Quantifying and attenuating pathologic tremor in virtual reality

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Abstract

We present a VR experience that creates a research-grade benchmark in assessing patients with active upper-limb tremor, while simultaneously offering the opportunity for patients to engage with VR experiences without their pathologic tremor.

Figure 1: Experimental setup in the field, with a healthy subject (picture used with permission). Under a tent, the computer and virtual reality peripherals are powered by an automotive inverter.

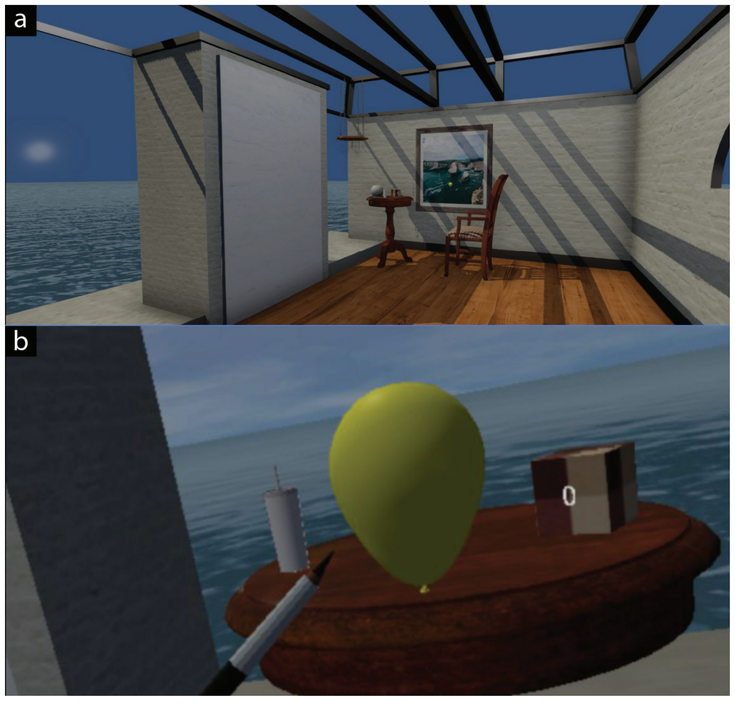

Figure 2: (a) Within a calming environment, (b) the patient pops balloons between their nose and a point using a pencil that takes its coordinates from the VR Controller.

It's challenging for patients to complete precision tasks in VR with a tremor. That's why we conduct tremor-nullification, which low-pass-filters the controller position. This means the patient sees a smooth pencil in spite of their hand shaking in the real world. Raw data from the controllers are collected.

Results

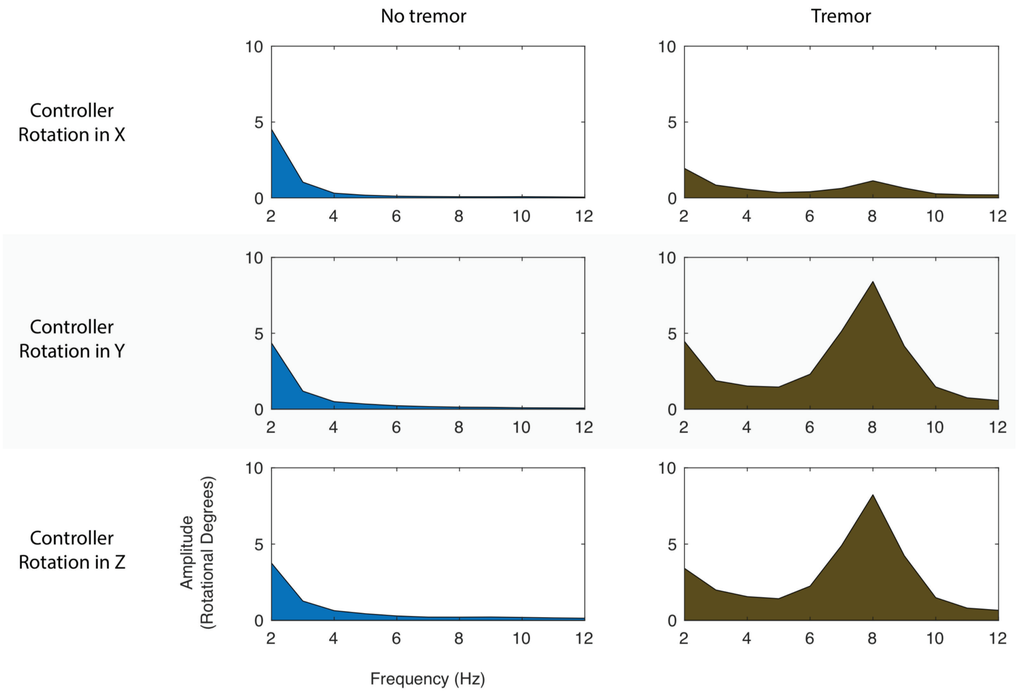

Figure 3. Data collected for a subject creating a patient-like tremorous movement. (a) 3D positions over time are used to generate (b) frequency distribution curves, which illustrate the amplitude of shaking across the different frequencies, along different axes of movement.

Conclusion

Tremor is readily measured across different dimensions, and further analysis can identify task-specific tremor profiles.

Furure steps:
Conduct clinical trial with Parkinson's Patients
Synchronization with EMG signals
Create partnership with a PT/OT clinic
Expand into motor learning and control

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