

Impact of Intermittent Stretching Exercise Animation on Prolonged-Sitting Computer Users' Attention and Work Performance

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Abstract. The prevailing use of computers and the Internet has contributed to popular symptoms of visual impairment, musculoskeletal injuries, and even emotional disorders nowadays. While certain ergonomics software packages have thus been designed to avoid or relieve the symptoms, some studies raised concern about possible decline in attention and work performance. This study aimed to explore the effects of the computer stretch/massage software on extended computer users' attention and work performance. The Neuroscience brainwave monitor was used to evaluate the participants' attention. Thirty college students who work more than 4 h a day in front of computer were recruited and evenly distributed to two groups. The participants in the experimental group were asked to perform the task on computer for 30 min with a stretch program on, which was set to pop-up every 10 min for about 30 s each. The control group took no breaks or interventions. The results show that the computer break software did not decrease the participants' attention scores. Meanwhile the experimental group demonstrated higher work performance scores. It is suggested that during prolonged sitting computer work, breaks and body movements are necessary for better attention and work performance.

Keywords: Stretching exercise animation · Brainwave · Attention score · Work performance

1 Introduction

Computer and Internet use is becoming increasingly commonplace at home, in school, and at work nowadays. The benefits of increased convenience, connectivity, and flexibility that the computer and Internet has brought to us are tremendous. However, these new technologies also add more stress and new demands to our lives. A population-based prevalence study showed that on average children and adults in the US spent 54.9 % of their waking time, or 7 h 42 min per day, in sedentary behaviors, or leading a sedentary lifestyle (Matthews et al., 2008). It has been shown that extended computer use may contribute to symptoms of visual impairment (commonly dry eyes),

musculoskeletal injuries (e.g., neck, shoulder, and low back pain), skin problems, and even emotional disorders (Hayes et al., 2007). Among the many possible causes of injuries, not taking regular breaks from computer work has been acknowledged as an important factor (Broughton, 2008).

In dealing with these computer-related health issues, more and more ergonomics software packages have been designed to prompt computer users to take a break and guide them toward regular exercise. Although the relevant programs showed positive effects on health behaviors and conditions (Marangoni, 2010; Van den Heuvel et al., 2003), Wang and Chern (2013) found that worries about decline in attention or work performance caused by the program's constant interruptions were also expressed by some of the research participants. Therefore, although most of the participants were aware of the benefits of the program toward their health and agreed on the necessity of the programs alike, they still hesitated to adopt the interventions.

For a long time, most researchers believe that attention is a limited resource and it will be used up overtime. Nevertheless, a recent study showed that brief interruptions could boost performance (Ariga and Lleras, 2011). Similar to building muscles, it is critical to rest and recover for the second round after sustained use. The problem is that most workers do not take enough breaks, especially breaks involving body movement (Trogakos, 2009). Research showed that 5-minute exercises improved children's performance on attention and reaction time (Hsieh, 2009). Massage therapy and yoga also showed positive effects on attention and mood improvement for students with Attention-deficit/hyperactivity disorder (ADHD) (Archer and Kostrzewa, 2012; Jensen and Kenny, 2004; Field, Quintino, Hernandez-Reif and Koslovsky, 1998).

In sum, research claimed that breaks with body movement would decrease visual and musculoskeletal discomfort for extended computer users, and the computer break/stretch programs also have similar effects on the computer symptoms. Research also found that brief distractions or breaks/exercises help improve attention and boosted work performance. However, the effect of the break/stretch programs alike on attention and work performance stays unknown. This study aimed to develop a user friendly computer program to deliver a series of 3D in-chair stretch and massage animation clips for prolonged sitting computer users, and to examine the program effect on people's attention and work performance.

2 Methods

This study recruited 30 college students aged 18–24 as research participants, who normally work more than 4 h a day in front of computer. The participants were asked to perform the task on computer for about 30 min with the designed stretch program on, which was set to pop-up every 10 min for 30–40 s each. The 30 participants were divided into two groups. The control group took no breaks or interventions throughout the task. The experimental group was told to follow the stretch animation movements. A pretest and post-test questionnaire was administered to elicit demographic information, symptom perception and mood state. The Neuroscience's brainwave monitor was used for the evaluation of the participants' attention. Figure 1 shows the experimentation process and a screenshot of work performance results.

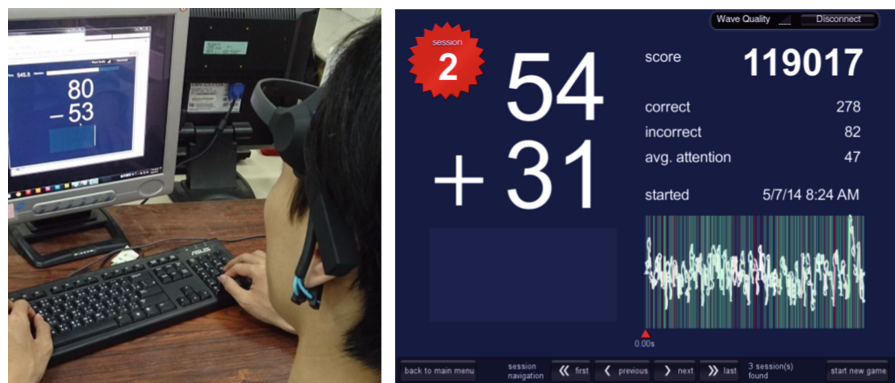


Fig. 1. Experimentation process (L) and a screenshot of work performance (R)

3 Results

The data were collected in three consecutive sessions. Overall, the difference in the attention scores (Fig. 2) between the control group (42.69 ± 2.70) and the experimental group (47.22 ± 4.03) reached statistical significance ($p < 0.005$). The result indicates that the computer break system for delivering the stretch program exerted a significant impact on the participants' attention.

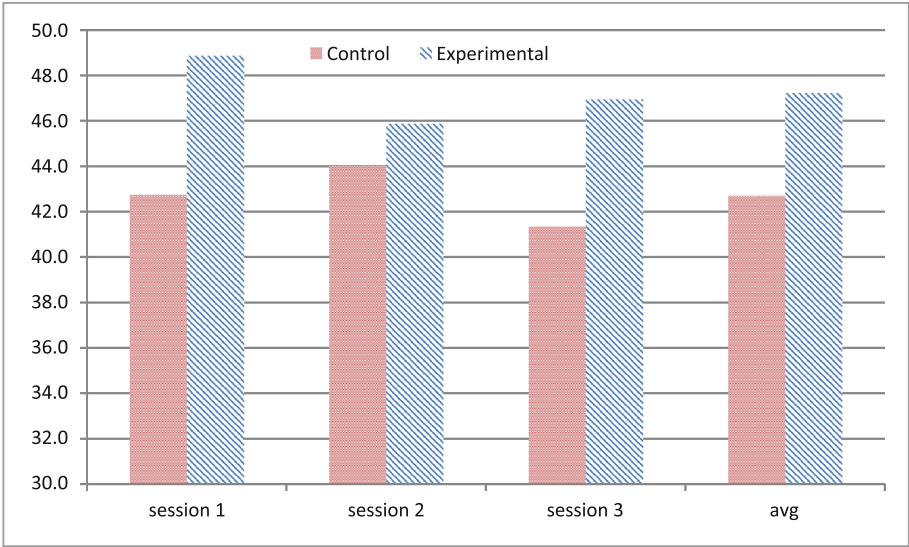


Fig. 2. Attention scores for three sessions and the means

Figure 3 shows the work performance scores for the control group and the experimental group respectively. The difference in means between the control group (76902 ± 23869.5) and the experimental group (99037 ± 36254.5) reached statistical

significance ($p = 0.029$), indicating that the implementation of the computer break system for delivering the stretch program exerted a meaningful impact on the participants' working performance.

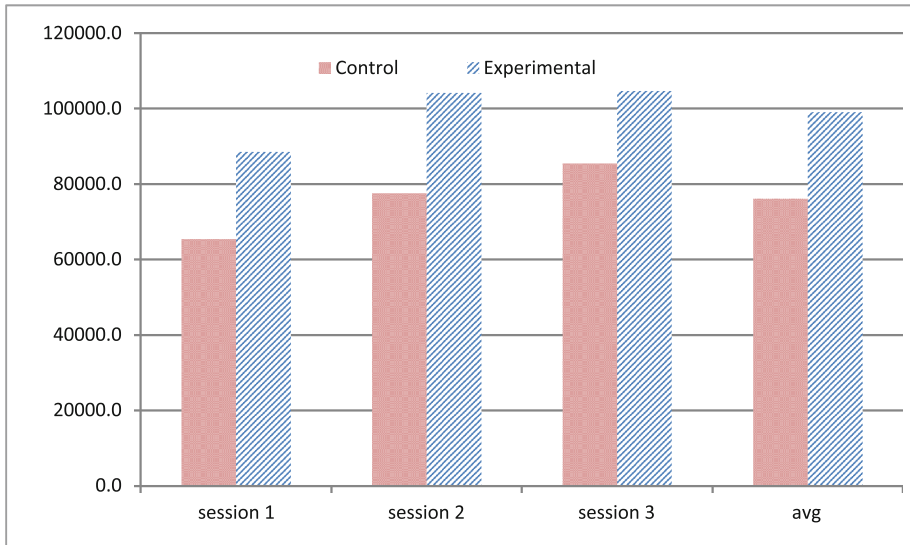


Fig. 3. Work performance scores for three sessions and the means

4 Conclusions and Suggestions

This study first called for attention on the negative effects of extended computer use and examined the potential benefits of computer break/stretch program. It is suggested that break and body movement are necessary during prolonged-sitting computer work. In brief, along with the increasingly severe problems associated with extended computer use, we need to figure out a way to balance the harm the computer has brought to us, particularly for this tech-savvy generation.

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