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Computer technology has changed work demands in many professions. Nearly all vehicles of modern transportation are operated with the aid of computers and traffic control has been computerized. In process industry mechanical work has diminished and work tasks in which the production process is carried out by automation have increased. The worker monitors as well as actively operates the production process with the aid of computer technology. All monitoring tasks require maintenance of attention to information presented on the computer screen and accurate responses to relevant factors/targets presented on the display. Some process monitoring tasks require constant responses, others mainly passive monitoring skills, but accurate reactions to disturbance situations. We are currently developing computerized test batteries for occupational health services for work ability testing. The test batteries should measure relevant aspects of cognitive performance in relation to the cognitive demands of work tasks. Cognispeed is a Finnish computerized test battery (Revnosuo and Portin 1995). The vigilance (VIG) subtest measures sustained visual attention and selective target monitoring. Three target letters were chosen out of 20 letters at the beginning of the test session and subjects were instructed to respond only to these targets by pressing the spacebar key on the keyboard. The duration of the test was 15 min. Letters appeared randomly (display time 200 msec, interstimulus interval 500–3000 msec) and in random order at the center of the screen. Reaction times as well as erroneous responses (omissions and responses to a non-target) were measured. Two types of monitoring tasks were applied: In the monotonous version only 15% (VIG15) of the stimuli presented on the computer screen were relevant. In the more demanding version 45% (VIG45) of the stimuli required a response. As a part of validating tests batteries for occupational health care, 10 train drivers (Tdr), mean age 43, range 34–52 years and 10 remote controllers of railway traffic (Tco), mean age 44,35–54 years, performed both VIG-tests twice but on two different test days, one week apart. Prior to testing the subjects' best corrected visual acuity for viewing distance as well as their contrast sensitivity was determined. Higher mean reaction times ($p < 0.0001$) were observed in the VIG15 -subtest (mean \pm SD, range: 512 ± 59 msec, 402–697 msec) compared to the VIG45 test (458 ± 53 msec, 383–600 msec). More variation in intraindividual reaction times between the two test sessions was also observed in VIG15 compared to VIG45. At group level the mean reaction times of Tdrs were faster (mean 496 ± 55 msec) than those of Tcos (529 ± 59 msec.), $p < 0.08$. The number of erroneous responses was higher with VIG45 (5.7 ± 6.8 errors, range 0 to 33) compared to VIG15 (2.9 ± 4.8 errors, range 0 to 23). Between professions, specially in Tcos there was a clear rise in erroneous responses between VIG15 and VIG45 tasks, from a mean of 2.4 to 6.5 errors. Our data shows that characteristics of a monitoring task effect both the speed of performance and the accuracy of responses.

Studies are currently in progress at our laboratory to further determine how e.g. target presentation in monitoring tasks as well as human factors (e.g. related to vigilance and overall mental load) influence human performance.

622 EVALUATION OF VISUAL ATTENTION OF BASKETBALL REFEREES BY USING EVENT-RELATED BRAIN POTENTIALS

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Basketball referees are a group of people who are being subjected to intensive visual tasks because of their profession. The aim of this work is to compare the visual attention of the sedentary people and the basketball referees by an objective electrophysiological method. The oddball P300 wave is a strong correlate of directed attention. Different features of visual stimuli such as colour, texture etc. have been used for creating the differences between the target and non-target stimuli of a visual oddball paradigm. For our application, spatial differences were more relevant, because in real conditions, the referee's attention is directed to abrupt changes of the relative position of the ball to the player, the player to player, and player and ball to the basketball court. Therefore, we used a simple stimulus pattern where white bars on a computer screen could be pseudorandomly located on the right or left of a fixation point. The task of the subject was defined to count mentally the stimuli appearing on a certain side of the fixation point. In a preliminary study, we obtained clear P300 responses by the application of this paradigm on normal sedentary people, where all parameters such as eye movements etc. were precisely controlled. Present results obtained from seven elite referees and ten sedentary person of the same sex and mean age show that the amplitudes of both the P300 and N200 waves are significantly higher in the referee group. We conclude that the training of directed visual attention system is reflected in ERPs, and hence visual P300 response to spatial changes can be used as a reliable and objective evaluation method of directed visual attention of the basketball referees. Similar experiments may also be carried out on basketball players and coaches to evaluate their attentive abilities objectively.

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623 BILATERAL CONTRIBUTION FROM FRONTAL LOBES TO MMN

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