

**Abstractvorlage 6. Jahrestagung der SGS 2013 in Fribourg/Freiburg****Title:**

An Experimental Study on Vibrations, Posture, and the Stabilization of Gaze

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**Abstract:****Introduction**

In recent years, more and more research focused on the phenomenon of perception-action-coupling, that is, the tight relationship between how and what is perceived and the type and quality of movement output to solve (complex) motor tasks. However, to date, most research focused on the effects of perception on motor control, not vice versa, which would constitute the facilitation of perception by improved motor control. Therefore, in a series of experiments, the question is asked whether improved motor control can also help to stabilize gaze what, in turn, may be essential for maintaining other control mechanisms (e.g., modeling of future states, Franklin, & Wolpert, 2011) in an optimal range. This is of particular interest in situations in which the task exhibits unpredictable components as it is the case, e.g., in downhill skiing. The first study of this series focusses on effects under predictable conditions in order to check whether visual performance can be altered by posture per se.

**Method**

In a 3x2x4 within-subject ANOVA design, 72 participants conducted three tests on visual acuity and contrast (Landolt / Grating and Vernier) in two different postures (standing vs. squat) on a platform vibrating at four different frequencies (ZEPTOR; 0 Hz, 4 Hz, 8 Hz, 12 Hz; no random noise; constant amplitude) in a counterbalanced order with 1-minute breaks in-between. In addition, perceived exertion (Borg) was rated by participants after each condition.

**Results**

For Landolt and Grating, significant main effects and interactions are revealed, representing higher acuity/contrast thresholds for standing and for higher frequencies in general and increasing posture differences with increasing frequencies ( $p < .01$ ). Overall, performance could be maintained at the 0 Hz level up to a frequency of 8 Hz, if bending of the knees was allowed. The fact that this result is not only due to exertion is proved by the Borg ratings, which show a constant increase over frequencies and decreasing posture differences with increasing frequencies ( $p < .01$ ). The same pattern, although not significant, is revealed for the Vernier test.

**Discussion**

Apparently, postures improving motor control not only turn out to help to resist disturbances but also assist in stabilizing gaze in spite of these perturbations. Consequently, studying the interaction of these control mechanisms in complex unpredictable environments seems to be a fruitful field of future research.

**References:**

Franklin, D. W., & Wolpert, D. M. (2011). Computational mechanisms of sensorimotor control. *Neuron*, 72, 425-442.