The Stability of The Current Motor State is Influenced by Expected Movement: Do Cognitive Events During the Inter-Stimulus Interval of Choice Reaction-Time Tasks Have a Motor Counterpart?

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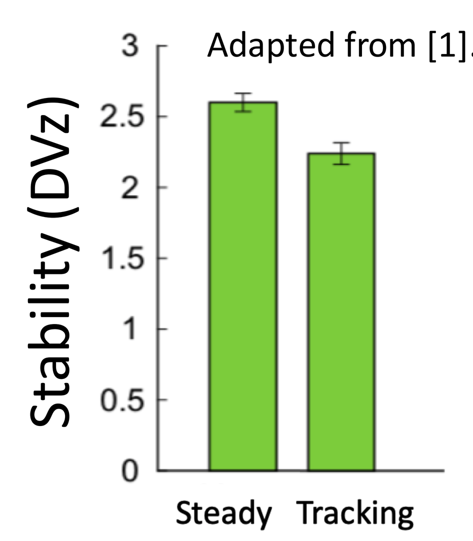
PURPOSE: Determine the relative contributions of **prior** and **expected** movements to the stability of a current motor state.

INTRODUCTION

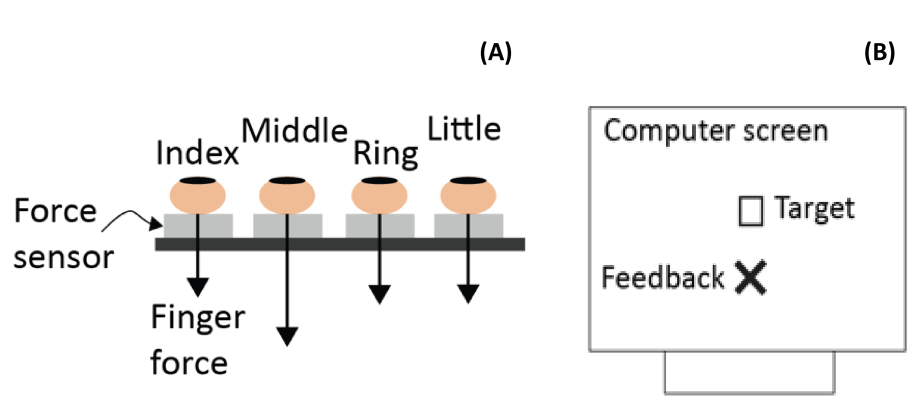
- Stability of a motor state is the ability to maintain that state by rejecting disturbances.
- We previously showed that stability of a motor state reduces prior to voluntary motor state transition, independent of its execution [1].
- It is also known that it takes time to establish the stability of the current motor state when preceded by other motor patterns.
- Stability of a current motor state is influenced by **prior** and **expected** movements.



Left. Significant stability reduction during the inter-stimulus interval of a reaction time task in 25 young healthy adults between the known-invariant target ***Steady*** task and the randomly moving target ***Tracking*** task.

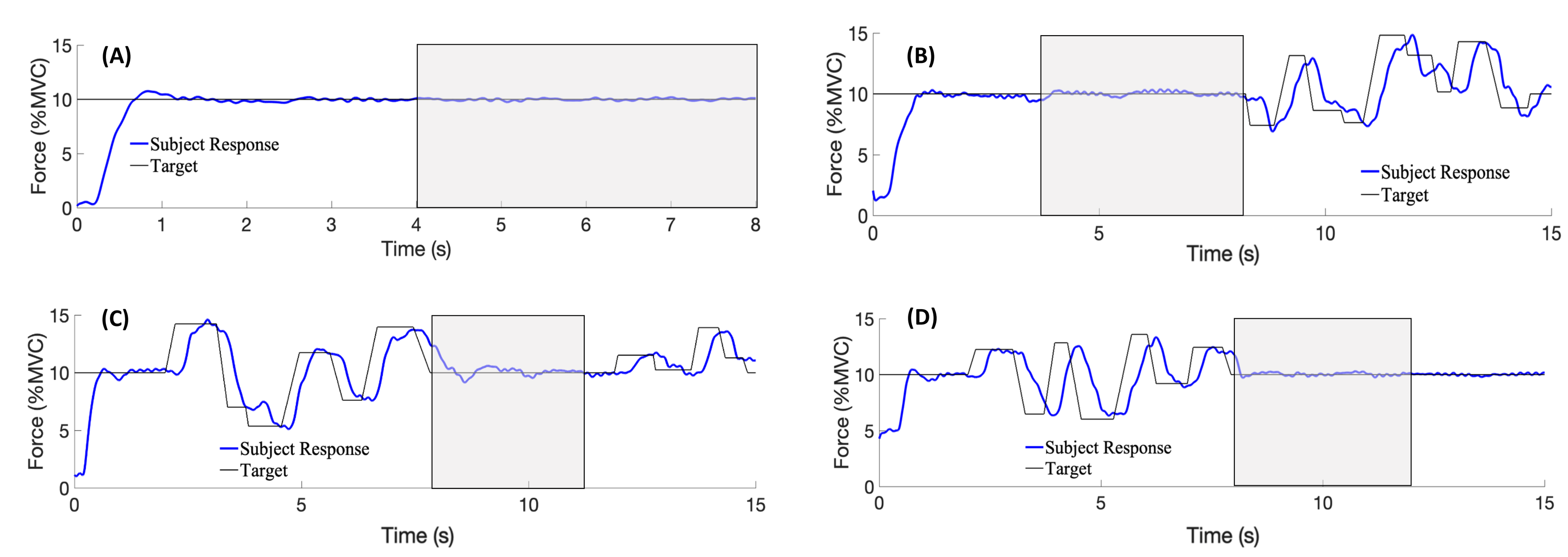
METHODS

- 22 participants (21.04 ± 0.4 years) produced a total force F_T with four finger forces: $F_1 + F_2 + F_3 + F_4 = F_T$.
- Participants tracked a target force with their total force
- One stationary target portion per trial, 4 task types, 20 trials per task type.
- Stability is computed over 1 second window when target is stationary at 10% MVC using RMSE (target – F_T) and the uncontrolled manifold analysis.



$$F_1 + F_2 + F_3 + F_4 = F_T$$

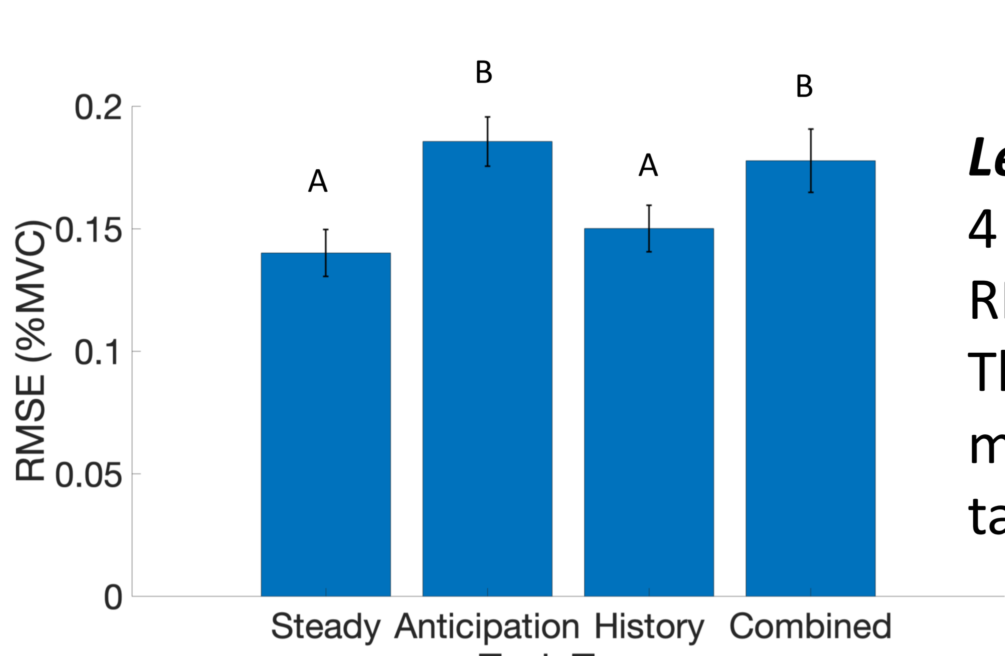
Left. The four finger force sensors setup **(A)**. The target box and F_T feedback cursor on a computer screen **(B)**.



Above. Timeseries of representative trials for the four task types. The Steady task **(A)**, Anticipation task **(B)**, Combined task **(C)** and History task **(D)** to isolate those components' respective contributions to stability. Stability was analyzed during the 4+ seconds inter-stimulus interval (ISI = grey shaded regions) in all four tasks.

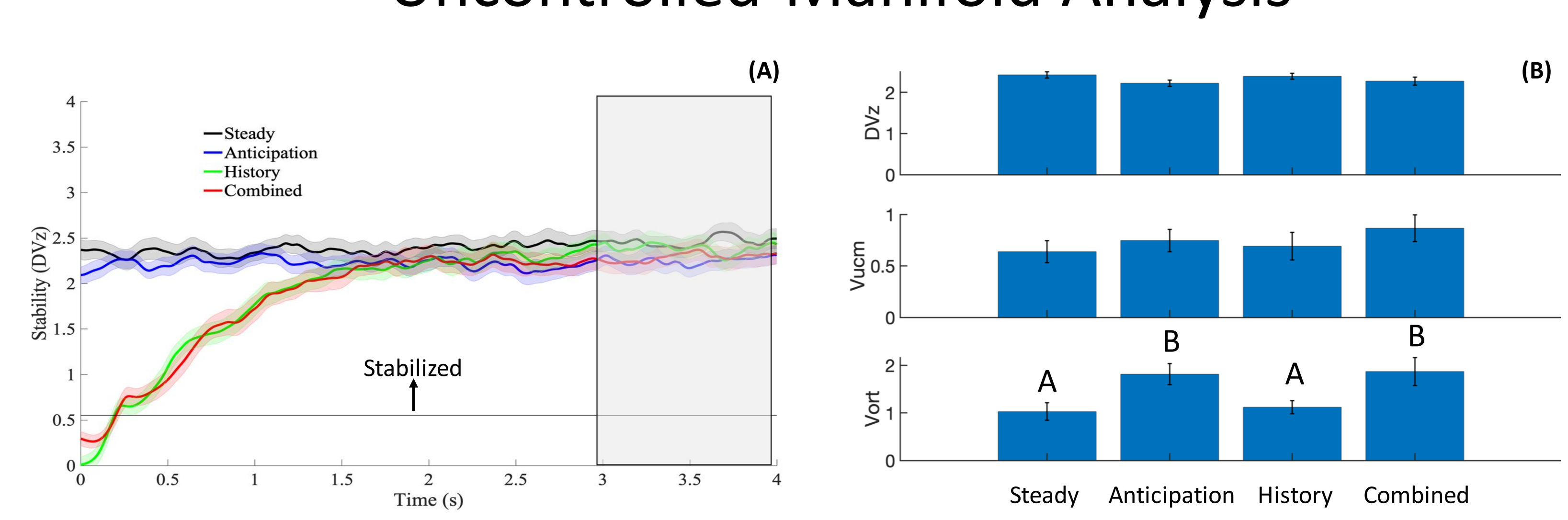
RESULTS

- Main effect of Task type [$F(3,21)=14.02$; $P < 0.01$].
- Larger RMSE implies lower stability.
- Stability of finger forces was greater when no movement was expected (Steady & History tasks) compared to when it was expected (Anticipation & Combined tasks).



Left. RMSE values during t=3-4 seconds of the ISI. Higher RMSE implies lower stability. The *uncued* task types (**A**) are more stable than the *cued* task types (**B**).

Uncontrolled Manifold Analysis



Above. Timeseries of stability **(A)**. Across-subject values of stability (DVz) and variance components (Vucm and Vort) **(B)**.

CONCLUSION

Effects of **prior** actions on the stability of the current state die out during the inter-stimulus interval, whereas the effects of **expected** motor actions on the current motor state dominate.

Stability reduction during ISI may be a motor counterpart of readiness potentials.

Reference: 1. Tillman and Ambike, *J. Neurophysiol,* 119:21-22, 2018.