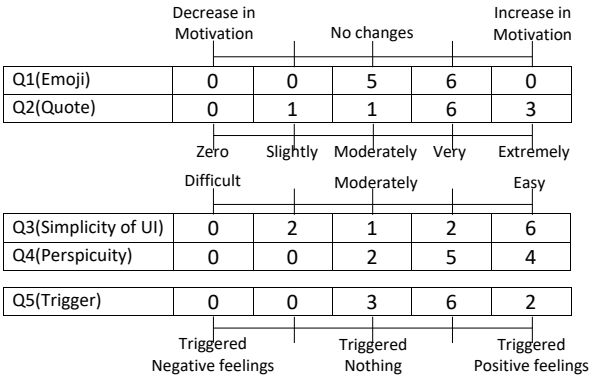


Figure 3: Collected Feedback

from 11 participants using a five-level rating scale. Figure 3 shows that 68.5% of participants were satisfied with the motivational enhancement feature, 70.6% answered it was fairly easy to use, and lastly 66.7% were triggered to conduct another lap of exercise.

## 5 Conclusion

In this paper, we proposed to develop application with simple user interface and provide productive reasons for engaging in workouts to the user, considering motivation, ability and prompts based on Fogg's Behavior Model. The experiment result showed that feedback on usability, motivational enhancement feature indicated the acceptance of user friendly interface and hardware. In conclusion, the smartwatch fitness application with its novel features of Karvonen calculation and Fogg's behavior model may motivates people to exercise more.

## References

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