PSYCHO-PHYSIOLOGICAL REACTIONS IN CHILDREN USING COMPUTER GAMES

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Nowadays, computer games account for a large proportion of the playtime activity undertaken by children. If children play these games in inappropriate environments, mental and physical problems might results from the resulting visual stimulation. Experimental parameters were measured in two children at beginning and end of game sessions. Measurement items comprised critical flicker fusion frequency (CFF), blood pressure, visual acuity, subjective physical symptoms, degree of exhaustion, heart rate, and analysis of movement using video tape recorder. Blood pressure and CFF demonstrated small changes between the beginning and end of the experiment. However, the other measurement items displayed differences depending on the frequency of playing computer games and on experiences during the games. Mental stress was observed if computer games were played for more than one hour or if player did not possess the requisite skills to play successfully.

INTRODUCTION

In 1997, an incident involving the Japanese television cartoon Pokemon achieved worldwide notoriety. As a result of an animation technique involving 4 seconds presentation of “PakaPaka” with red and blue strobe light, 685 children required ambulance treatment and 208 children were taken to hospital.

As a result of this incident, The National Association of Commercial Broadcasters in Japan (NAB) and the Japan Broadcasting Corporation (NHK) developed[1)] guidelines relating to special picture techniques which are used in animation and other types of programs, and which may affect the health of viewers, particularly children.

Naturally, it is of great concern that a program intended for children’s enjoyment should have caused harm to some viewers. In order to restore, as quickly as possible, the relationship of trust between the television medium and the public, which has been built up over many years, it is imperative that the industry accepts responsibility and makes every effort to prevent a repetition.

Such events create problems for the whole broadcasting industry. In association with experts in medicine and psychology, they have conducted detailed investigations into the cause of the problem with a view to establishing concrete rules for preventing a recurrence.

Television is, by its very nature, a flickering medium, so that it is impossible to eliminate entirely all risk of flicker effects on viewers, particularly children. However, it was discovered that particular parameters for picture techniques which involve fast-flickering or rapidly-changing images are to be avoided, and risks may thereby be reduced to a considerable degree.

Great care must be taken in the use of the following:

1. Flashing or flickering lights or images, particularly those involving the use of deep red color;

2. Brightness inversion of high-contrast images, or fast scene changes; and

3. Geometric repetitive patterns.

In the light of these factors, we have resolved both to promote common guidelines for the broadcasting industry, and to urge broadcasters to set up their own internal regulations for their daily application.

It is important that all those involved in broadcasting fully understand the reasons for the compilation of the guidelines, given below, and adhere to these voluntary common rules for the broadcasting industry. The guidelines will be revised as necessary in the light of new scientific evidence or research results.

1. As a general rule, the use of lights or images that flash or flicker more than 3 times per second should be avoided. In particular:

(1) Great caution should be exercised over the use of deep red color;

(2) Where the use of flicker at rates higher than 3 Hz is absolutely necessary, a rate of up to 5 Hz may be used, but

only provided that the change in image brightness is less than 20% and duration at the high rate does not exceed 2 seconds.

2. Brightness inversions of high-contrast images, or scene changes in which the image brightness changes by more than 20%, should as a general rule be limited to the rate of 3 Hz.

3. Geometric repetitive patterns (stripes, spirals, concentric circles, etc.) which occupy a large proportion of the screen should be avoided.

Education in "the appropriate way to watch TV" also has an important role to play in protecting viewers from adverse effects: protective measures include viewing TV in a well-lit room from a distance of at least 2 meters. The NAB and NHK will cooperate henceforth in their efforts to provide viewers with accurate information about "the appropriate way to watch TV".

The Committee on Public Education of the American Academy of Pediatrics[2] recognizes that exposure to mass media (i.e. television, movies, video and computer games, the Internet, music lyrics and videos, newspapers, magazines, books, advertising, etc.) presents both health risks and benefits for children and adolescents. Media education has the potential to reduce harmful effects. By understanding and supporting media education, pediatricians can play an important role in reducing the risks of exposure to mass media for children and adolescents.

For the elementary school, guidelines provided by the Computer Ergonomics for Elementary School Students (CergoS) Web site[3] demonstrate simple and affordable ways to ensure physical safety and comfort while using a computer. All material at this Web site is free to all and can be reproduced.

Computer games now account for a large proportion of the playtime activity of children. If children play these games under unsuitable environmental conditions, mental and physical problems may result from the visual stimulation they provide.

The incident described above prompted the present research into some of the possible physical and psychological effects of computer games on children, and the role of the physical parameters of their computer usage. Ethical and practical difficulties are inherent in performing research and tests on children, and the data of this study is limited to the responses to questionnaires completed by parents.

QUESTIONNAIRE SURVEY

The questionnaire was distributed at 6 kindergartens and 4 elementary schools (1st to 3rd year children). A total of 1401 parents provided responses for 745 boys and 656 girls, with an average age of 6.4 years.

The questionnaire consisted of 18 questions relating to the children and their use of computer games, including :

age
gender
eyesight
conditions under which the games are played
posture adopted while playing
level of concentration while playing
hours spent playing one session and one day
any symptoms exhibited after long sessions of play
kind and content of games
advice given to child not to play computer games so often

The following conclusions were reached from the responses to the questionnaires of this study

1) A positive correlation was observed between age of child and hours spent playing computer games.

2) A positive correlation was observed between age and eyesight problems (i.e., the older the child, the more they play computer games, and the worse their eyesight).

3) A positive correlation was observed between size of and distance from monitor, and a negative one between both these factors and playing hours. (i.e. if the monitor was bigger, children sat further back and played games for shorter durations).

Children enjoyed playing fighting and action games, but tended to display physical symptoms if these games were played frequently, but no statistically significant association was observed. Some subjective impressions of parents were that children’s eyesight had deteriorated, that they had developed poor posture through watching the display from a side angle, and that game playing was followed by nightmares.

It is suggested that, to combat these problems, parents should limit playing time for their children, insisting that they take rest periods from the computer.

METHODS

Based on the questionnaire results, a experiment of two children was performed in their home.

Physiological and experimental parameters were

measured in two 9 year old children, a boy and a girl at the beginning and end of game sessions and their visual acuity were good (1.5).

Measurement items comprised critical flicker fusion frequency, blood pressure, visual acuity, subjective symptoms on fatigue feeling, degree of physical exhaustion, heart rate, surface face temperature by thermal video system, and analysis of behavior and eye blinking numbers using a video tape recorder.

Playing software for experiment were most high frequency on questionnaire results. Subject A is not skillful (playing one or two times per month), and Subject B is skillful (playing 2-3 hour every day) on computer games Experiment performed in subjects home that as usual environment for playing game. Playing hours set up two session that first session is 30minutes, then measurement short brake, after brake, second session is 30minutes.

RESULTS

Subjective symptoms on fatigue feeling are increasing on Subject A during playing game, but Subject B is decreasing. Therefore, Category I (general fatigue symptom) were remarkably appealed on both subject, especially “Feel tired” and “Become drowsy”

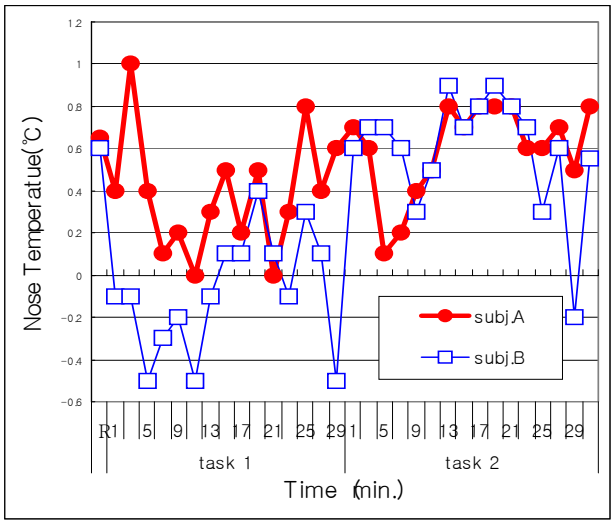

Fig.1 Variation of Surface Nose Temperature

Figure 1 shows the variation of surface nose temperature. Surface nose temperatures decreased after starting play, and then up and down on task first session. Task second session increased compare to task first session. This situation means subjects were concentration to games by long hours playing games.

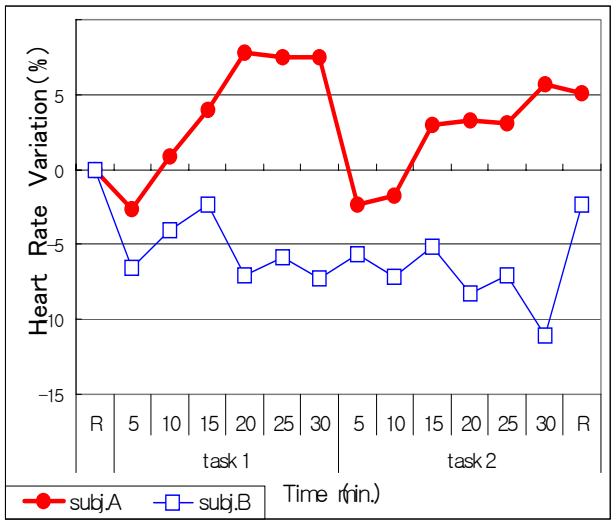

Fig.2 Variation Rate of Heart Rate

Figure 2 shows the variation rate of heart rate. Subject A were increased heart rate during playing game. This was conjecture she is not skilful to game. Skilled gamer subject B slightly decreased during playing game.

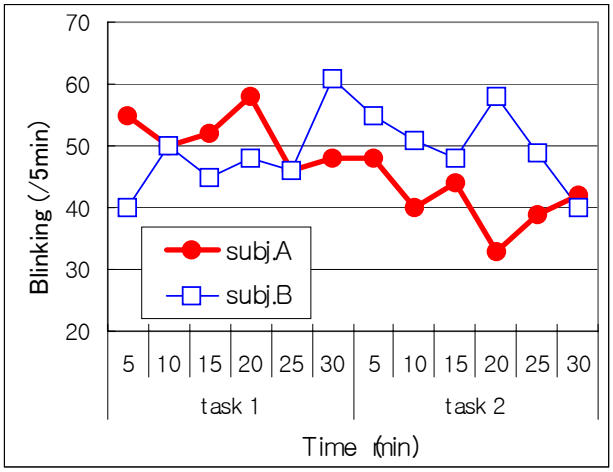

Fig.3 Eye Blinking Numbers

Eye blinking numbers counted from videotape each five minutes after starting games. Both subjects were increased by the scene change. (Figure 3) During playing game Subject A decreased eye blinking numbers.

CONCLUSIONS

Blood pressure and flicker value demonstrated small changes between the beginning and end of the experiment. However, the other measurement items displayed differences depending on the frequency of playing computer games and

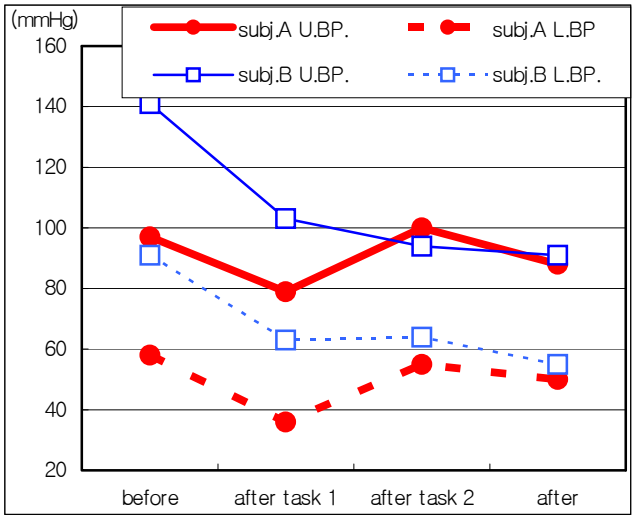

Fig.4 Variation of Blood Pressure

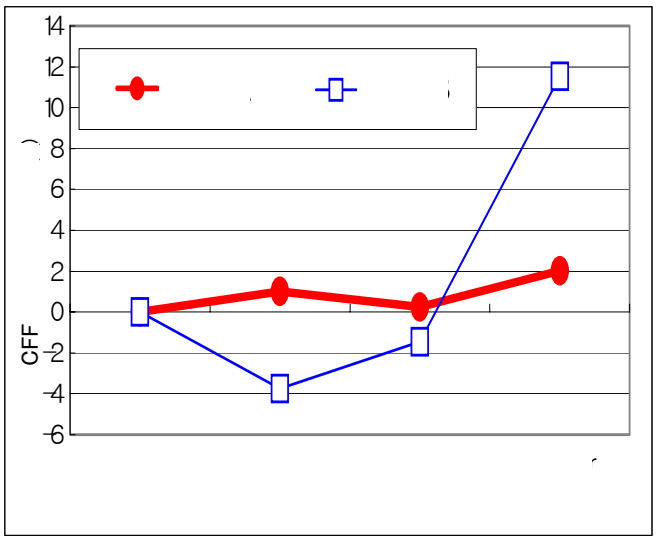

Fig.5 CFF Variation Rate

on experiences during the games. Mental stress was observed if computer games were played for more than one hour or if the player did not possess the requisite skills to play successfully.

Computer games are currently utilized in both education and child care, and the relationship between computer games and children is matter of substantial importance. Appropriate hardware and software can be expected to be utilized more effectively under good environmental conditions in ways that prove beneficial or at least not detrimental to children.

REFERENCES

1. The National Association of Commercial Broadcasters in Japan (NAB) and the Japan Broadcasting Corporation (NHK), Guidelines for Picture Techniques Used in Broadcast Programs ~ Especially in Animation Programs, http://www.nab.or.jp/htm/english/eANIMEguidelines.html. (1998)
2. Committee on Public Education, The American Academy of Pediatrics, Policy Statement, Vol.104, No.2, Media Education (RE9911), http://www.aap.org/policy/re9911.html. (1999)
3. http://www.orosha.org/cergos/index.html
4. Alan Hedge, Marisol Barrero and Lorraine Maxwell, Ergonomic Issues for Classroom Computing, Proc. of the IEA 2000/HFES 2000 Congress, 6-296-6-299, 2000
5. Berns.T, Klusell.L, Computer Workplaces for Primary School Children - What about Ergonomics?, Proc. of the IEA 2000/HFES 2000 Congress, 5-415-5-418,2000