The Relationship between Action Video Game Players and Aircrew Recruitment and Sustainability due to Enhanced Cognition

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BACKGROUND

AIRCREW RECRUITMENT: Applicants for commissioned personnel must take the CBAT, computer based aptitude test. This test is designed to assess a range of cognitive abilities that the RAF deem to be important for job and training success.

ACTION VIDEO GAMES: Action video game training causes enhanced cognitive abilities due to the attentional demands placed on cognitive processing during game play[1].

ATTENTIONAL CONTROL: Action video game players (AVGPs) show a superior ability in focusing on task-relevant information due to improved top-down attentional control and flexible allocation of spatial attention[2]. These skills are being directly tested throughout the CBAT. For example, the Dynamic Projection Test, assesses a participants ability to interpret and direct the movement of objects in a dynamic 3D environment, and the Colours, Letters and Numbers Test, assesses participants ability to shift attention between different tasks.

AFFECTIVE PROSODY: The effect of action video games on the emotional domain is poorly understood, particularly in auditory spatial attention, but there are common preconceptions that playing action video games translates into aggression. The CBAT assesses participants ability to respond to auditory information in tests such as the situation awareness test and the auditory capacity test. However, these tests do not take into account the varying emotional tones that auditory cues present in reality. Thus the CBAT would not be able to identify if the effect of action video games affects a players response to auditory emotions.

AIM 1: Find out whether the enhanced cognitive processing caused by action video gaming, translates to the cognitive abilities in the CBAT – this will be investigated through the relationship between hours spent playing video games and CBAT score.

AIM 2: To understand how affective prosody, effects auditory attentional networks and cognitive ability in AVGPs compared to non-video game players (NVGPs) which would not be reflected in the CBAT due to the lack of affective prosodies used – in other words, does playing action video games causes an alternative processing of auditory emotions which is not tested for in the CBAT but could contribute to job and training success.

METHODS

CBAT STUDY

QUESTIONAIRE: A questionnaire that asked participants about their most recent CBAT attempt and video gaming habits was distributed to past and present University Air Squadron (UAS) members. A total of 126 filled in the survey however 7 did not reach the inclusion criteria, therefore data analysis was conducted on 119 responses.

VIDEO GAMING STUDY

STIMULI: 9 different two-syllable pseudo-words each spoken in 4 different emotions (neutral, fearful, happy, threatening) resulting in 36 different auditory stimuli presented from both a left and a right loudspeaker. Three of the pseudo-words were deviant target stimuli (two different syllables), the remaining six were standards (two identical syllables)[3].

EXPERIMENTAL PARADIGRAM: 9 AVGPs and 7 NVGPs were asked to attend to one loudspeaker and respond to deviant target stimuli from this attended spatial location by pressing the spacebar.

ANALYSIS: An EEG measured participants' neural signals to understand the underlying neural mechanisms in how different emotions were processed depending on spatial location. The event related potentials were clustered and separated into four time-windows: 87-122ms, 170-220ms, 240-330ms, 400-600ms. A mixed ANOVA compared attentional location, emotional valance, and differences between AVGPs and NVGPs for each time window and behavioural data including accuracy and reaction times.

RESULTS

CBAT STUDY

QUESTIONAIRE: The results of the questionnaire are shown below in the form of a frequency table, figure 1, and bar chart, figure 2, outlining the relationship between hours spent playing action video games per week and the participants' most recent CBAT score.

		Hours Spent Video Gaming per Week					
		0 hours	<1 hour	1-3 hours	3-5 hours	5-10 hours	10+ hours
CBAT Score	<80	3	0	0	0	0	0
	81-90	1	0	0	0	0	0
	91-100	3	2	1	0	0	0
	101-110	3	2	0	1	1	0
	111-120	1	3	3	3	1	1
	121-130	4	4	2	3	0	2
	131+	11	10	8	14	12	20

Figure 1: A frequency table showing participants' CBAT scores against the number of hours a week they spent playing action video games

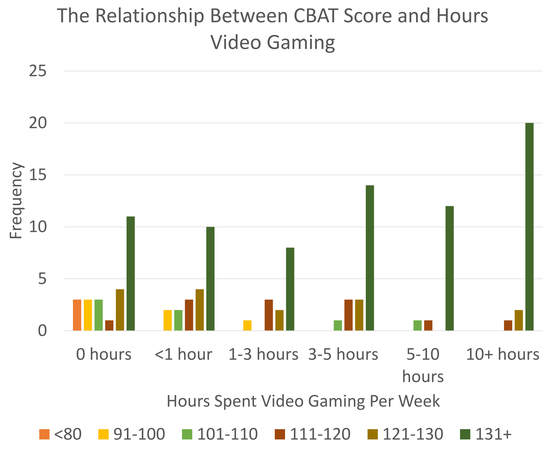

Figure 2: A graph showing the frequency of CBAT scores obtained when playing a set number of hours of action video gaming per week.

The results in figures 1 and 2 show the general trend that as the number of hours spent playing action video games per week increases, the CBAT score of participants increases. This is best represented by results showing that of participants who played 0 hours of action video games per week, only 42.3% of them achieved CBAT scores of 131+, yet in the participants who played over 10 hours of action videogames per week 87.0% of them achieved a CBAT score of 131+.

Correlations

			CBATScore	VideoGaming
Spearman's rho	CBATScore	Correlation Coefficient	1.000	.393**
		Sig. (2-tailed)	.	<.001
		N	119	119
	VideoGaming	Correlation Coefficient	.393**	1.000
		Sig. (2-tailed)	<.001	.
		N	119	119

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 3: A table showing the spearman rank correlation between CBAT scores and hours spent playing action video games.

The table above shows a Spearman rank correlation table for the relationship between hours spent playing action video games per week and CBAT scores. At a 0.01 significance level there was a correlation coefficient of 0.393 representing a moderately positive correlation between the two variables.

BEHAVIOURAL RESULTS

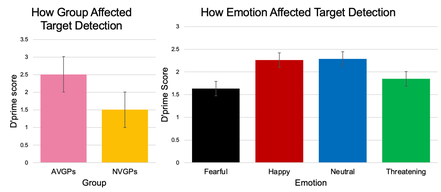

Figure 4: Group effect in d' prime

Figure 5: Emotion effect in d' prime

GROUP EFFECT: ($p=0.003$), AVGPs detected stimuli more accurately, see figure 4.

EMOTION EFFECT: ($p<0.001$), neutral and happy stimuli detected more accurately, see figure 5.

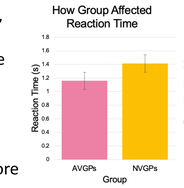

Figure 6: Group effect in reaction times

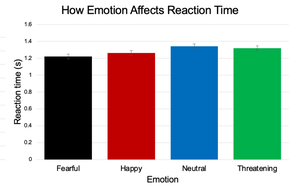

Figure 7: Emotion effect in reaction times

GROUP EFFECT: ($p=0.09$), AVGPs detected stimuli faster, see figure 6.

EMOTION EFFECT: ($p=0.012$), fearful stimuli detected faster, see figure 7.

EVENT RELATED POTENTIALS

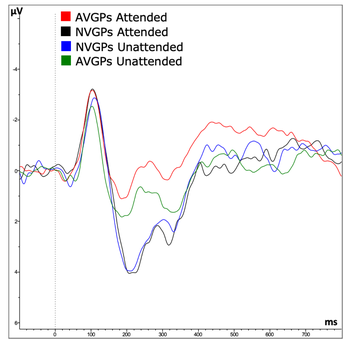

Figure 6: Attention by group effect at cluster 13 (Pz)

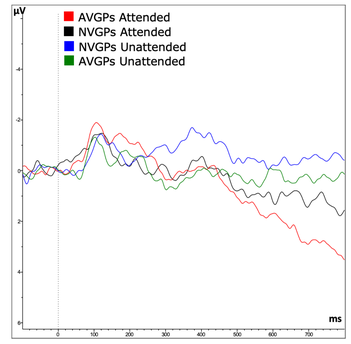

Figure 7: Attention by group effect at cluster 14 (Oz)

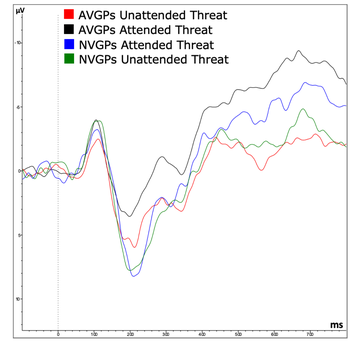

Figure 9: Attention by Emotion to threatening stimuli

EFFECT OF ATTENTION BY GROUP BY CLUSTER: At 240-330ms ($p=0.057$), an attention effect elicited by: AVGPs at more central clusters ($p=0.060$), figure 8, and NVGPs at more posterior clusters ($p=0.025$), figure 9.

ATTENTION BY EMOTION BY GROUP: Attention effect in AVGPs seen in threatening emotion, figure 10.

DISCUSSIONS/CONCLUSION

CBAT AND VIDEO GAMING: A moderate positive correlation was observed between number of hours playing action video games per week and CBAT score. This highlights that the cognitive abilities enhanced due to video games are linked to those being tested in the CBAT and those with enhanced cognitive abilities will obtain a higher score.

BEHAVIORAL DATA – ACCURACY AND REACTION TIME: AVGPs were seen to more accurately detect stimuli which would directly translate to better CBAT performance. As for emotional prosody, happy and neutral auditory stimuli were detected more accurately, which could be due to positive stimuli presenting more contrast[4].
AVGPs were seen to be faster at detecting stimuli which would directly translate to better CBAT performance due to the time pressures placed on participants during the tests. As for emotional prosody fearful stimuli were detected faster, which could be due to negative stimuli capturing attention[5].

VIDEO GAMING AND THE AUDITORY ATTENTIONAL NETWORK: AVGPs auditory attentional network was observed to be more restricted and efficient than NVGPs, seen by the attention by cluster by group effect[6]. Due to AVGPs prolonged practise of the cognitive abilities trained whilst video gaming, it has caused their attentional network to undergo neuroplastic changes, appearing restricted. This effect would be beneficial during the CBAT test due to the use of this attentional network during the cognitive tasks required.

EVENT RELATION POTENTIALS OF VIDEO GAMING AND AUDITORY EMOTION:
An attentional effect was observed in AVGPs for only threatening stimuli, see figure 9. This attentional effect was not present for NVGPs or other emotional prosody. At the attended position, AVGPs' event related potential response to threatening stimuli, appeared most negatively pronounced at the N1 (87-122ms) compared to AVGPs unattended response and to NVGPs attended and unattended responses. The N1 pronunciation is thought to reflect initial auditory attentional filtering[7] AVGPs response was also more negatively pronounced at N2 (270-330ms). The N2 pronunciation is thought to represent discrimination, identification, and categorisation of stimuli[8]. These observations may be consistent with the hypothesis that AVGPs are more sensitive to aggressive emotions. In context of the CBAT, some tests require participants to respond to aural instructions said in a neutral tone. In reality, noise in a military environment will not be neutral and in dangerous situations perceived as threatening. Therefore, if AVGPs are more sensitive to threatening emotions, this could end up playing to their advantage in job and training success.

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