Zanshin: Altering Our Alertness And Relaxation

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ABSTRACT
In this paper, we explore how to alter human emotion with a haptic feedback giving device. We present our first insight in how a false heart rate feedback on neck with a frequency of 120 bpm influences human alertness. Although the result of an experiment with 10 participants does not show a positive influence, we discuss our implications and findings toward this type of alteration design for emotion.

Author Keywords
Alertness Improving; Emotion; Heart Rate; Haptics; False Feedback.

INTRODUCTION
Emotions play an important role in our daily lives. They can effect what we would like to do while we do not even notice it.

Relaxed Alertness
Relaxed Alertness is a kind of emotions which usually we are not able to clearly feel. However, it is an important concept both in Japanese martial art and learning. The term "Zanshin" [3], in Japanese, can represent the concept of relaxed alertness. It describes the state in which martial artists are able to be calm but also have high alertness to notice their surroundings. Moreover, in the few decades, researchers have been claiming that relaxed alertness is an important emotional state for learning [4] [10].

Situation of Relaxed Alertness Requirement
Educators and martial artists concern about relaxed alertness, however, we also assume that a state of relaxed alertness would be beneficial in our daily life situations. For instance, in a party, people try to be more active and do more contact with others. It means that they need relaxed alertness to do conversation in a way with high sense of alert but also calm. In another situation, when people feel lazy, relaxed alertness would be able to make people to be more active to finish things they want to do.

RELATED WORKS
This work relates to research discussing haptic heartbeats interaction systems and emotion regulation through haptic heart rate feedback.

Real-time Haptic Heartbeats Interaction System
In *"Heartbeat Picnic": Workshop for Touching Heartbeats* [11], a system is designed to enable users to hear and feel both their own and others' heartbeats through haptics. The main purpose of this workshop is to provide a sensation of heartbeats between two people, and furthermore, it is able to make users be aware of living itself. With a vibration speaker, real-time heartbeats taken from one person become a haptic feedback to the other.

Another paper discussing this type of interaction system is *SMASH: Synchronization Media of Athletes and Spectator through Haptic* [7]. It is a system which provides real-time haptic heartbeats feedback from athletes to spectators. By feeling a sensation of heartbeats in hands, spectators are able to feel the athletes closer while watching sports games. In this system, *TECHTILE toolkit* [8] is used as the main technique to present the feedback. Similar to *Heartbeat Picinic*, *TECHTILE toolkit* is a vibration speaker based haptic device.

Emotion Regulation Through Haptic Heart Rate Feedback
The closest work to *Zanshin* is *EmotionCheck: Leveraging Bodily Signals and False Feedback to Regulate our Emotions* [5]. Psychological studies have indicated that a fast heart rate can intensify peoples feelings and a slow heart rate can make people feel calm [9] [6]. Therefore, in *EmotionCheck*, a watch shaped vibration giving device is designed to present a false heart rate feedback with a frequency of 60 bpm. In the experimental setup, participants were separated into 4 groups with different conditions:

- In **Control Group Condition**, participants wore *EmotionCheck* device without any vibration given.
- In **Vibration Condition**, participants felt the false heart rate feedback at a frequency of 60 bpm. They were only informed that they would feel vibrations from the device.
- In **Slow Heart Rate Condition**, participants also felt the false heart rate feedback at a frequency of 60 bpm but were informed that the feedback represented their real heart rate.
- In **Real Heart Rate Condition**, participants were informed that the feedback represented their real heart rate

and it was indeed changing according to participants' real heart rate.

The result of this experiment says that when participants took the 60 bpm vibration as their real heart rate, they had less anxiety. It means that this false heart rate feedback indeed changed participants' emotion.

IMPLEMENTATION

The hardware design of *Zanshin* device is a choker with a flat vibration motor. Figure2 shows the hardware. We use a haptic module and Arduino programming environment to complete this prototype.

Placement of Feedback

The vibration motor is implanted in the center of a choker. As the vibration motor placement is close to the place where we can usually feel our pulse, we assume that this placement is able to make the feedback feel more like our own pulses, and therefore, it can make people think that it is their real heart rate.

Haptic Module

We use *Adafruit DRV2605 Haptic Controller Breakout* [1] to create click effect on a vibration motor. It provides 123 kinds of different haptic effects (See examples in Figure1). In *Zanshin* device, we select effect1, which provides a strong click, and set the click frequency to 120 bpm.

EFFECT ID NO.	WAVEFORM NAME
1	Strong Click - 100%
2	Strong Click - 60%
3	Strong Click - 30%
4	Sharp Click - 100%
5	Sharp Click - 60%
6	Sharp Click - 30%
7	Soft Bump - 100%
8	Soft Bump - 60%
9	Soft Bump - 30%
10	Double Click - 100%
11	Double Click - 60%
12	Triple Click - 100%
13	Soft Fuzz - 60%
14	Strong Buzz - 100%
15	750 ms Alert 100%

Figure 1. Haptic Module Effect Example

METHOD

In order to test the effectiveness of the *Zanshin* device, we conducted a experiment with a between-groups design. We have 10 participants (4 males, 6 females), between 21 and 28 years old from Keio Media Design.

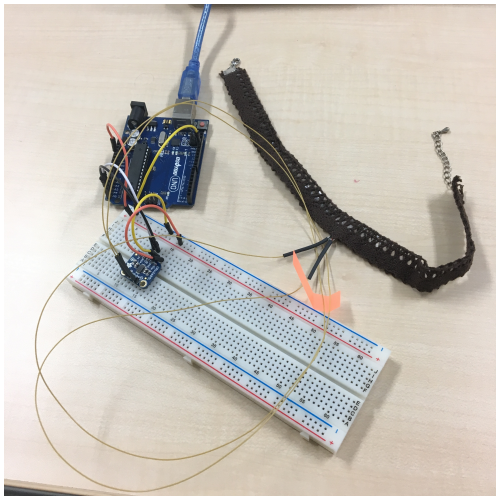

Figure 2. The Zanshin Device

Experimental Setup

In this experimental setup, we use *Reaction Time Test* [2] evaluate participants' alertness. And we hypothesized that "With the false heart rate feedback, people will have shorter reaction time."

Figure 3. Example for Experimental Setup

Participants were divided into 2 groups: **Control Group** and **Vibration Group**. In every trial, first, participants would be instructed to do one set of reaction time test. After we got the reaction time in the participants' usual condition, they would be asked to wear the *Zanshin* device, and then moved to the next step. From the second step, participants in **Vibration Group** would feel the false heart rate feedback until they finished the full trial; however, participants in **Control Group** would not feel any vibration. In the second step, participants were informed to watch a 3-minute video and try to relax. After watching the video, participants would do one set of reaction time test again, and thus, we would have a new reaction time to compare with the one under usual condition. In the end of the trials for Control Group, we also let participants

try the vibration and have comments from them.

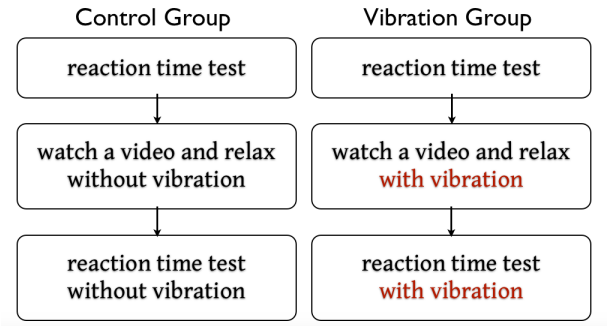

Figure 4. Steps in A Trial

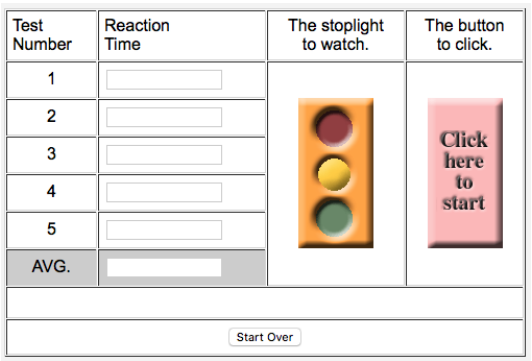

Figure 5. Reaction Time Test

Result

We easily compared the reaction time before and after participants watching the video. As it shows in Table1, 4 participants in control group have shorter reaction time after watching video; however, only 1 participant in vibration group has it.

Although there are no significant differences between the reaction time before and after watching video, we still have the result that control group have shorter reaction time. It means this result did not support our hypothesis.

Table 1. Result of Control Group

Control	P1	P2	P3	P4	P5
Before	0.2982	0.3376	0.2813	0.2721	0.3075
After	0.2776	0.332	0.32445	0.2677	0.3001
Vibration	P6	P7	P8	P9	P10
Before	0.2711	0.301	0.28205	0.3077	0.26165
After	0.2859	0.3344	0.2941	0.29975	0.31045

DISCUSSION

We did not see a positive result in this experiment, however, we received some practical comments from our participants.

Feelings Toward the Vibration

Many participants have the same feeling that the vibration given by the *Zanshin* device feels like their own pulses. And this comment supported our assumption that "as the placement is close to where we usually feel the pulse, it would be able to make the feedback feel more like our own pulses."

However, most of the participants also claimed that the vibration made them feel uncomfortable and distracted. One participant remarked:
"The vibration on my neck made me feel uneasy so I could not concentrate on the task." - P8

And we have another impressive comment remarked by P7. She declared that *"I can clearly know that the vibration is not my real pulse because it is too fast. I can notice my heart rate is not as fast as the false feedback."*

Different Placement

Several participants gave us some feedback about the placement. Since the vibration motor is implanted in the center of a choker, it makes participants feel uncomfortable on their throats. Some participants suggest it would be better if the vibration motor could be on the left or right side of throat. Furthermore, 3 participants remarked that they usually felt uncomfortable with everything surrounding their necks. One of them also said:
"It would be okay if it was only a necklace. But it is a choker so it makes me feel uncomfortable during the task." - P7

Besides neck, some participants indicated that it might be less distracting if the vibration is on wrists or fingers. Because these parts of body are the places we usually receive external haptic information, it might be more acceptable for people.

CONCLUSION AND FUTURE WORK

In this paper, we presented a choker designed false heart rate feedback giver which was assumed to be able to alter people's alertness. However, result of the experiment showed that it might not be a proper design to increase the sense of alert. The result makes us rethink about the design:

- Vibration in the frequency of 120 bpm might be too fast for an adult's general heart rate. It makes the feedback become only a external vibration but not like a heart rate.
- Vibration motor in the center of the choker makes people feel uncomfortable because it presses the throat. We should suggest another placement which people can take the vibration as a heart rate feedback and also it doesn't feel uneasy and distracting.

Additionally, in a future work, we would like to design a longer experimental setup. We suggest that the intensity of human emotions increase gradually, therefore, if we have a longer experimental setup, perhaps it would show a different result.

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