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  Visual constraints on motor performance

  Contemporary models of motor control use a forward model equipped with Kalman filters to model goal-directed reaching and pointing. These models use visual estimates of the position of the hand and the target at stages during the movement for the generation of a plan, and for online control. For optimal performance, these visual estimates need to be both precise and accurate. Accuracy (systematic error) can easily be corrected with few trials if feedback is available. Precision (random error), on the other hand, cannot be eliminated and therefore gives an estimate of internal noise. In a series of experiments, we compare visual and motor performance to determine how visual information contributes to endpoint precision for a rapid point. First, we demonstrate that visual error can limit pointing precision for targets presented near the body's midline, where motor error might be expected to dominate motor performance. Next, we show that visual information is used throughout a rapid point to control endpoint precision. We then demonstrate that people need at least 150ms to correct for a visual perturbation of target position in order to maintain high endpoint precision. We conclude that the brain uses a dynamic weighting of visual and proprioceptive error to control endpoint precision, and that the same information is used to localise positions visually and to point to them rapidly.

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