

Compensation for visual reafferent signals in functional neurological disorder subtype PPPD

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Introduction

- Persistent Postural Perceptual Dizziness (PPPD):** Functional Neurological Disorder (FND) subtype with no structural abnormalities but symptoms of chronic dizziness/perceived unstable environment [1].
- Study to Assess & Reduce Dizziness Using Sensory Theory (STARDUST):** Asks whether PPPD symptoms driven by changes in mechanisms that compensate for reafferent visual signals arising during self-motion.
- One such mechanism, **Flow Parsing (FP)**, involves analysing retinal motion to filter optic flow due to self-motion [2,3].
- Here, we present preliminary data in two tasks comparing FP performance in control and PPPD patient groups. We test the **mismatch hypothesis** that PPPD symptoms arise from inappropriate compensation for reafferent optic flow

Methods

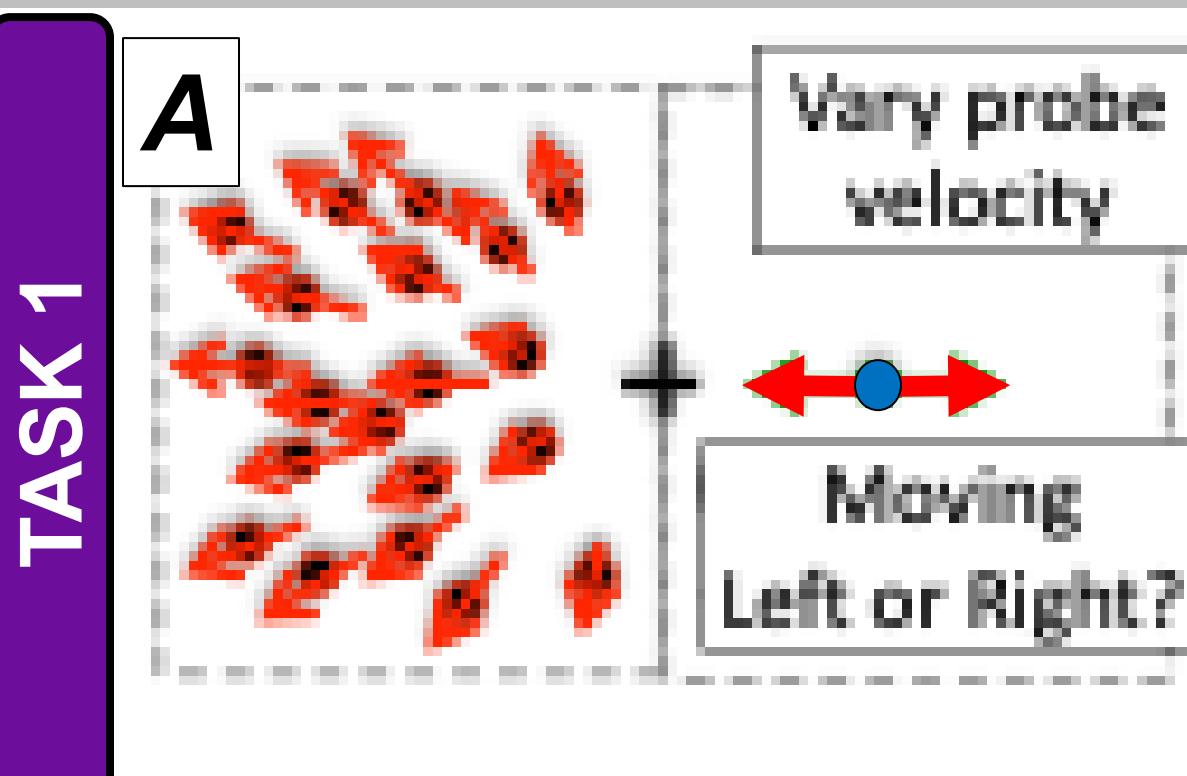


Figure 1: A. Task 1 schematic; B. Psychometric function fits; C. Typical pattern of FP biases

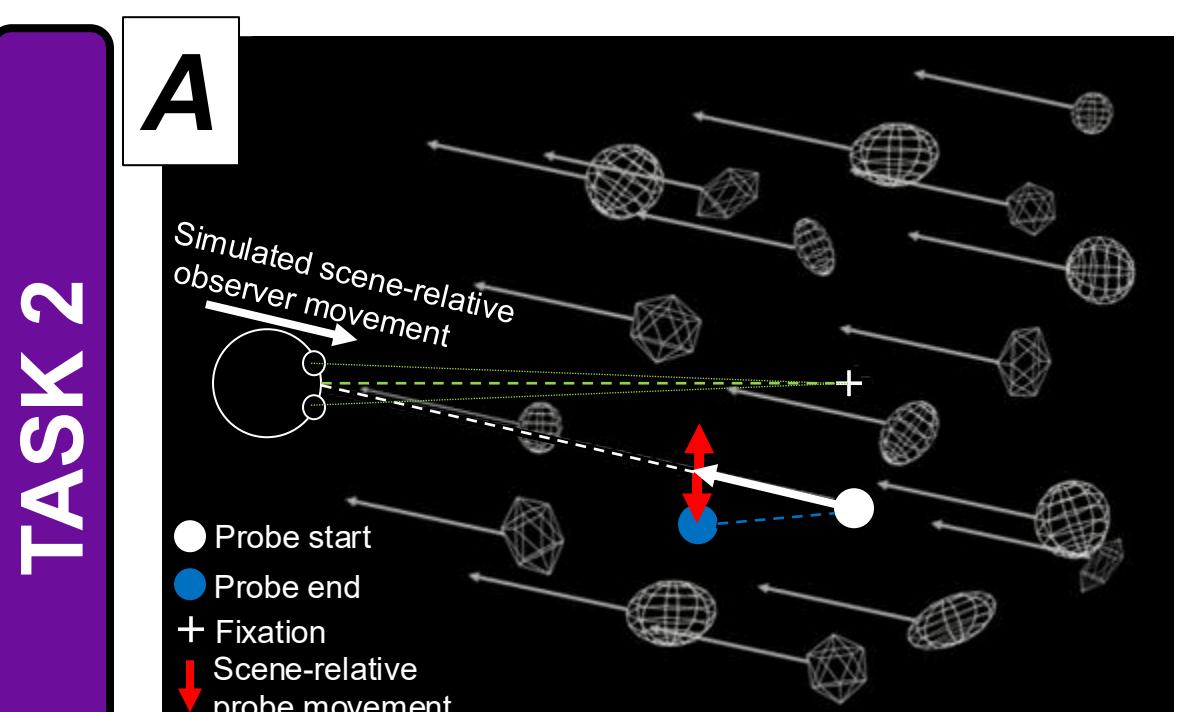


Figure 2: A. Task 2 schematic (overhead view); B. Psychometric function (PMF) fits C. PMF slopes and FP Index (Δ)

- N = 33 (21 patients, 12 controls). Age and IQ matched.
- All patients had pre-screening interview for eligibility with a neurologist or vestibular/balance clinician.
- Task 1:** Stationary observers view 2D hemifield of optic flow simulating forward movement + probe in opposite hemifield (Fig. 1A). Horizontal probe velocity controlled by adaptive staircase. Participant reports scene-relative probe direction (L/R). FP-induced bias (β) in perceived probe motion recovered from psychometric function fits (Fig. 1B). Bias recovered for flow (IN, OUT) x probe (Left, Right) conditions (Fig. 1C)
- Task 2:** Stationary observers view 3D scene comprising wireframe objects + laterally displaced probe. Scene stationary or moving to simulate forward+lateral observer movement (Fig. 2A). Independent lateral probe velocity controlled by adaptive staircase. Participant reports scene-relative probe direction (L/R). Probe direction discrimination thresholds = slopes of static & moving psychometric functions (Fig. 2B). FP Index (FPI) $\Delta = \sigma_{mov}/\sigma_{stat}$. (Fig. 2C).

Results

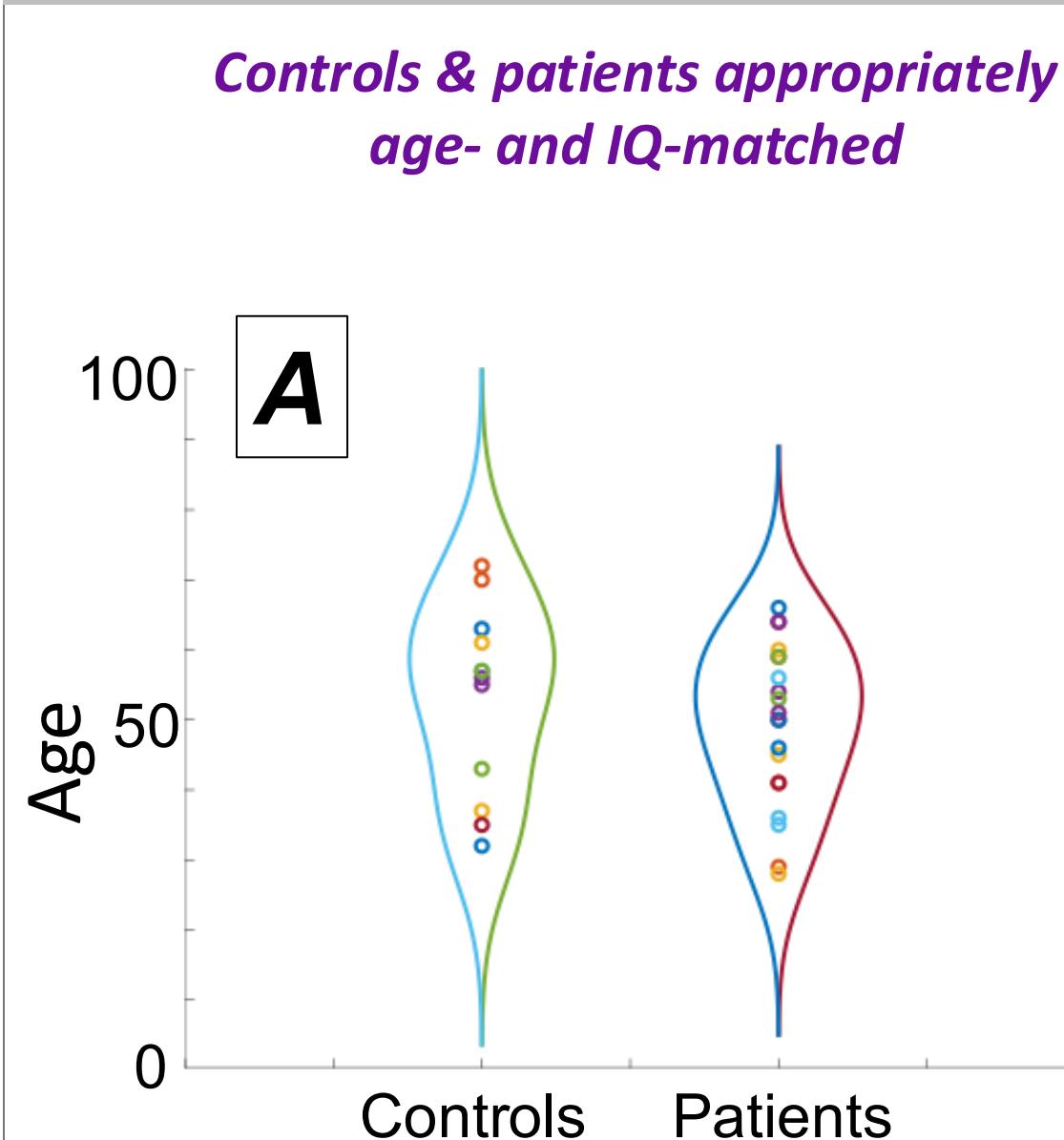


Figure 3: A. Age distributions and B. IQ distributions by group

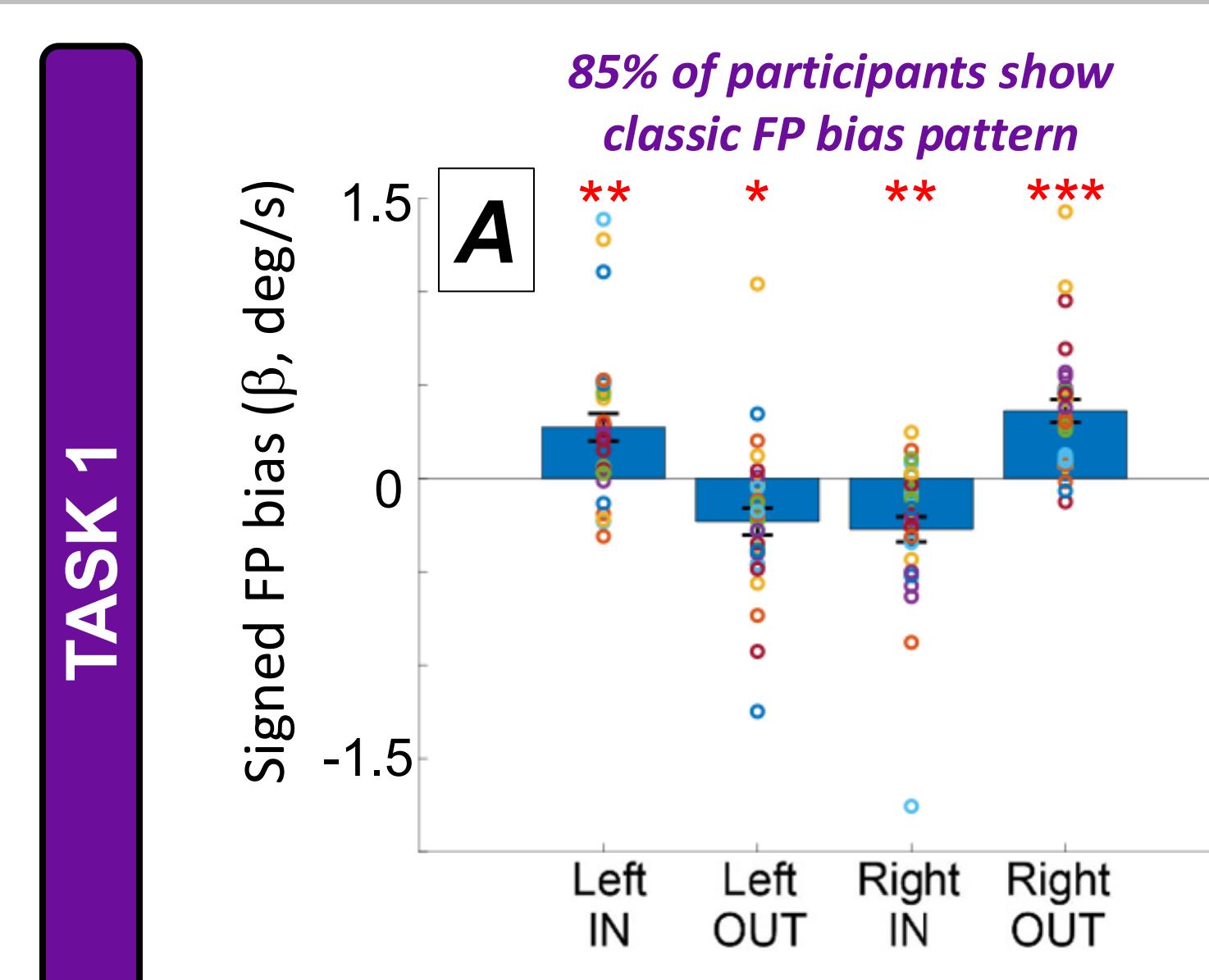


Figure 4: Task 1 data – A. Signed FP bias (β) across conditions; B. Counts of typical vs atypical participants; C. Absolute FP bias split by typical/atypical patients

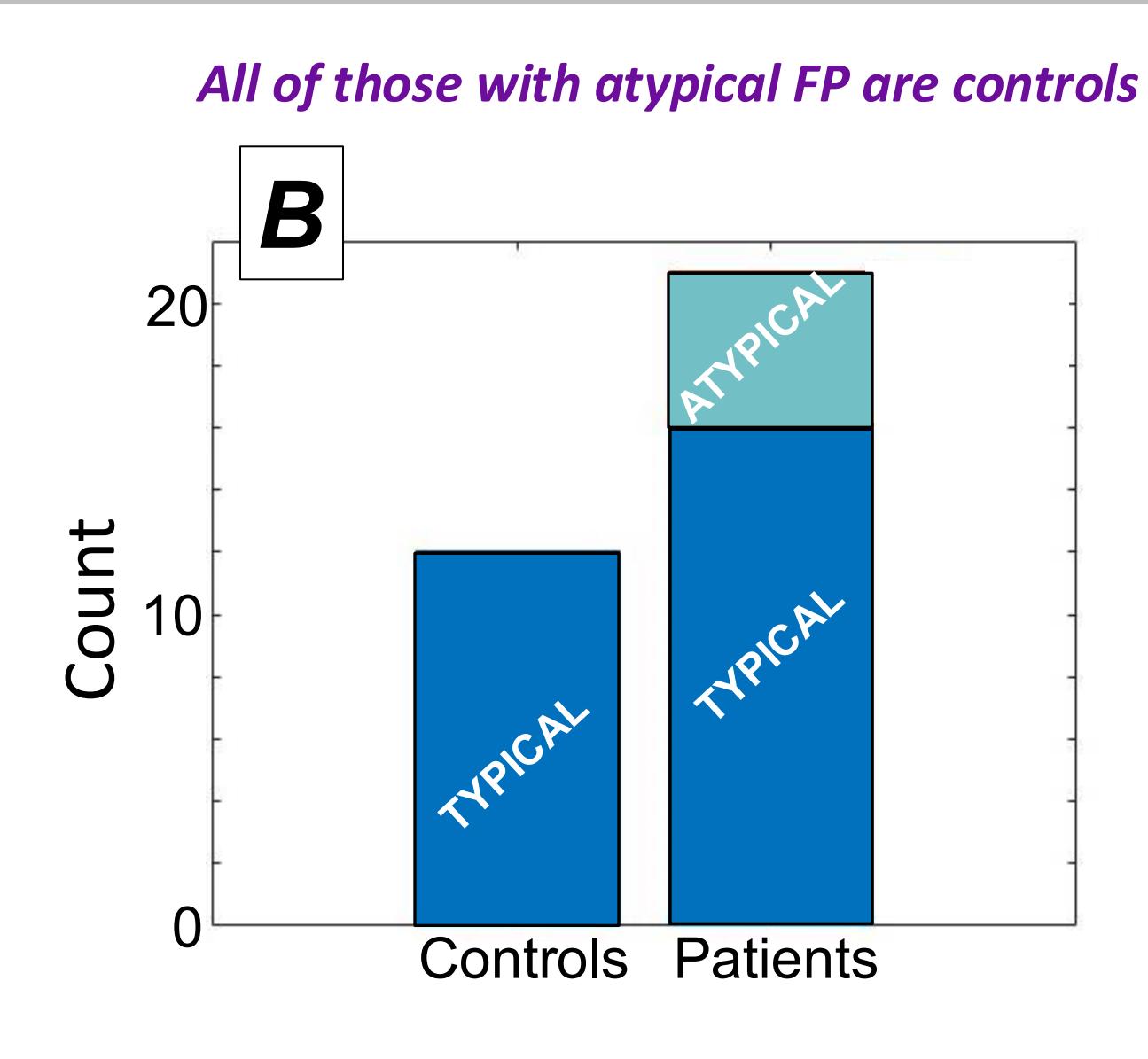


Figure 5: Task 2 data – A. L/R discrimination thresholds for static & moving conditions; B. FPI Index by group; C. FPI index by typical/atypical patients from Task 1

Conclusions

- Preliminary evidence for mismatch hypothesis:** May contribute to dizziness/scene instability symptoms in PPPD via mismatched compensation for reafferent visual self-motion signals.
- PPPD subtypes?**: Raises the possibility that PPPD diagnosis may incorporate different sub-types.
- STARDUST project:** Continues (60% complete) to investigate mismatch hypothesis as well as the **integration hypothesis** suggesting altered integration of sensory cues to self movement in PPPD. For preliminary results see poster **PSTR173.02**, Board S5 @ 0800-1200 tomorrow

References

- Popkirov, S., Staab, J. P., & Stone, J. (2018). Persistent postural-perceptual dizziness (PPPD): A common, characteristic and treatable cause of chronic dizziness. *Practical Neurology*, 18(1), 5–13.
- Rushton, S. K., & Warren, P. A. (2005). Moving observers, relative retinal motion and the detection of object movement. *Current Biology*, 15(14), R542–R543.
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