



Introduction:

“When you're hitting the ball, it comes at you looking like a grapefruit. When you're not, it looks like a blackeyed pea” - Georg Scott, an American baseball legend, was not only outclassed because of his sport-motorical abilities but also his visual performance seems to have been extraordinary. In addition to sport-motoric fitness, the performance of athletes is decisively destined by visual perception, especially in fast ball sports. Innovative training tools – such as the MJ Impulse shutter goggles– should improve visual parameters.



Fig. 1: MJ Impulse

Purpose:

By using the MJ Impulse, the present pilot study helps to describe the effectiveness of a single stroboscopic training on anticipative skills such as reaction time and decision making as well as on temporal resolution.

Methods:

In a controlled study design, 27 subjects participated in a thirty-minute MJ Impulse training. Starting with a frequency of 5 Hz and a light/dark ratio of 45 to 55%, test persons did simple passing and reaction exercises. Every ten minutes, the duration of the dark period was increased by 5%.



Fig. 2: Frequency of 5 Hz



Fig. 3: Light/Dark Ratio of 40/60%



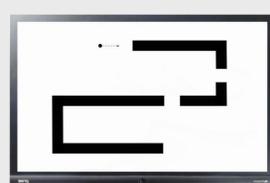
Scenario I - „Flying Balls“

The task of the test person is to signal whenever detecting the incipiently presented ball type (e.g. a football).



Scenario II - „Rotation of Balls“

Four balls are moving on an elliptical path. The optotype-opening must be termed by a button press - starting with the slowest, innermost moving ball.



Scenario III - „Tunnel Anticipation“

The velocity of the entering Balls should be anticipated. The test person presses a button when the ball is expected at the tunnel exit.

Fig. 4: Self-programmed Computer Scenarios

The evaluation of the perception training was carried out by a pre- and posttest using three self-programmed computer scenarios and a flicker fusion test based on the Vienna Test System. Five of the 27 subjects additionally took part in EEG-measurements to validate the outcome of the flicker fusion test.

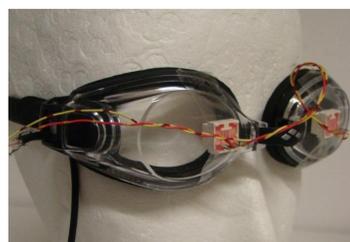


Fig. 5: LED-Goggles for the EEG-Measurements

Results:

I Reaction Time and Anticipative Ability

The data evaluation is based on a Mixed Factorial ANOVA as well as variance analyses within each experimental group. A subjective improvement in reaction time could not be confirmed by the objective psycho-physiologically measured values (Fig. 6). Concerning the anticipation of two-dimensional motions, no changes were found either (Fig. 7).

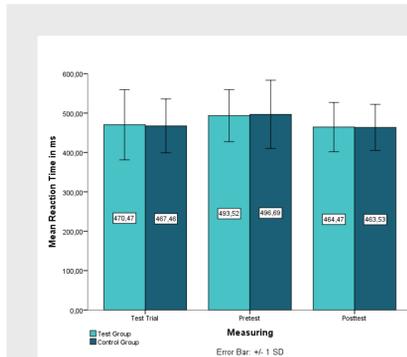


Fig. 6: Flying Balls Test: Mean Reaction Time [ms], Test- vs. Control Group

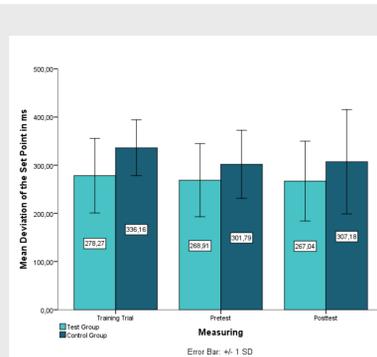


Fig. 7: Tunnel Anticipation: Mean Deviation of the Set Point [ms], Test- vs. Control Group

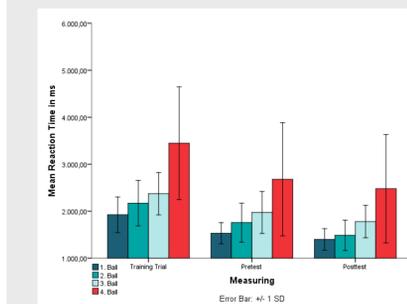


Fig. 8: Rotation of Balls Test: Mean Reaction Time [ms], Test Group

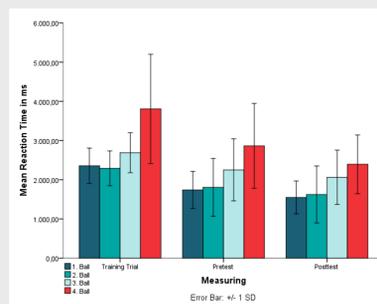


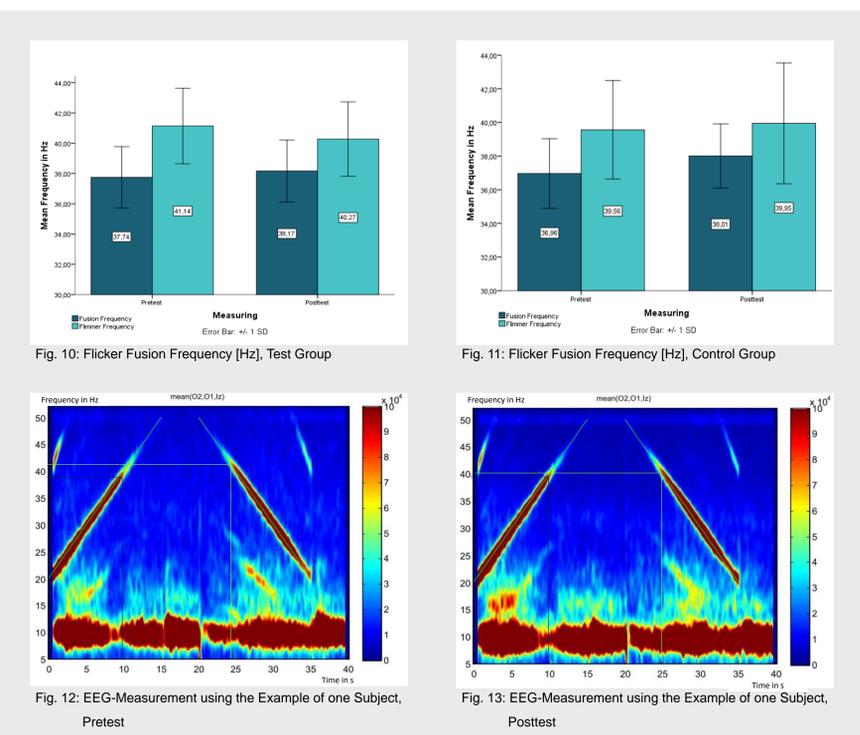
Fig. 9: Rotation of Balls Test: Mean Reaction Time [ms], Control Group

Along the trial types a higher decrease in reaction time of the fourth (fastest) ball in comparison to the first reference ball was hypothesized but not ratified by the present results (Fig. 8 and 9).

II Temporal Resolution

The flicker frequency, as a parameter of temporal resolution, significantly decreased within the test group by 2.3% (p=0.00) whereas it increased in the control group (Fig. 10 and 11). There was no evidence in the EEG measurements due to the fact that electrophysiological signals are still detectable although the flicker fusion threshold is subjectively achieved.

The green and the blue lines (Fig. 12/13) represent the subjective measured flicker fusion frequency.



Discussion:

The flicker fusion frequency as a parameter of the temporal resolution provides an evidence of cerebral fitness [3]. Accordingly a decreased flicker frequency could be a contraindication for an MJ Impulse training. The reason why the flicker frequency in the test group decreases while the fusion frequency increases is unknown. The ancillary effect of the ambivalence in the value between the objectively detected and subjectively perceived flicker fusion frequency verifies the results of Gerling [1] and Herrmann [2].

Conclusion:

The present study indicates no influence of a single training using the MJ Impulse onto reaction time and anticipative abilities, but it seems to have a negative impact on the flicker frequency. Further studies are required to detect a long-term effect and to validate the results ascertained.

References:

- [1] GEHLING, J. et al.: Shift of Equiluminance in Congenital Color Vision Deficiencies: Pattern-ERG, VEP and Psychophysical Findings. Vision Research. 37 (1997) 6, 821-826
- [2] HERMANN, C.S.: Human EEG responses to 1-100 Hz flicker: resonance phenomena in visual cortex and their potential correlation to cognitive phenomena. Experimental Brain Research, 137 (2001), 346-353
- [3] SCHOBBER, F.; BEYER, L.: Die objektive Bestimmung der Flimmerverschmelzungsfrequenz zur Charakterisierung des aktuellen Aktivitätszustandes des ZNS. IN: Medizin und Sport. 24 (1984), 245-252

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No conflict of interest to disclose.