

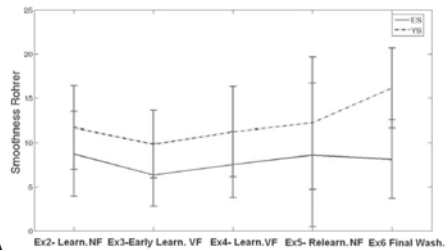
B. Cesqui, G. Macri, S. Micera, P. Dario. *Evaluation of adaptation to perturbed environments in elderly subjects: the inhibitory process in motor control. Gerontechnology 2008; 7(2):89.* A number of research groups observed that most of the age-related declines in cognition occur as a result of a decline in the efficiency of inhibitory mechanism¹. Their theories evidenced that in advanced age there is a modification of the working memory. The general capacity available for mental work decreases, resulting in failure to inhibit information that is irrelevant to current goals. This influences performance. In this work the implication of this phenomenon on motor control is discussed. Pointing movements on the horizontal plane were analyzed both in unperturbed dynamic environment (NF) and in the presence of a velocity dependent force field (VF) exerted by a robotic device both in healthy young and elderly subjects. Movements' smoothness was monitored throughout the experiment in order to describe the motor control adaptation process evolution. The long term goal of our activities is to understand whether the ability of elders to learn new movements is modified by ageing. **Methods** Eight young healthy subjects (24±4 years old), and eight elderly healthy subjects (72±5 years old) were involved in the experiment. A SCARA robotic device (the InMotion2, InMotion Technology, MA, USA), was used in the training sessions. End-effector position was recorded at 200Hz while moving. The robot was programmed to exert a force field on the hand of the subject according to the rule: $F = K \cdot v$, where K is an antidiagonal matrix with coefficient v. Starting from the centre of the workspace, subjects were instructed to reach eight different placed on the circumference of 14 cm diameter. The experiment protocol was divided in three sessions: consolidation of the NF environment, learning VF (analyzed in two phases: early and late learning), re-learning NF (analyzed in two phases: early and late learning). Two more elderly subjects were involved in the experiment and performed a double number of trials in the re-learning phase. For the data analysis the smoothness Rohrer (S1)² parameter was computed dividing the negative of the mean jerk magnitude by the peak of speed. **Results and discussion** ANOVA and t-Test of results demonstrated that there are differences between young

and elderly behaviours during the adaptation and de-adaptation process. Elderly performances were less smooth than the young ones. Young subjects behaviour was in accordance to the expected learning trend which considers improvement of movements smoothness in final washout. The elderly group seemed not to show a coherent learning process (Figure 1A) and in fact subjects needed a more prolonged training to achieve the same performances of young group (Figure 2B blue lines). In conclusion our work gives the evidence that aging strongly influences the acquisition of the new Internal Models of the dynamic of the external environment, because it seems to imply the presence of competition at retrieval processes that affect the working memory.

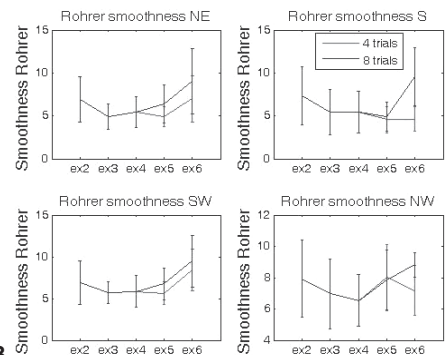
References

1. Engle RW, Sedek G, Hecker U von, McIntosh DN. New York: Cambridge University Press; 2005
2. Rohrer B, Fasoli S, Krebs HI, Hughes R, Volpe B, Frontera WR, Stein J, Hogan N. Journal of Neuroscience 2002;22:8297-8304

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A



B

Figure 1A: S1 trend during the different experiment sessions in young (blue) and elderly (red) subjects. B: S1 trend during different sessions with the first protocol (red) and with double trials in the relearning phase (blue)