In: Schöllhorn, W.I., Bohn, C., Jäger, J.M., Schaper, H., Alichmann, M. (Hrsg.) (2003): European Workshop on Movement Science. Köln: Sport und Buch Strauß, 57.

Learning Strategies and Force Precue in Force-Feedback controlled Learning Situations

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Learning strategies have been researched especially respect to program theories. Wulf&Schmidt (1997) e.g. demonstrated that variability in practice can be more effective in special situations. Up to now precuing techniques have been privilegedly used in reaction time experiments. Rosenbaum (1980) demonstrated the benefit of partial information about defining characteristics of a motor response regarding reaction times.
This study examines learning differences effected by learning strategies and force precue in force-feedback controlled situations. Force-feedback denotes the perception of (reaction-) forces which act on the individual dependent on the actual individual-environment constellation. This perception can be used for movement control.
Method: Following an experimental paradigm used in neurology and neuroscience (cp. Thoroughman & Shadmehr, 2000; Krakauer, Ghilardi & Ghez 1999) a force-feedback device (Impulse-Stick by Immersion) combined with my personally developed software-tool has been used to control movement situations. Six groups with 20 students of each participated in this experiment. None had prior experience with the task. The task required participants to move the stick of the force-feedback device on a linear trajectory without visual control. Dependent on three learning strategies (blocked condition, variability condition and differential condition) the movement had been disturbed by a special sequence of six different force fields. The forces in each force field acted perpendicular to the required movement and were generated by a sine function of the general form: force.x = a*sin(position.y*b) + a*sin(position.y*c) where force.x denotes the applied force and position.y denotes the position along the required trajectorie. There were two precue conditions (no precue and force precue presented 3 sec before acting on a monitor). The participants performed three sessions within a week each of 2 x 50 trials. At the beginning and at the end of the experiment they performed an interpolation test.
Some results: A 3 (learning strategy) x 2 (precue condition) ANOVA (with repeated measures on the two factors) leads to following effects. The RMSE of the trajectory in the interpolation situation of all six groups decreases significantly from pre- to post test: $F(1, 114)=1357.07$; $p=.000$. The greatest improvement can be seen within the blocked learning condition. There is no difference between the precue conditions: $F(1, 114)=.040$; $p=.842$.
Discussion: Most importantly for the present study is the finding that differences can be seen between force-feedback controlled learning situations and the visual controlled learning situations used in previous variability of practice studies. An advantage of variable learning in comparison with blocked learning within force-feedback controlled learning situations can not be seen. Force precue seems not to be suitable to enhance the movement control.

Key References

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