

Study on Memory and Concentration - 2009

An Exam work of Viktor Wuchrer – accomplished and passed in at the psychological Institute of the Friedrich-Alexander University Erlangen-Nürnberg

On the basis of the present study, it has been examined to what extent the influence of audio-visual stimulation with corresponding alpha- or beta-frequencies leads to an activation of cognitive processes regarding investigated memory- and concentration-performance. According to previous research-results, the study emerges upon the physiological mechanisms of audio-visual entrainment and examines the effects of audio-visual stimulation by means of modern Digital Audio-Visual Integration Devices (DAVID) by observing the improvements in regard of cognitive performances. To this, 104 students in the age of 18 to 41 years were examined at the Friedrich-Alexander-University of Erlangen-Nuernberg in a laboratory-experiment. The students had randomly been assigned to either an Alpha-, a Beta- or a control-group. The results of the study showed a significant improvement on memory and concentration-performance as an effect of the applied alpha-session as well as a highly significant improvement on concentration-performance as an effect of the applied SMR/Beta-Session.

Methodical proceedings

Selection of the participants:

As participants for the study had been selected 78 students of the Friedrich-Alexander-University Erlangen-Nuernberg. The age of the participants ranged from 18 to 41 years. The selected participants were randomly assigned to either the Alpha experimental group, the Beta-experimental group or the control group.

Pre-Tests:

At the beginning of the experiment each participant was subjected to a Pre-Test in order to measure his memory- and concentration-performance. For the measurement of the memory-performance, the sub-test „objects “from the Baeumler Memory Test (1974) had been applied to each participant. Also, each participant had to undergo the Brickenkamp d2 Concentration Test (2002) in order to evaluate his concentration-performance.

Treatment:

In succession to the Pre-Test, each participant was submitted to the respective Treatment:

The participants of the Alpha group received a 20-minute audio-visual stimulation with a stimulation-frequency of 10 Hz. For the treatment, a DAVID PAL in conjunction with the implemented session „Healthy Alpha“ was being used.

The participants of the Beta group also received a 20-minute audio-visual stimulation, but in this case a dual-frequency session was being applied, which stimulates both brain hemispheres with different frequencies. The left brain-hemisphere was being stimulated with a pulse rate of 18 Hz, whereas the right brain-hemisphere was being stimulated with a pulse rate of 13,5 Hz. According to scientific hypotheses, the higher stimulation-frequency within the Beta-range for the left brain-hemisphere is supposed to cause a corresponding activation of the logical-analytic thinking, which was being observed for verification within this experiment and which should especially show its effect in a higher concentration-performance of the Beta-group. For the treatment, a DAVID PAL in conjunction with the implemented session „SMR/Beta“ was being used.

The participants of the control-group received no stimulation. Instead, they had to read a relaxing prose text for a fantasy journey and write a short essay afterwards, which represented the placebo-treatment.

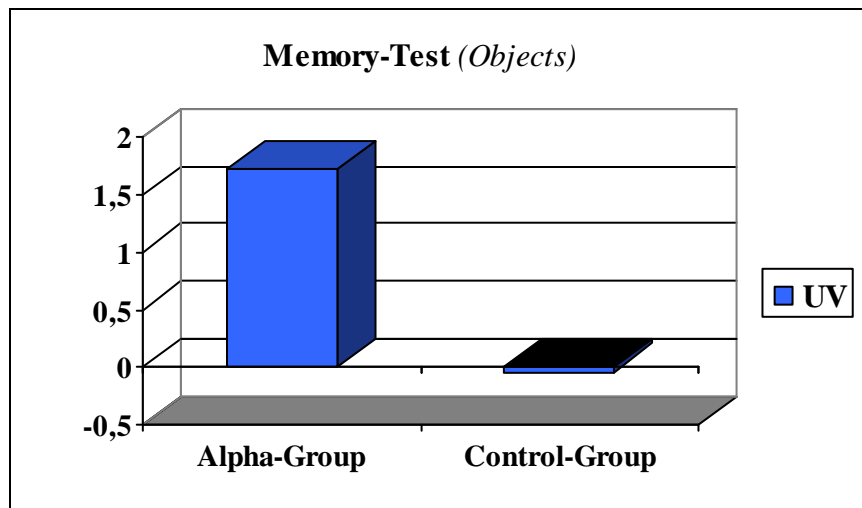
Post-Tests:

In succession to the treatment, each participant was again subjected to a Post-Test in order to measure the effects of the treatment onto his memory- and concentration-performance. For the measurement of the memory-performance, the sub-test „objects “from the Baeumler Memory Test (1974) had been applied to each participant again as well as the Brickenkamp d2 Concentration Test (2002) in order to evaluate his concentration-performance again – but both in a different version than the according Pre-Tests in order to exclude memory effects.

Results

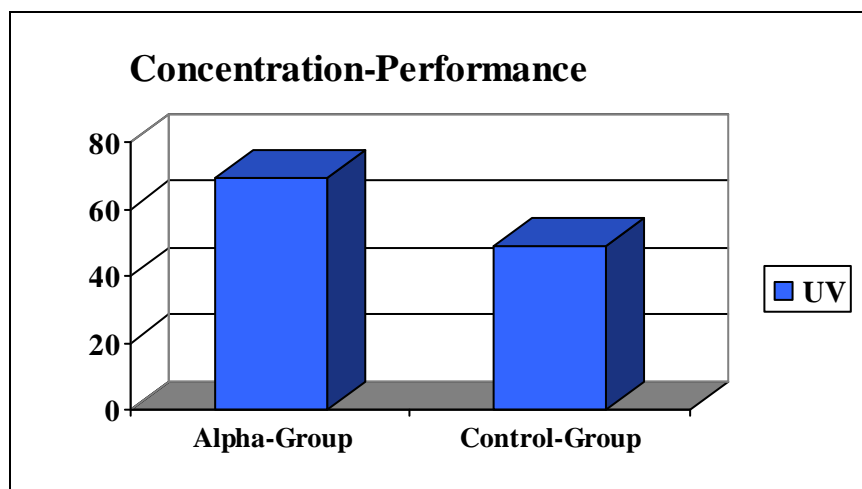
1. Significant improvements in memory-performance as an effect of the Alpha-treatment

As a result of the 10 Hz audio-visual stimulation the Alpha-group achieved a significant improvement of the memory-performance in comparison to the control-group. The following illustration displays the average difference of the reproduced items between the Pre-Tests and the Post-tests from the Baeumler Memory-Test LGT-3 between the Alpha-group and the control-group. Test persons, who received a specific audio-visual stimulation with a DAVID 10-Hz-Alpha-Session, reproduced significantly more items in the Memory-Test ($A = 1.73$, $SD = 2.38$) than the control-group without AVE ($A = -.04$, $SD = 2.03$).



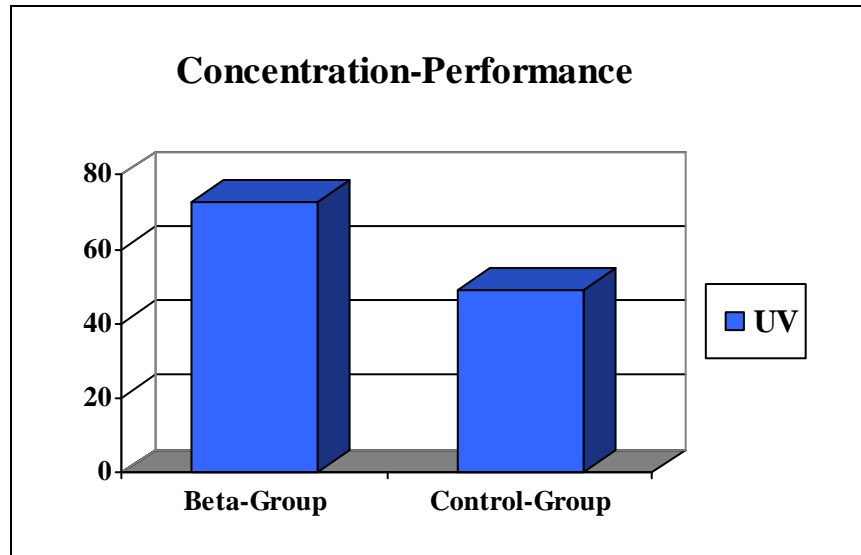
2. Significant improvements in concentration-performance as an effect of the Alpha-treatment

As a result of the 10 Hz audio-visual stimulation the Alpha-group achieved a significant improvement of the concentration-performance in the comparison to the control-group. The following illustration displays the average difference of the concentration-performance between the Pre-Tests and the Post-Tests from the Concentration-Test d2 between the Alpha-group and the control-group. Test persons, who received a specific audio-visual stimulation with a DAVID 10-Hz-Alpha-Session, achieved a significantly higher concentration-performance ($A = 69.44$, $SD = 26.19$) in the d2-Concentration-Test than the control-group without AVE ($A = 49.00$, $SD = 21.55$).



3. Highly significant improvement in concentration-performance as an effect of the Beta-treatment

As a result of the 13.5/18 Hz audio-visual stimulation the Beta-group even achieved a highly significant improvement of the concentration-performance in the comparison to the control-group. The following illustration displays the average difference of the concentration-performance between the Pre-Tests and the Post-Tests from the Concentration-Test d2 between the Beta-group and the control-group. Test persons, who received a specific audio-visual stimulation with a DAVID 13.5/18-Hz-SMR/Beta-Session, achieved a highly significantly better concentration-performance ($A = 72.50$, $SD = 19.88$) in the d2-Concentration-Test than the control-group without AVE ($A = 49.00$, $SD = 21.55$).



With an average difference of 1,5 reproduced items between the Pre-Test and the Post-Test from the Baeumler Memory-Test LGT-3, the Beta-group also showed improvements in memory performance ($M = 1.5$, $SD = 1.88$) in comparison to the control-group ($M = -.04$, $SD = 2.03$). However, this difference was slightly too low to be regarded as a significant improvement in quantitative terms.

Conclusions

Altogether the experiment shows, that the audio-visual stimulation with Digital Audio-Visual Integration Devices (DAVID) has a positive effect on cognitive performances. The results reported a significant effect of the Alpha-Treatments on the memory- and concentration-performance. Additionally, a strongly significant effect of the Beta-Treatments onto the concentration-performance could be observed, however not on the memory-performance.

The fact, that the Beta-group achieved a stronger improvement in concentration-performance than the Alpha-group, moreover also confirms the hypothesis, that a different stimulation of the two brain-hemispheres with an aimed Beta-stimulation of the left brain-hemisphere leads to a stronger activation of logical-analytic thinking and a higher concentration-performance in comparison to a pure Alpha-stimulation.