Content Evaluation of Exciting Feeling by Using Biosignals

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ABSTRACT

Entertainment markets continue to expand, and Interactive systems are becoming more and more common, fueled by the dramatic progress in the fields of computer graphics and hardware (Tetsuro Aoto, 2007). In the content of such interactive systems, important factors include increasing excitement. Thus, we use young adult males in their twenties and assess their opinions of *"exciting"* by questionnaires and employed it as a keyword to clarify their exciting scene. Based on our questionnaire results, we created two game contents and evaluated whether they elicited exciting feeling using biological signals.

Keywords: Effective engineering, Biological signal, Exciting feeling

INTRODUCTION

Entertainment markets continue to expand, and interactive systems are becoming more and more common, fueled by the dramatic progress in the fields of computer graphics and hardware (Tetsuro Aoto, 2007). In the content of such interactive systems, increasing excitement is critical. Previous research measured excitement or mental workload by biological signals (Michiko Ohkura, 2011, Nobumichi Takahashi, 2013). Thus, we assess a game content's excitement by biological signals on young people in their twenties to whom we gave questionnaires in which "exciting" was employed as a keyword to clarify their exciting scene. Based on questionnaire results, we created two game contents and evaluated whether they elicited exciting feeling using biological signals.

EXPERIMENTAL

Experimental System

The outline of our experimental systems is shown in Fig 1. They consist of the following components:

- PC that shows exciting contents
- Speakers
- Sensors (or electrodes) and instruments to measure EEG, ECG, SPA, and Eye tracking
- PCs that control measurements of these biological signals

To measure SPA (Galvanic Skin Potential), the surface of the finger's palm is commonly used. However, since palms are involved in PC operation, we instead employed the bottom of the foot.

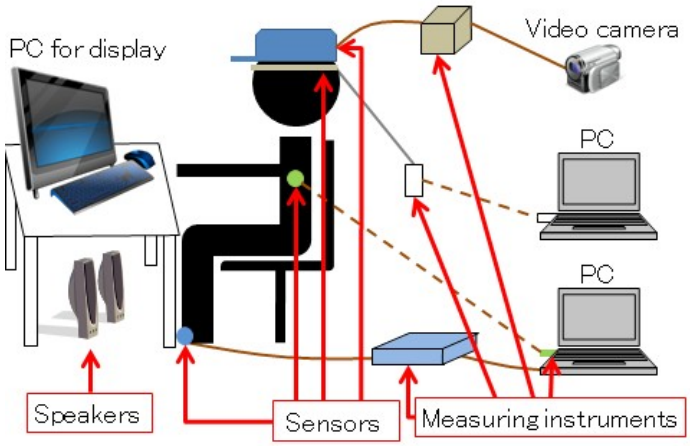

Fig. 1 Outline of experimental system

Game content

We created the following two "exciting contents":

I. Music server: exciting content

Participants select the most exciting song from a song database on the PC and listens it.

II. Treasure box: exciting content

Participants choose one of three treasure boxes and gets points when he finds treasure. He repeats this selection ten times to get more points. The six games that provide treasure are determined beforehand. Participants play six games.

Experimental procedures

We conducted the following experiments of the two game contents:

Music server experiment

(i). The experimenter explains the content.
(ii). Participants select the most exciting song.
(iii). They listen to it.
(iv). They answer questionnaires.

Treasure box experiment

(i). The experimenter explains the content's task.
(ii). Participants play one game.
(iii). They answer questionnaires.
(iv). Procedures (ii) and (iii) were repeated five more times.

We constantly measured the following four biological signals during the experiments:

- EEG
- ECG
- SPA
- Eye-tracking

Questionnaire and biological indexes

We employed question items of paired 7-point evaluations. The following are the question items:

- Exciting
- Thrilling
- Interesting
- Nostalgic
- Expecting

The biological indexes for our analysis are shown in Table 2. These indexes were candidates for exciting feelings and mental workload (Shinji Kajiwara, 2010 and). RRI means the interval between the R-waves of ECGs, and SPR means the change of the skin's resistance by sweating.

Table 2 Biological indexes for analysis

Biological Signals	Biological Indexes
EEG	Alpha ratio average
	Beta ratio average
	Beta/alpha average
ECG	RRI average
SPA	SPR average
Eye-tracking	Pupil diameter average

EXPERIMENT RESULTS

We performed experiments with eight male students in their twenties. We divided each biological signal time sequence into sections on which we set each content and analyzed it. The missing values of the pupil diameters were excluded due to the blinking of every participant. We calculated and standardized the biological indexes for each content for each participant's section. We used the rest states of the biological indexes for each content's section for standardization.

Music server
Questionnaires

The average of each question for all participants is shown in Fig. 2. We performed t-tests to determine whether the averages exceed 0. The following significant differences were found:

During selection: exciting, interesting, nostalgic > 0 ($p<0.01$)

During listening: exciting, interesting, nostalgic > 0 ($p<0.01$)

From this result, participants might be excited at the content.

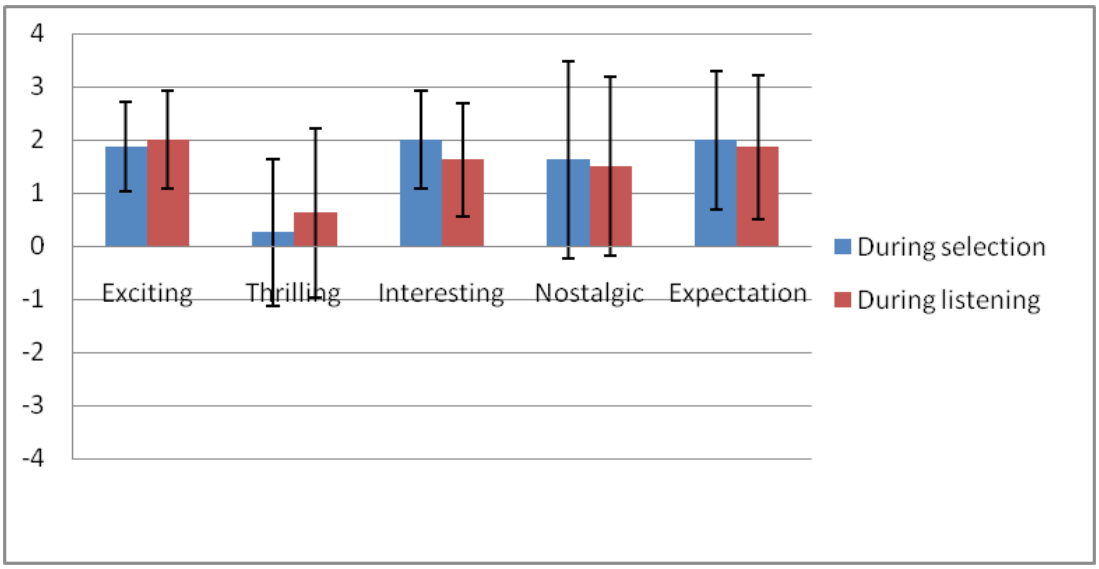

Fig. 2 Average of each question of all participants

Biological signals

Biological signals are divided into the sections as following:

- Rest state section
- During selection section
- During listening section

Figure 3 shows the RRI averages of all participants. We performed an analysis of variance between each section and found that the section's main effect was effective at a 1% level. The following are the multiple comparison results:

During selection, listening < rest state ($p<0.01$).

From this result, participants might be more excited during both the selection and listening to the song than the rest state; this agrees with the questionnaire result.

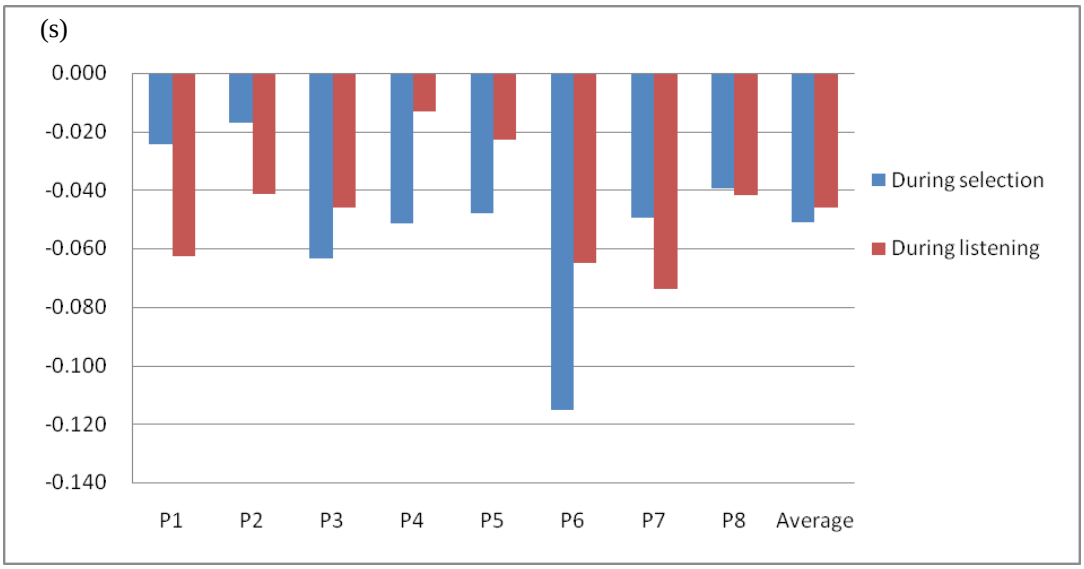

Fig. 3 RRI averages of all participants

Treasure box
Questionnaires

The questionnaire results suggest that P6 and P7 might not be excited. Therefore, these two participants were excluded from our analysis. The averages of each question of the remaining participants are shown in Fig. 4.

We performed an analysis of variance among the games. The main effects of the sections were effective at the 1% level. The following are the multiple comparison results:

5th game > 6th game ($p<0.01$).

The choices of the 5th game's patterns are all correct, and thus the participants might feel greater expectation to continue choosing the right choice.

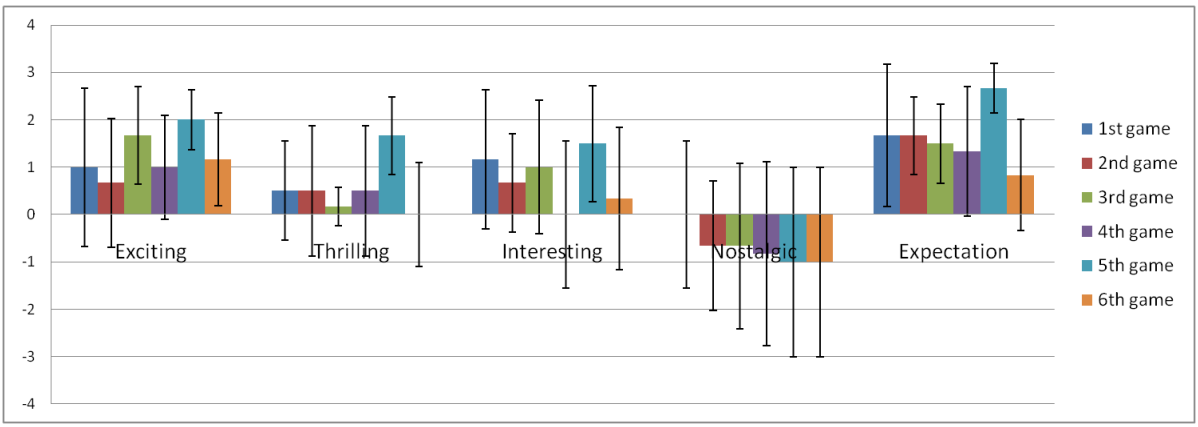

Fig. 4 Averages of each question of six participants

Biological signals

The biological signals were divided into the following seven sections:

- Rest state section
- All six individual game sections

Figure 5 shows the SPR averages of six participants. We performed an analysis of variance between each section. The main effects of the sections were effective at the 1% level. The following are the multiple comparison results:

1st game < 5th game ($p<0.01$).

The game that shows a difference is not the same as the questionnaire results. However, since the 5th game shows a high value on both sides, the participants might feel excited due to their expectations.

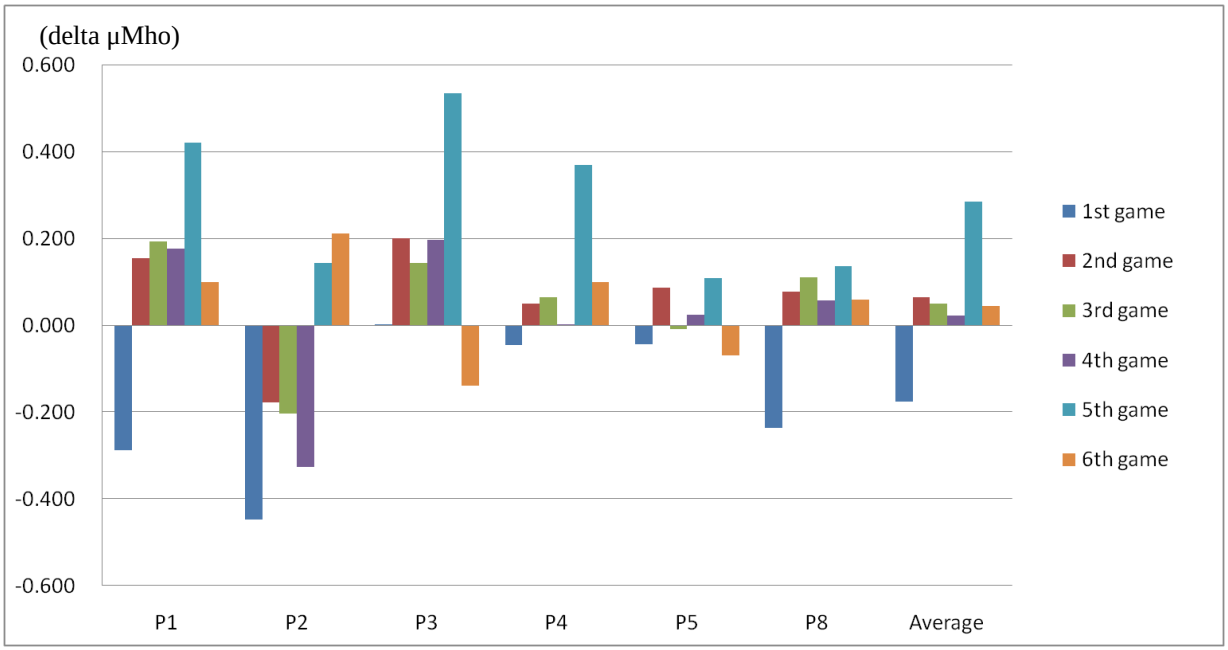

Fig. 5 SPR averages of six participants

DISCUSSION

We confirmed that the RRI and SPR averages are indexes of exciting feelings. However, since the tendencies of the RRI and SPR averages were different, their averages might show different exciting feelings.

CONCLUSIONS

We experimentally obtained the following conclusions.

- The RRI average might be an index of exciting feelings.
- The SPR average might be an index of exciting feelings.
- Perhaps the RRI and SPR averages reflect different exciting feelings.

Future work will distinguish among kinds of exciting feelings by biological indexes.

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