Video Games and Neuropsychological Tests: A Comparative Study

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Introduction

How do we detect age associated cognitive decline early, facilitating early diagnosis and treatment?

- Typically, neuropsychological tests administered by trained clinicians, and infrequently – barriers to early detection
- Tests can also create anxiety, which can influence performance

Research Question:

Can *video game play* at home, delivered via a tablet, be used to measure cognitive ability and cognitive decline?

- In this study, gold-standard neuropsychological tests are compared to game scores at home in a sample of older adults

Mind Frontiers

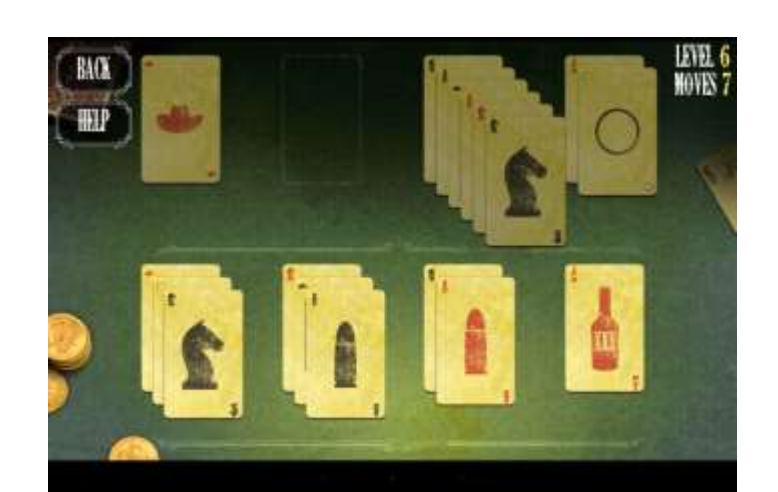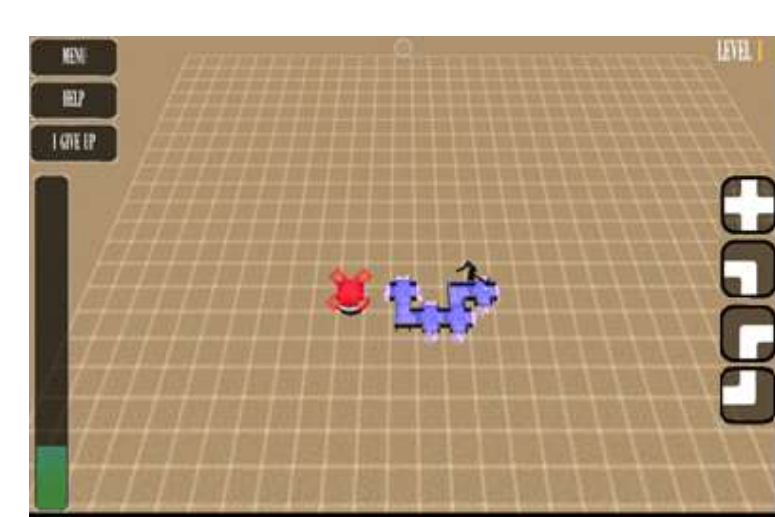**Gamified versions of neuropsychological/cognitive tests**

SENTRY DUTY
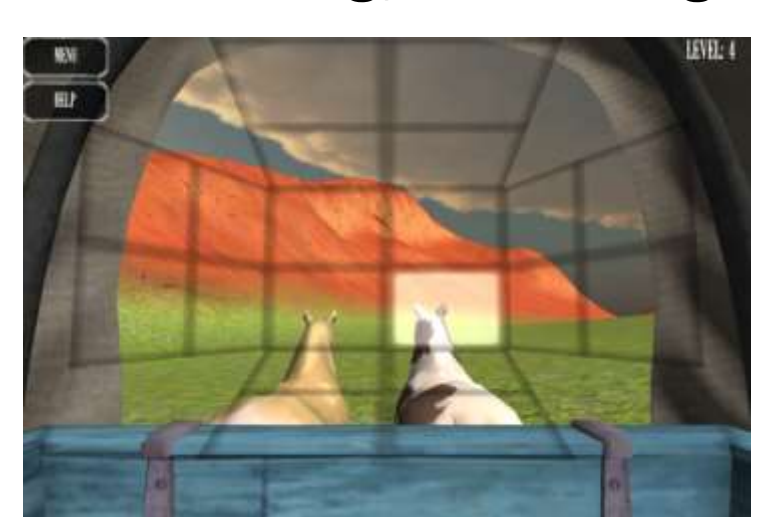**Working Memory**

PEN 'EM UP
Task Switching

SUPPLY RUN
Working Memory

ANTE UP
Planning/Reasoning

IRRIGATOR
Visuospatial Reasoning

RIDING SHOTGUN
Spatial Memory

Methods

Participants:

Secondary analysis of data from Harrell, Roque, Boot, & Charness (2021)

- Originally intended to assess adherence to technology-based interventions

101 healthy older adults with game data

- M age = 72.8 years, SD = 5.47

Procedure:

- Diverse cognitive battery administered in the lab
- Participants asked to play games 5 times a week
  - 45 minutes per session

Cognitive Battery:

Memory:
- Hopkins Verbal Learning Test
- Rey Auditory Verbal Learning Test

Reasoning:
- Letter Sets
- Raven's Advanced Progressive Matrices

Processing Speed:
- Digit Symbol Substitution
- Useful field of View

Composite scores created for each cognitive domain

Game level achieved during week 3 analyzed

Results

Correlations

	Memory	Speed	Reasoning
AnteUp	**0.32**	**0.34**	**0.51**
Irrigator	**0.38**	**0.39**	**0.45**
PenEmUp	**0.25**	**0.22**	**0.21**
RidingShotgun	0.14	**0.27**	**0.31**
SentryDuty	**0.32**	**0.42**	**0.55**
SupplyRun	**0.40**	**0.41**	**0.39**
TraderJacks	0.15	**0.28**	**0.40**

Robust correlations between game performance and cognitive performance (red: $p < .05$)

Results

Regression

Single games predicted cognition well – what about all games together?

- Linear regressions conducted, with all 7 games used to predict each cognitive domain

Reasoning: Game scores accounted for **50%** of the variance in reasoning ability
- Sentry Duty strongly predictive ($p < .001$), trend for Trader Jacks ($p = .09$)

Processing Speed: Game scores accounted for **34%** of the variance in reasoning ability
- Irrigator strongly predictive ($p < .05$), trend for Supply Run ($p = .05$)

Memory: Game scores combined had little ability to predict memory performance.

Conclusions

- Simple correlations demonstrated modest but significant relations between gold-standard measures of cognition and video game performance

- Data from all games combined can account to 50% of the variance in some cognitive abilities

- Results provide initial support for the potential of games to assess cognition at home, this approach may be a promising means to detect cognitive change early to promote early intervention

References

Harrell, E. R., Roque, N. A., Boot, W. R., & Charness, N. (2021). Investigating message framing to improve adherence to technology-based cognitive interventions. *Psychology and Aging*, *36*(8), 974–982.