

Supplementary Methods

Participants were seated with their forehead supported on a headrest and their semipronated right hand gripped a manipulandum underneath a horizontally suspended mirror (Figure 1a). The mirror prevented direct vision of the hand and arm and showed a reflection of a computer monitor mounted above. The visual display comprised of a central 30 mm square indicating starting position, a 5 mm diameter circular cursor representing the position of the manipulandum and a 10mm square target at one of four radially arranged positions 90 mm from the center (45°, 135°, 225° or 315°). The start of the trial was indicated by the appearance of the target and subjects were instructed to 'shoot' through the target with a smooth arm movement. The cursor was visible throughout the trial. If movement duration was greater than 300ms the target changed from white to blue at the end of the trial indicating that the movement was too slow. After completion of the outward movement participants were asked to relax and allow the robotic arm to return the arm to the central starting position. Once the cursor was re-centered the next target would appear. Participants familiarised themselves with the basic task by performing 25 trials during in which verbal feedback was given to further explain the desired movement (data not analysed).

Each participant then completed five experimental conditions in which baseline performance was assessed and then subjects were examined for their ability to adapt and washout both visuomotor and forcefield perturbations (Figure 1a). In the visuomotor condition visual feedback was distorted by 30° in the clockwise (positive) or anticlockwise (negative) direction. The forcefield condition consisted of a rightward (positive) or leftward (negative) velocity dependent force applied to the robotic arm during movement (3N/(m/s)). The type of adaptation perturbation was counterbalanced such that if the first perturbation was positive visuomotor the second perturbation was negative forcefield (giving four possible order combinations).

Hand rate was sample at a rate of 200Hz. The start time (t_1) of movement was defined as the time point at which 10% of maximal velocity of that trial was reached. The end of movement was defined as the time at which the target perimeter was first breached by subject movmenet (t_2). Movement duration was the difference between these two values (t_2-t_1). Reaction time was calculated as the difference between the time of target presentation (t_0) and the start of movement (t_1-t_0). Angular error was the angle in degrees from target direction at maximal velocity. Trials that had an angular error >45°, a movement duration of <200ms or >800ms, or a reaction time <200ms or >600ms were excluded. Epochs were created by taking an average value across four consecutive trials. The study was approved by the local ethics committee and was conducted according to the Declaration of Helsinki. Written informed consent was obtained from all participants.