Observing the Effects of Cognitive Fatigue on Performance in Basketball

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Introduction

Prior Research

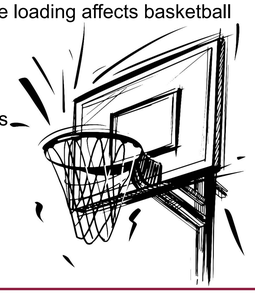
- Prolonged cognitive demand reduces executive function and attentional control [1]
- Cognitive fatigue can impair physical performance through central mechanisms [2]
- Sustained cognitive effort worsens endurance outcomes more consistently than sport-specific motor outcomes [3]
- Cognitive load impairs sport-specific performance, especially physical and technical execution [4]

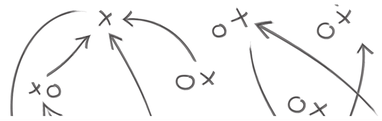
Study Goal

- Basketball specific cognitive fatigue effects on reaction time remain underexplored
- Existing sport fatigue work emphasizes endurance and accuracy more than movement timing
- Rapid basketball actions such as cutting and catching depend on temporally sensitive responses
- This study aimed to quantify how repeated cognitive loading affects basketball specific reaction time

Hypothesis

- As cognitive fatigue increases, player reaction times are expected to increase





Methods

Overview

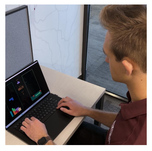
- Subjects were equipped with 2 IMU's and movements recorded using a camera
- A cognitive and reaction time baselines were established at the start of testing
- All cognitive levels were based on subjects' Stroop Test times

RED BLUE
BLACK YELLOW

Stroop Test → 10 Side Cuts

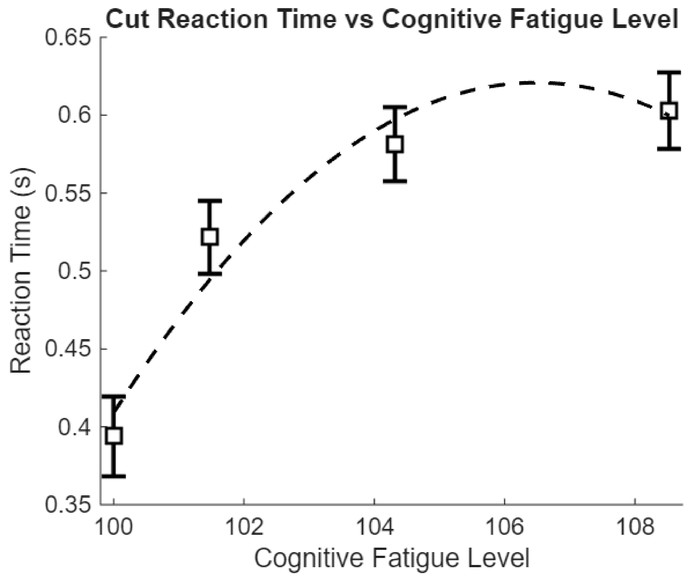
10 Throws → 5 Minutes of Fatigue Inducing Game

X3



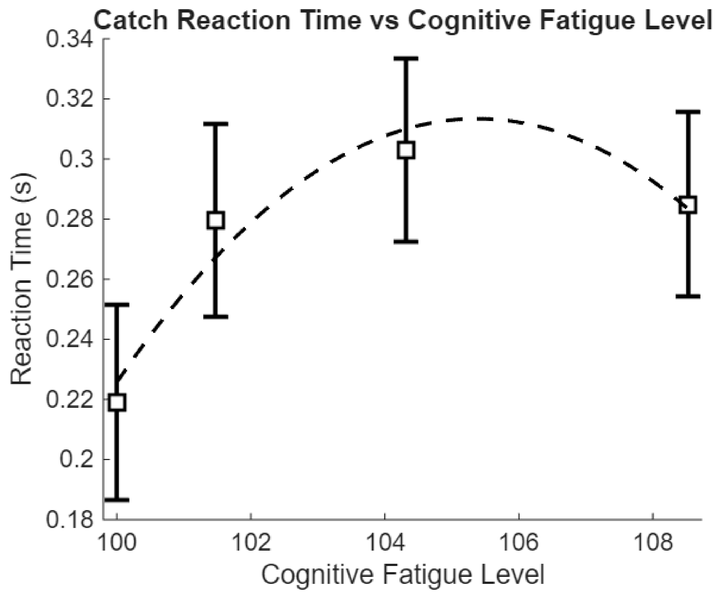
For a fun and detailed explanation of the study's set up and execution, check out the video!

Results



Side Cuts

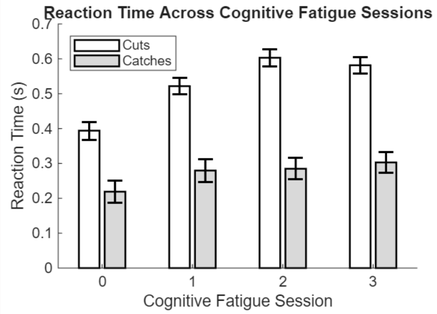
- Mean cut reaction time increased across all cognitive fatigue levels
- Second order fit suggests a nonlinear relationship, characterized by initial increase in reaction time followed by a relative plateau at higher fatigue levels



Catches

- Mean catch reaction time increased across cognitive fatigue levels, but with a lower magnitude of change than cuts
- Second order fit suggests a nonlinear relationship

Results



Mental or Physical Fatigue?

- Reaction time (RT) did not track session order directly
- If compounded physical fatigue were the primary driver, RT would be expected to directly increase across sessions
- The observed pattern supports cognitive fatigue as stronger contributor to increased RT

Summary, Conclusions and Future Directions

Key Take Aways

- Cognitive fatigue shown to directly correspond with increasing RT
- A more substantial trend observed in full body side cuts vs. catches
- RT patterns consistent with cognitive fatigue rather than physical

Next Steps

- Phase 2 aims to identify how players' cognitive levels and reaction times vary during actual game play and if similar findings for RT vs cognitive levels are observed
- For game play, movements such as side cuts and catches will be used to identify RT

Baseline Stroop → 15 minutes of Gameplay → Stroop → 15 minutes of Gameplay → Repeat Until Game Finished

References

[1] A. Boksem and M. Tops, "Mental fatigue: Costs and benefits," *Brain Research Reviews*.
[2] S. M. Marcora, W. Staiano, and V. Manning, "Mental fatigue impairs physical performance in humans," *Journal of Applied Physiology*.
[3] D. Van Cutsem, B. Marcora, K. De Pauw, et al., "The effects of mental fatigue on physical performance: A systematic review," *Sports Medicine*.
[4] M. R. Smith, J. Coutts, D. Merlini, R. Deprez, M. Lenoir, and S. Marcora, "Mental fatigue impairs soccer-specific physical and technical performance," *Medicine & Science in Sports & Exercise*.

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