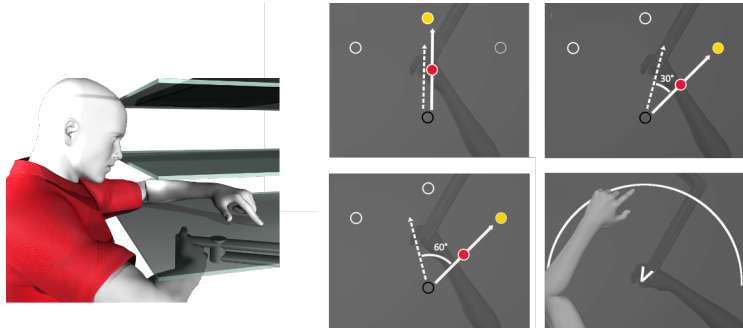


Efferent and afferent estimates of hand location do not optimally integrate

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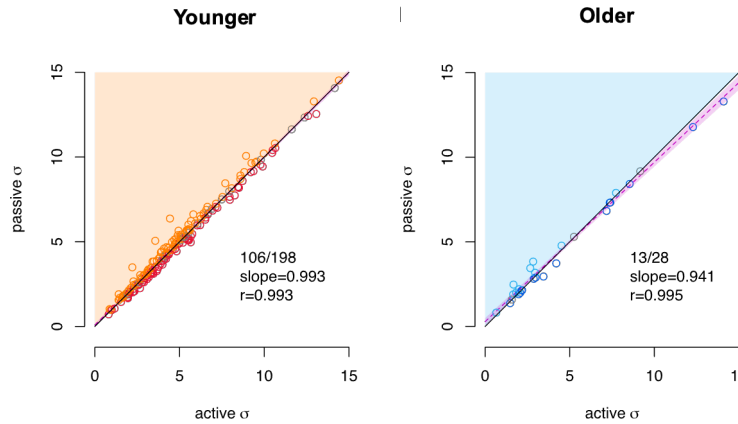
Hand Position is Central for Reaching

In the absence of vision, the CNS can localize the limb by relying on at least (1) proprioceptive afferents, and (2) an efference copy of the motor command used by the cerebellum to generate a prediction of sensory consequences. To produce a single location estimate, these two sources of information could be optimally integrated using maximum likelihood estimation (MLE).

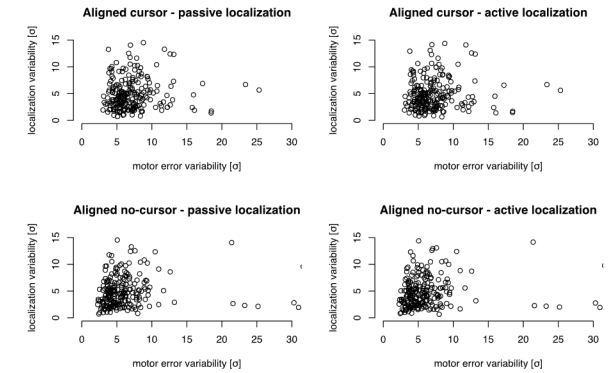


One or two signals: Equally reliable

Passive hand localization, with access to only proprioception, should be less reliable than active localization, with both proprioception and prediction, but it is not.

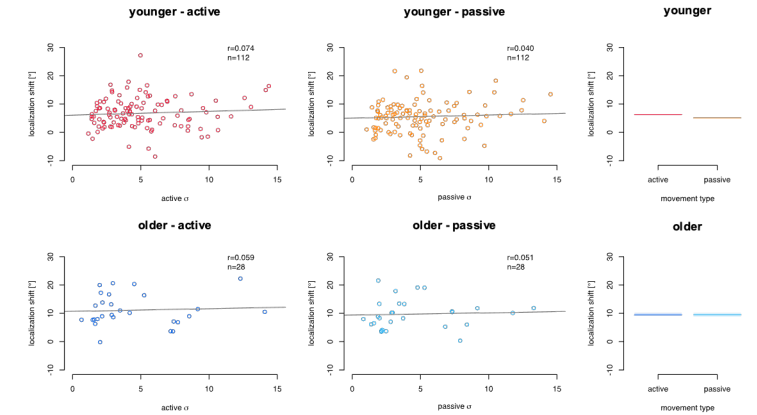


Reach variability does not account for localization variability



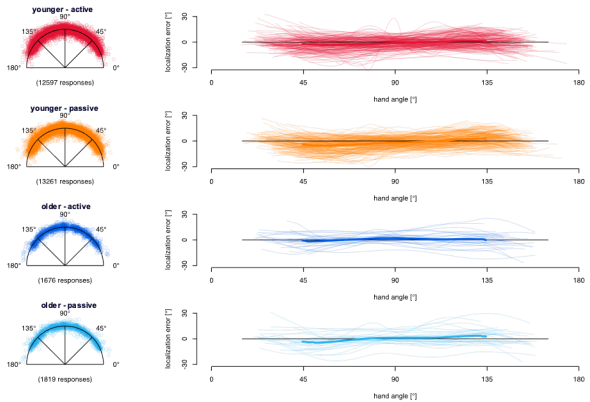
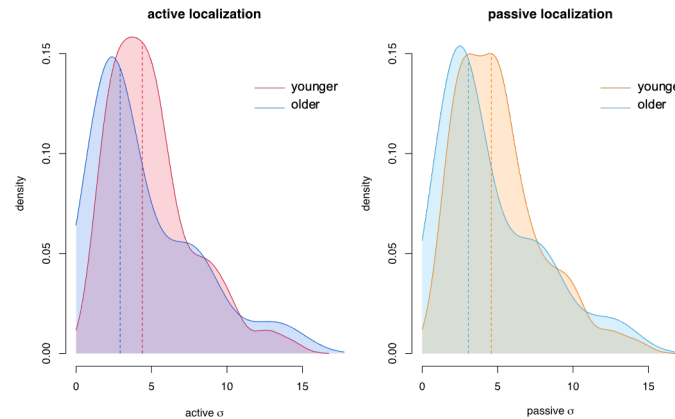
Here, we use our new paradigm to isolate efferent-based estimates of hand position from proprioception, by having over 200 healthy participants, both younger and older adults (55+), localize their hand after actively reaching in a self-chosen direction (active localization), or after being passively moved by a robotic manipulandum (passive localization).

Reliability does not predict change



No effect of age on reliability of localization

Older participants have slightly lower localization variability in general, but this is not significant.



The CNS does not use optimal integration to combine efferent-based predicted sensory consequences and proprioceptive afferents when estimating and updating the final limb position.