Separate effects of handedness on prediction and control of hand movement

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Skilled motor behaviour relies on the brain learning both to control the body and predict the consequences of this control (Flanagan et al., 2003). Prediction turns motor commands into expected sensory consequences, whereas control turns desired consequences into motor commands (Kawato, 1999). Here, our objective was to investigate the effect of handedness on prediction and control of hand movement. We reasoned that if prediction and control are mediated by distinct neural networks they might exhibit different dependence on handedness. To achieve this objective, right-handed participants were tested in two sets of task that were performed either with the right or the left hand. In the first task participants had to track with their eyes a self-moved target whose displacement was driven by means of random hand motion (Landelle et al., 2016). This eye tracking task allowed testing the ability of participants to predict visual consequences arising from own hand actions. In the second task participants had to move a cursor with their hand so as to track an externally moved target (Ogawa & Imamizu, 2013). This hand tracking task allowed testing the ability of participants to control a cursor along a desired trajectory. As expected preliminary data analyses show that hand tracking is more accurate with the right hand than with the left hand, as evidenced by a smaller cursor-target distance (-15%). However our data fail to show a significant difference in terms of eye tracking performance, namely we found a similar eye-target distance when the target is moved by the right or the left hand. Overall these data suggest that, although handedness influences the accuracy of hand control, it does not seem to influence the ability to predict visual consequences of hand movement. We interpret these findings as further evidence that prediction and control of movement are processes mediated by separate neural substrates (Flanagan et al., 2003; Danion et al., 2013). At a more general level, those results provide further evidence that humans exhibit different levels of dexterity with the right and the left hand, but they underscore that the ability to predict visual consequences arising from each hand action is identical.