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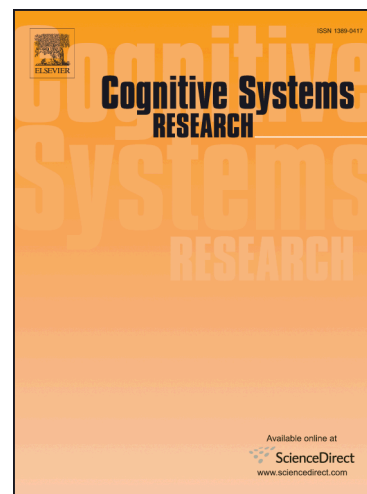
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# Evaluation of Cognitive Behavior among Deaf Subjects with Video Game as Intervention

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## Abstract:

Previous research on video gaming mainly focused on negative impact on users. In this study, the positive impact of action video gaming among congenitally deaf subjects is investigated. Subjects possessed high level of visual information processing capacity. A 96 hours of action video game play resulted in the improvement of mean reaction time (mRT) (post=413.21ms, pre=453.39ms) and certain cognitive functions. Higher heart rate variability (HRV) subjects demonstrated faster and significant improvement in mRT ( $p < 0.0045$ ) after intervention. The  $\alpha$  and  $\beta$  EEG band powers were found increased in parietal (6.33%, 4.28%) and occipital (8.38%, 38%) lobes respectively. The  $\theta$  band power increased in frontal (32%) and parietal (13%) lobes. These results can reflect enhancement in certain cognitive performances such as visual perception, attention, memory, and motor skills. The ratio index  $\beta/(\alpha+\theta)$  increased in frontal and occipital lobes while  $\beta/\theta$  increased in frontal and temporal lobes. These results may also suggest improvements in attention processing capacity and neural activity. These results implies improvements in certain aspects of cognition among deaf subjects. However, to validate these results a further study on larger number of samples with advanced computerized cognitive battery testing can be employed.

*Key words: Video game, Cognitive enhancement, EEG, Heart rate variability (HRV), mean reaction time (mRTs), Stroop test, Draw-A-person test, Deaf subjects*

## 1. Introduction

Video games have become one of the favorite activities of children and adolescents'. Survey reveals that about more than 85% of video games contains violent content [1]. Playing time by children has increased from about 4 hours a week to more than 9 hours per week; and more than 97% of U.S teenagers' play video games 1hour per day. About 55.7% of boys and 29% of girls play on regular bases, while 40% of boys and 51% of girls play casually. It was reported that 6% of boys and 20% of girls never play video games. Boys (73%) and girls (59%) prefer to play violent games [2]. The literature review on video games [3] mainly focused on the studies involving aggression as an outcome and have not considered either violent outcomes or other mental health issues. The impact of playing violent video games on players, particularly on adolescents' mental well being is divided among research community [4]. Most of the research into the video games and aggressive behavior has focused mainly on violent video games, neglecting other characteristics of the games such as competitiveness and pace of action. Playing violent video games may have smaller relationships with aggressive behavior, reduced prosocial behavior, decreased academic performances and depression[4]. The results of the two pilot studies indicated that the aggressive behavior largely depends on the competitiveness than the violent content of the games [5, 6]. The findings of the study [7, 8] suggested that violent video game is not a substantial predictor of aggressive behavior and age plays an important role in the relationship of aggressive behavior and violent video games. The study with catalyst model [9] suggested that violent video game has little effect on aggressive behavior. In this study respecting both views, the impact of action video game among deaf subjects is analyzed interms of physiological parameters such as EEG and ECG.

Video game play is an active process and learning is better because of active involvement of the subjects. Playing action video games provide many benefits, such as fun, problem solving ability, logical thinking, strategizing, acquiring basic knowledge and spatial awareness. If used effectively, they can produce subtle changes in mental abilities and enhance certain cognitive abilities [10]. Playing action video games modifies the range of visual skills to improve selective attention [11]. They can also improve many cognitive abilities such as visual perception, attention, spatial cognition, processing speed, enhancement on higher level intelligence, problem solving skills, decision making, word and number recognition among others [12-14]. Recently there has

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