Detection of Short Term Effect of Violent Video Game: an fMRI Study using Emotional Face Matching Task

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Purpose:
Previous studies [1, 2, 3] have raised concerns about the effect of exposure to violent media (television, video games, movies) on brain functioning. Mathews et al. [1] found reduced fMRI activation in the anterior cingulate cortex (ACC) and prefrontal cortex (PFC) of adolescents with high levels of media violence exposure during the past year, compared to adolescents with low levels of media violence exposure. To determine the short term effect of video game playing on brain function, the BOLD responses to an emotional face matching task [4] were measured immediately after playing a violent or nonviolent video game.

Methods:
Fourteen healthy adolescents were included in this report. All subjects and their parents rated the subjects' violent media exposure (VME) in the past [2]. Subjects were randomly assigned to two experimental groups, seven per group. These two groups did not differ on gender, age and IQ. Immediately before the fMRI scan, one group played a violent video game (Medal of Honor) for half hour, while another group played a nonviolent video game (Need for Speed).
The paradigm [4] consisted of alternating 3 control and 2 emotion blocks, each for 30 seconds. In the control phase, subjects were required to match one of two geometric shapes with a simultaneously presented target shape. In the emotion phase, subjects were instructed to select one of two facial expressions (either angry or fear) that matched that of a simultaneously presented target facial expression. Emotional photos were derived from a standard set of pictures of facial effect (Ekman and Friesen, 1978). All stimuli were presented for a period of 5 sec. Subjects responded with button presses using their dominant hand during scanning.
FMRI data were acquired on a 3T MR scanner using 2D gradient echo EPI sequence with parameters: TR/TE=2000/30ms; thirty-three 3.5mm contiguous axial slices for 91 repetitions. Functional scan data were analyzed using AFNI. General linear task was performed using a gamma variate function to create individual activation maps. All single subject maps were transformed into Talairach space. Using VME score as covariate, ANCOVA was performed to generate group maps.

Results:
Behavioral data showed no statistically significant group difference in accuracy or reaction time for either emotional or control phases of the emotional face matching task. After controlling for effect of VME, the group playing the nonviolent game showed robust BOLD response associated with perceptual processing of fearful and angry facial expressions in the right amygdala, bilateral dorsolateral and ventral PFC, ACC, pre-SMA, bilateral insula and visual cortex, whereas group playing violent game demonstrated only activation in right amygdala, bilateral dorsolateral PFC and visual cortex. Direct group comparison (mixed model ANOVA) found greater activation mainly in bilateral dorsolateral PFC in the group playing the nonviolent game compared to the group playing the violent game. The latter did not show any significantly greater response than the former.

Conclusions:
Recent research [5] suggested the existence of a functional network in which cognitive engagement of neocortical regions, especially the PFC, leads to the modulation of amygdala activity. The decreased activity of dorsolateral PFC in subjects playing a violent video game may reflect decreased capacity for active emotion regulation through such "top-down" processes as a result of such game playing.

Acknowledgements: This work was supported by a grant from the Center for Successful Parenting.

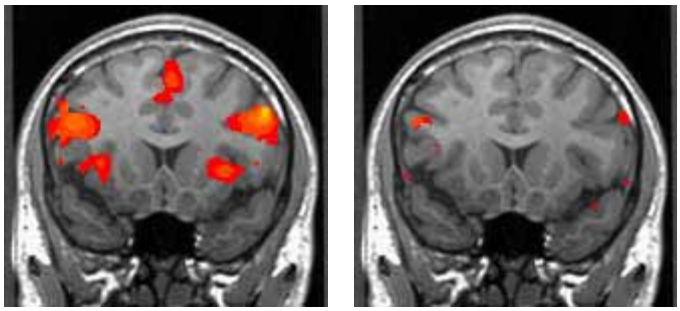

Fig. 1. Group map of subjects play nonviolent video game (left) showed more activation than that of group playing violent game (right).

Reference:
1. Mathews, VP. et al.; JCAT 2005 .
2. Kronenberger, WG. et al.; JCP 2005.
3. Wang, Y. et al.; ISMRM 2004 .
4. Hariri, AR. et al. ; Science 2002
5. Davidson RJ. et al.; Science 2000