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Presentation Abstract

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Title:	Anisotropic changes in task precision constraints do not lead to an anisotropic modulation of the hand trajectory control
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Abstract:	Everyday motor tasks can be characterized by different precision constraints in different directions in space. For instance, reaching for the long handle of an emergency exit requires very little precision in the lateral, but not in the vertical direction. On the contrary, reaching for a light switch requires similar precision in both directions. One can hence ask whether the CNS can anisotropically modulate the mechanisms of control of the hand movement depending on the shape of the target to be reached, so that unnecessary corrections can be avoided. To answer this question we asked 12 volunteers subjects to reach with their hand from different positions to a circular or a linear target and on a few catch trials we perturbed the movement in the direction parallel or perpendicular to the line target. If the brain minimizes pointless corrections, we should have observed clear differences in the reaction to perturbation parallel to the line for subjects reaching to the circle and those reaching to the line, i.e. when pointing to the line one need not correct for perturbations parallel to the line. On the other hand, one would expect similar reactions for perturbations perpendicular to the

line independently from the target shape, since accuracy requirements are the same in this direction for both the circle and the line targets. We did not, however, observe any target-dependent motor control strategies either in terms of hand kinematics or muscular activity. We tested also an additional experimental condition in which the application of isotropic random forces to the subjects' hand during several reaching movements to line and circle could have lead to anisotropic modulation of the hand control mechanisms (biomechanical stiffness or reflex responses): subjects reaching the line could, in theory, learn to comply with the random perturbations parallel to the line and to counteract for those in the perpendicular direction. Even in this condition the changes in the correction strategy with respect to the normal conditions did not significantly differ in any direction between line and dot target. In fact, subjects tended to equally increase the arm stiffness in all directions independent of the shape of the target to be reached, resulting in similar deviations of the hand trajectory and similar muscular responses to perturbations in the catch-trials. These results suggest that an anisotropic modulation of the correction mechanisms is not the solution adopted by the brain in case of different spatial precision constraints of the goal. This could be due to an intrinsic cost of the decoupling of the control in different directions given the characteristics of the neuromuscular system.

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