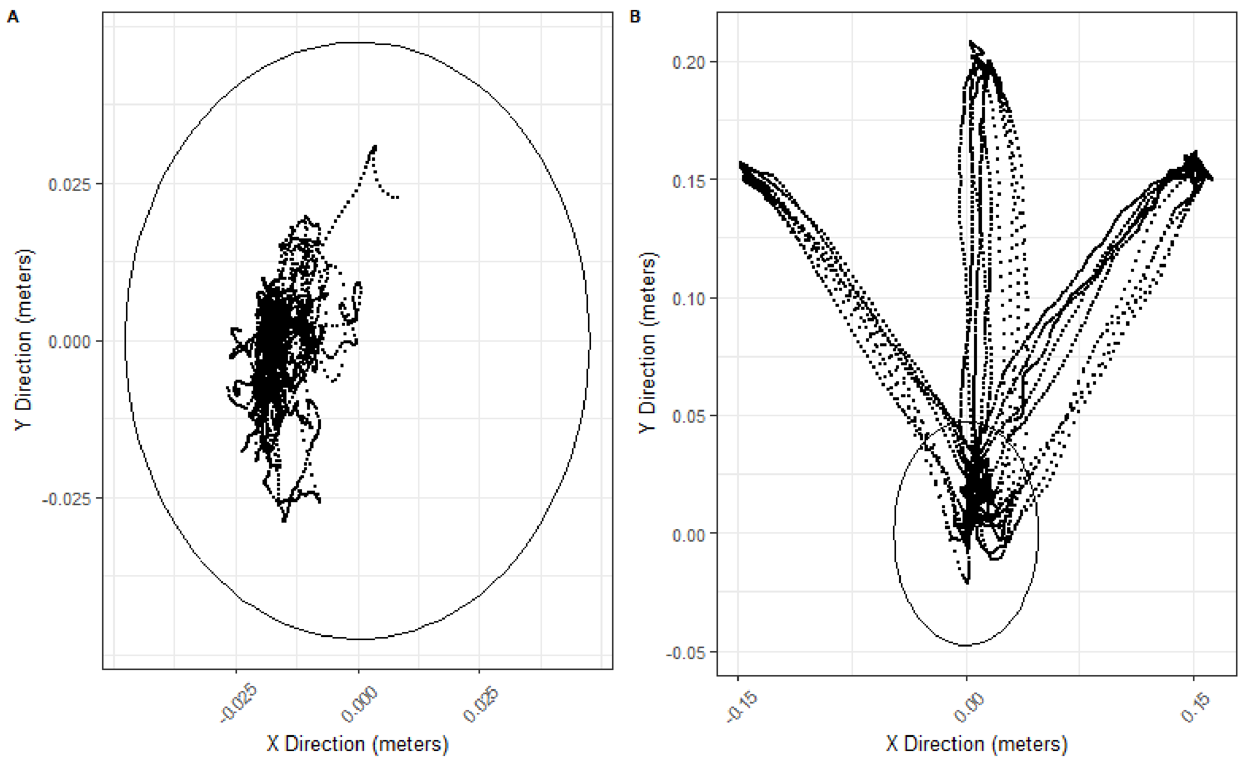

Figure 1S. Data from a representative participant for one trial of the motor task, parsed into the fine motor (A) and gross motor (B) phases. Panel A represents the total distance moved during the fine motor phase during a single trial, while Panel B represents all reaches from the home cup (solid circle) to each of the three target cups (targets not rendered here). Axes not to scale.

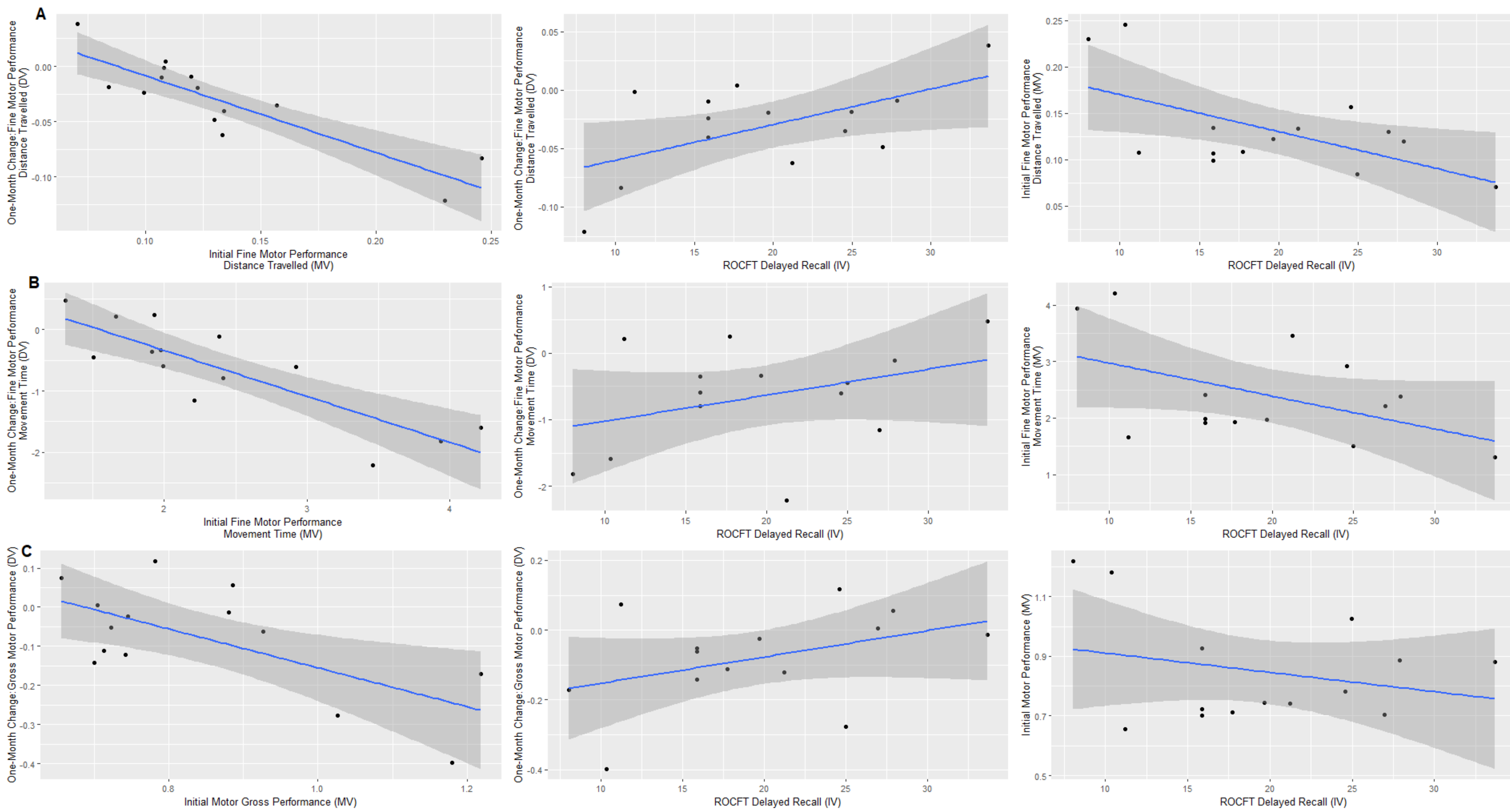

Figure 2S. Participant data for visualizing the relationship between each independent (IV), dependent (DV) and mediator (MV) variable for each phase. Top panels (Row A) indicate the fine motor phase in distance travelled. Middle panels (Row B) indicate fine motor phase in movement time. The bottom panels (Row C) indicate the gross motor phase movement time.

Validity the relationship between initial performance and one-month change

The correlation between a change score and an initial (or baseline) value may be spurious due to mathematical coupling (i.e., when one variable is part of another, such as Δ = y-x ~ x), or due to measurement error. It has been argued that high correlations between a baseline score and a change in score from baseline must be spurious if they are not accompanied by high correlations between baseline and follow-up. Additionally, previous research has argued that along with strong correlations between y ~ x and Δ ~ x, one can also look at the variance ratio *k* between the follow-up and baseline score (σ_y/σ_x) to also verify whether Δ and x are related. This is because Δ ~ x is dependent on the relationship of y ~ x and *k* (Oldham, 1962). Thus, it is feasible that values of *k* can lead to a strong Δ ~ x even with y ~ x equals 0. Previous research performing data simulations with ranges of k cor(x, y) and cor(x, Δ) have yielded a contour map that locates where a specific relationship and its corresponding *k* would fall within the likely space that the change to baseline relationship is legitimate or not (Goldsmith et al., 2021). Based on the values that we obtained, we visualized where the relationship of our fine motor skill falls along this contour map, although there is currently no definitive test to determine if the relationship between Δ ~ x is non-artifactual. However, presentation of the following analyses and their results will demonstrate our attempt at being both transparent and rigorous in the assessment of this relationship in the context of the primary purpose of this paper, which was to examine plausible causal links between visuospatial memory, initial performance and one-month change in performance for two distinct phases of our motor task.

Additionally, we utilized a resampling-based method on our data for deeper inference of *k* (i.e., a bootstrap procedure to produce an empirical distribution for *k*). Specifically, we resampled initial and follow-up values 1000 times and calculated *k* each time. This will provide an overall area on the contour map to visualize to further illustrate the point that our Δ ~ x is not spurious.

First, we performed a linear regression between distance traveled in the home cup during the one-month retention trial as the dependent variable, and distance traveled in the home cup at baseline as the independent variable. Results showed that initial distance traveled in the home cup predicted the distance traveled in the home cup at one-month follow-up (Supplemental Figure 3S, $p = 0.02$, $\beta = 0.3$, 95% CI = [0.06, 0.55], $R^2 = 0.38$). This demonstrates a strong relationship between baseline and follow-up values on the same measure, which is the first indication that the relationship is not spurious.

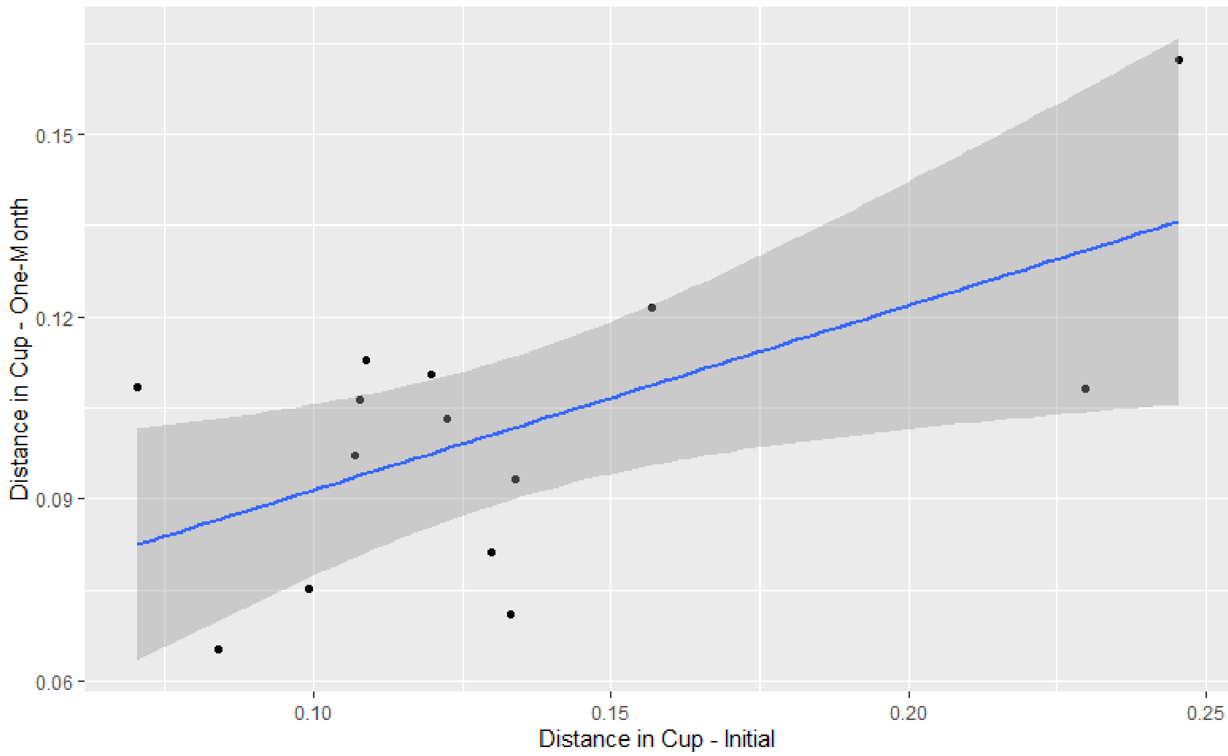

Figure 3S. The relationship between distance in cup at one month predicted by distance in cup at initial.

Second, we calculated the variance ratio $k = \sigma_y/\sigma_x$. The resulting k for our data set is 0.49. This is because the variance of measurement of the fine motor phase at one-month is smaller than the variance at the initial measurement (Supplemental Figure 4S). This suggests that some process, (i.e., skill learning) is taking place whereby fine motor skill improves with practice and is retained over time. Based on methods described by Goldsmith and colleagues (2021), we visualize where the cor(x, Δ) and cor(x,y) of distance in the home cup, with its corresponding k (Supplemental Figure 5S). Based on this visualization and the strength of cor(x,y) between initial and one-month distance traveled in the home cup, it is likely that the relationship between initial performance and one-month change is non-artifactual (see red dot in Supplemental Figure 5S). Previous research has suggested that spurious cor(x, Δ) occurs when k is close to or equal to 1, but in our case the cor(x,y) is near 0 (see yellow dot in Supplemental Figure 5S).

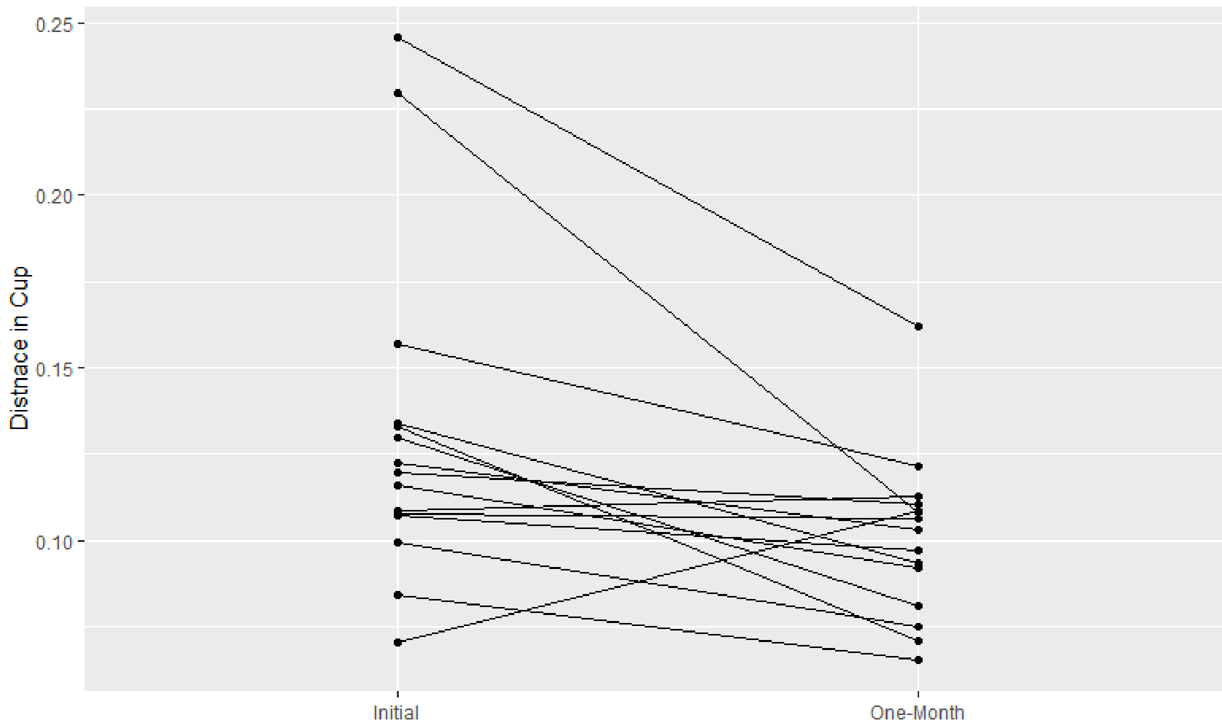

Figure 4S. Individual participant data of distance traveled in the home cup at the initial observation and at one-month follow-up. Across these two timepoints, improvements in performance begin to converge (i.e., variance at one-month is smaller than variance at initial performance).

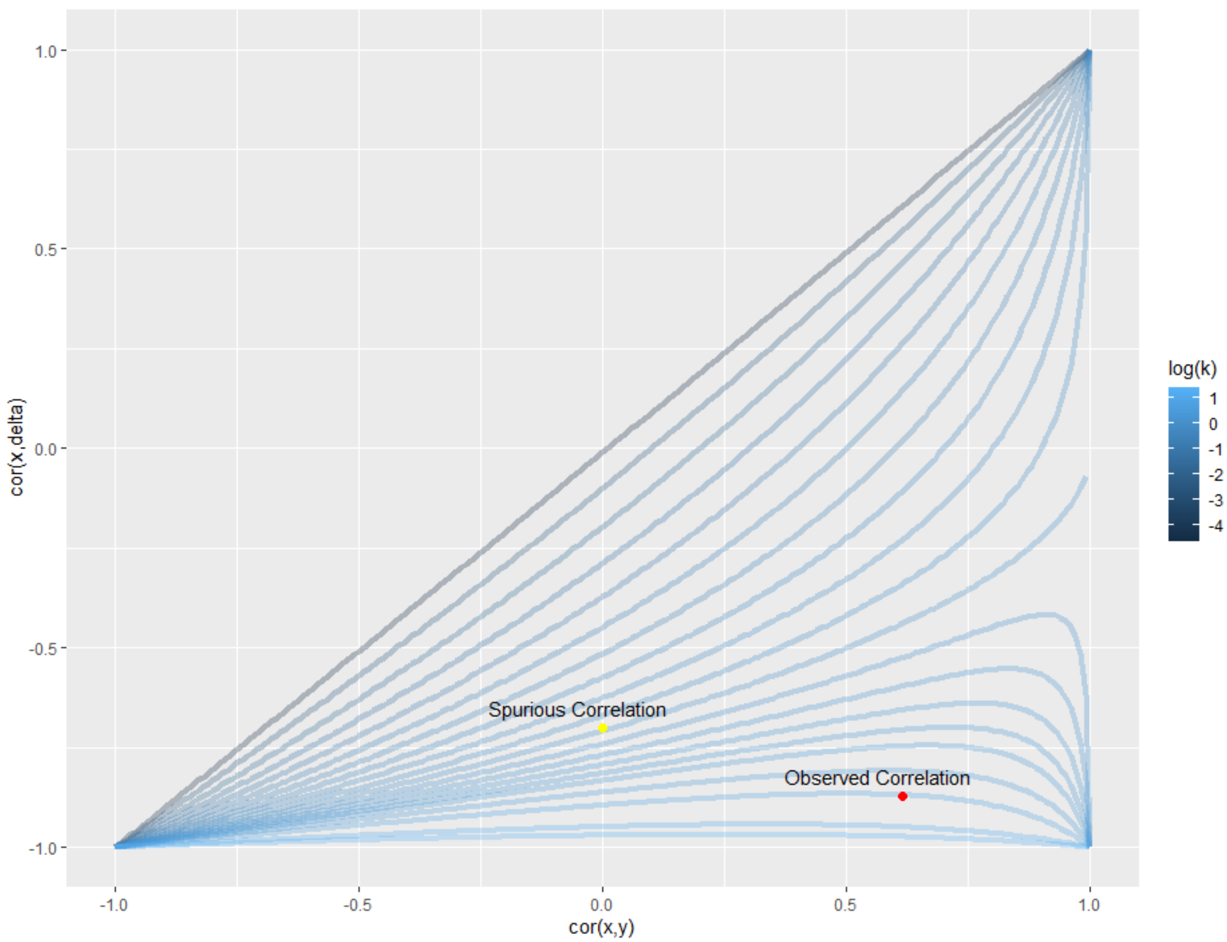

Figure 5S. Contour map visualizing simulated contours between possible mappings between cor(x,y) and cor(x,delta) given a specific variance ratio, *k*. Our observed relationship (red dot) falls within lines of a non-artifactual correlation compared to a spurious correlation (yellow dot).