

# Smart balance performance does facilitate supra-postural activity ?

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## OBJECTIVE

Dexterous postural control is neither the goal of conscious actions nor the result of unknown behavior. It might be conceptualized in terms of affordance exploitation (Stoffregen, 2004). The type of control that is optimal depends upon specific constraints of the person, task and environment (Newell, 1996). Human postural control is not an end in itself. It is integrated within a functional context of various *supra-postural goals* (cf., Riccio, Stoffregen, 1988). In our opinion, postural control is not autonomous but is part of a broader action-perception system (cf., Mitra, 2004, 28f.; Bootsma, 1998, 58: *information-movement coupling!*). We report an experiment in which we examined the influence of supra-postural tasks on postural control in elderly adults.

## METHODS

Elderly adults (N=62; age > 60) took part in a study of different interventions to improve their general motor performance in the HIS (Hamburger Inline-Skating School). They underwent two trials in the pre- and post-measurement. We used a motion analysis system with optic-electronic markers (AS 200 @ LUKOtronic) to record the three-dimensional sway of head and hip (Fig. 1). In the first trial the participants were asked to maintain a one-leg stance on normal ground as a baseline. In the second trial they executed an *additional, supra-postural task*, searching for and counting symbols within a block of text on a poster (distance: 60 cm). The duration of each trial was 45 seconds. The sway of hip and head was measured by the motion analysis system (100 Hz) (Fig. 2). We evaluated body sway by calculating the deviation of position of body segments ( $SD_{x,y,z}$  [mm]).



Fig. 1: Participant with optic-electronic markers at head, hip etc,

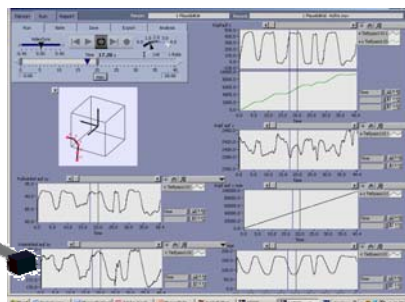


Fig. 2: Control panel of the motion analysis system (AS 200)

## RESULTS

A MANOVA (3x2) revealed a significant *main effect of task* ( $F(1,61): 7.421; p<.008$ ). There were also effects of body segment (head vs. hip) ( $F(1,61): 160.656; p<.000$ ) and of sway direction (x, y, z) ( $F(2,122): 60.208; p<.000$ ) as well. A decomposition of the main effect of direction (post-hoc: Turkey) shows: (a) no statistically significant difference ( $p \leq 0.079$ ) of y-direction (10.72 [mm]) when compared with x-direction (11.15 [mm]); (b) statistically significant difference ( $p \leq 0.000$ ) of y-direction when compared with z-direction (3.77 [mm]); (c) statistically significant difference ( $p \leq 0.000$ ) of x-direction (11.15 [mm]) when compared with z-direction (3.77 [mm]).

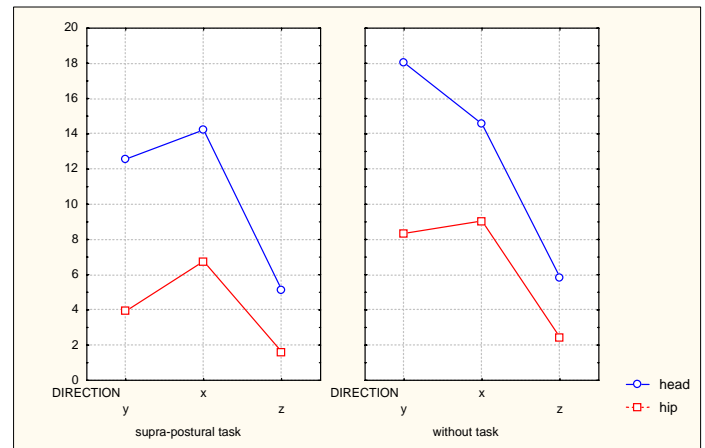


Fig. 3: Results of MANOVA for postural control ( $SD_{x,y,z}$  [mm]).

Sway in y-direction of the head (12.56 vs. 18.04 [mm]) and the hip (3.93 vs. 8.35 [mm]) was generally smaller during the search task than in the baseline condition.

## CONCLUSION

Smart balance performance refers to the concept of functional integration. In searching for target letters, sway in the med.-lat. direction may have decreased to support the supra-postural task. These results are in accordance with previous studies of supra-postural tasks (e.g., visual oriented: Stoffregen et al., 1999, 2000; tactile oriented: e.g., Holden et al., 1987, Riley et al., 1999; precise oriented: Balasubramaniam et al., 2000) and of balance performance in the elderly (Lippens, Nagel, 2004; Stoffregen et al., 2006). In our study, reduced body sway appears to have afforded more optimal visual search: *Dexterous balancing was functional integrated to facilitate supra-postural activity while standing.*

Ref.: Balasubramaniam, R. et al. (2000): Specificity of postural sway to the demands of a precision task. *Gait and Posture*, 11, 1, 12-24. Holden, M. et al. (1987): Influence of light touch from the hand on postural sway. *Society for Neuroscience Abstracts*, 13, 292-296. Lippens, V.; Nagel, V. (2004): Alles im Lot: Management von zentralen Ressourcen oder funktionale Integration? In: Stoll, O.; Lau, A. (Hg.): *Abstractband zur 36. Jahrestagung der Arbeitsgemeinschaft Sportpsychologie. Belastung und Beanspruchung*. Halle, 97-98. Mitra, S. (2004): Adaptive Utilization of Optical Variables during Postural and Suprapostural Dual-Task Performance: Comment on Stoffregen, Smart, Bardy, and Pagulayan (1999). *Journal of Experimental Psychology: Human Perception and Performance* 30, (1), 28-38. Newell, K.M. (1996): Change in movement and skill: learning, retention, and transfer. In: Latash, M.L.; Turvey, M.T. (Eds.): *Dexterity and its development*. Mahwah, New Jersey: Lawrence Erlbaum, 393-429. Riccio, G.E.; Stoffregen, T.A. (1988): Affordances as constraints on the control of stance. *Human Movement Science*, 7, 265 - 300. Riley, M.A.; Stoffregen, T. et al. (1999): Postural stabilization for the control of touching. *Human Movement Science*, 18, 795-817. Smart, L.J.; Mobley, B.S.; Otten, E.W.; Smith, D.L.; Amin, M.R. (2004): Not just standing there: The use of postural coordination to aid visual tasks. *Human Movement Science*, 22, 769-780. Stoffregen, T.A., et al. (1999): Postural Stabilization of Looking. *Journal of Experimental Psychology: Human Perception and Performance*, 25, 6, 1641-1658. Stoffregen, T.A., et al. (2000): Modulating postural control to facilitate visual performance. *Human Movement Science*, 19, 203-220. Stoffregen, T.A. (2004): Breadth and Limits of the Affordance Concept. *Ecological Psychology* 16, 79-85. Stoffregen, T.A., et al. (2006): Enactive looking in the elderly. In: Benguigui, N., et al. (Eds.): *Recherches Actuelles en Science du Sport. Actes du 11th Congrès International de l'ACAPS*. Monts: EDP Sciences, 349-350.