

AWARD NUMBER: W81XWH-19-1-0798

TITLE: Virtual Reality-Based Assessment of Functional Capacities in Individuals with Alzheimer's Disease or Alzheimer's Disease-Related Dementia

PRINCIPAL INVESTIGATOR: Michael Barnett

CONTRACTING ORGANIZATION: The University of Texas at Tyler

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<b>13. SUPPLEMENTARY NOTES</b>					
<b>14. ABSTRACT</b> The primary aim of this project is to pilot the Virtual Environment Grocery Store (VEGS) and Virtual Apartment for use among older adults with cognitive impairment. A related aim is the development and evaluation of computational and statistical models of patient data from the virtual environments that generate reports for caregivers. Our ultimate goal is to provide clinical assessments and clinical feedback to patients that is more meaningful for the lives of aging adults. We will compare measures embedded in the virtual environments with measures obtained from traditional neuropsychological tests. We will compare older adults with Alzheimer's Disease (AD)/Alzheimer's Disease Related Dementia (ADRD) and no history of traumatic brain injury (TBI), those with AD/ADRD and a history of TBI, and healthy controls on both traditional neuropsychological tests and those embedded in the virtual environments. We will gather patient/caregiver feedback regarding the utility of the reports generated by the virtual environments.					
<b>15. SUBJECT TERMS</b> Neuropsychological assessment; virtual reality, Virtual Environment Grocery Store; Virtual Apartment; older adults; Alzheimer's disease; dementia; traumatic brain injury					
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## 1. Introduction

The purpose of this study is to pilot two virtual reality environments – the Virtual Environment Grocery Store (VEGS) and the Virtual Apartment – for use with older adults with neurocognitive impairment.

## 2. Keywords

Neuropsychological assessment; virtual reality, Virtual Environment Grocery Store; Virtual Apartment; older adults; Alzheimer’s disease; dementia; traumatic brain injury

## 3. Accomplishments

Abbreviations: The University of Texas at Tyler (UTT); Michael Barnett (MB); University of North Texas (UNT); Thomas Parsons (TP)

<b>Specific Aim 1</b> – The <b>primary aim</b> is to pilot the Virtual Environment Grocery Store (VEGS) for use among older adults with TBI and AD/ADRD.	<b>Time line</b>	<b>UTT</b>	<b>U N T</b>	<b>% Complete</b>
<b>Major Task 1: Finalize protocols and obtain IRB and USAMRDC HRPO approval</b>	Months			
<b>Subtask 1:</b> Meeting of all key personnel to finalize study protocols for UT Tyler IRB	1	MB	TP	100%
<i>Milestone #1: Create written protocol for UT Tyler IRB and establish regular meetings</i>	3	MB	TP	100%
<b>Subtask 2:</b> Meeting of all key personnel to finalize study protocols for USAMRDC HRPO	4	MB	TP	100%
<i>Milestone #2: Create written protocol for USAMRDC HRPO and submit</i>	4-8	MB	TP	100%
<b>Subtask 3:</b> Meeting of all key personnel to finalize modifications, if necessary, for UT Tyler IRB	8	MB	TP	100%
<i>Milestone #3: Create written modification for UT Tyler IRB, based on USAMRDC HRPO feedback, and</i>	8	MB	TP	

<i>submit to UT Tyler IRB</i>				100%
<b>Major Task 2: VEGS content refinement and testing to develop caregiver feedback</b>				
<b>Subtask 1:</b> Storyboard materials and generating example scripts; data logging implemented; plan feedback to caregivers	2-4		TP	100%
<b>Subtask 2:</b> Recruit participants and run them through neuropsychological assessments and VEGS [Total $n = 20$ patients from one of the clinical groups – i.e., with probable AD/ADRD and either with or without TBI – and their caregivers]	5-12	MB		100%
<b>Milestone #2:</b> Meeting of all key personnel to review VEGS and feedback from caregivers	13	MB	TP	0%
<b>Specific Aim 2</b> – The <b>secondary aims</b> are to 1) conduct study comparing persons with AD to healthy controls on neuropsychological assessments and VEGS; and 2) assess reaction/satisfaction of caregivers to feedback from the VEGS.				
<b>Major Task 3: Conduct Comparison Study comparing persons with AD to healthy controls on neuropsychological assessments and VEGS</b>				
<b>Subtask 1:</b> Recruit participants for study. Ultimate goal: Healthy older adult controls ( $n = 90$ ), no history of TBI and probable AD/ADRD ( $n = 90$ ), history of TBI and probable AD/ADRD ( $n = 90$ )	14-30	MB		30%
<b>Subtask 2:</b> Conduct comparison study	14-30	MB		100%
<b>Subtask 3:</b> Database development	14-30	MB	TP	100%
<b>Milestone #3:</b> Meeting of all key personnel to compile and discuss data gathered	30	MB	TP	0%
<b>Major Task 4: Comparison Study Data analytics</b>				
<b>Subtask 1:</b> Computational and statistical modeling of data from study	30-		TP	0%

	36			
<i>Milestone #4: Publish results from Pilot Comparison Study</i>	30 - 36	MB	TP	0%

**Recruitment Table**

<b>Quarter</b>	<b>Planned</b>	<b>Screened</b>	<b>Enrolled</b>	<b>Complete</b>
Year 1 Q1	0	0	0	0
Year 1 Q2	18	0	0	0
Year 1 Q3	18	0	0	0
Year 1 Q4	24	1	1	1
Year 2 Q1	24	1	1	1
Year 2 Q2	30	14	14	12
Year 2 Q3	30	0	0	0
Year 2 Q4	33	5	5	5
Year 3 Q1	33	15	15	13
Year 3 Q2	30	13	13	12
Year 3 Q3	30	13	13	11
Year 3 Q4	0	6	6	3
<b>Total</b>	270	68	68	58

Wanting to build off of this research, we have submitted proposals for additional funding.

- » 2021. NIH Research Enhancement Award Program (R15). Virtual reality-based assessment of decision-making related to financial capacity in normal aging and Alzheimer’s disease, \$439,524. M. D. Barnett (PI). Submitted.
- » 2021. NIH Research Enhancement Award Program (R15). Virtual reality-based assessment of decision-making related to financial capacity in normal aging and Alzheimer’s disease, \$440,995. M. D. Barnett (PI). Not awarded.
- » 2021. NIH Research Enhancement Award Program (R15). Virtual reality-based simulation of care decisions related to dementia, \$440,995. M. D. Barnett (PI). Not awarded.
- » 2020. NIH Basic and Translation Research on Decision Making in Aging and Alzheimer’s Disease (R21). Virtual reality-based assessment of decision-making related to financial capacity in normal aging and Alzheimer’s disease, \$398,750. M. D. Barnett (PI). Not awarded.
- » 2020. NIH Basic and Translation Research on Decision Making in Aging and Alzheimer’s Disease (R21). Virtual reality-based simulation of care decisions related to dementia, \$398,750. M. D. Barnett (PI). Not awarded.

We also have one manuscript almost ready for submission, and we have had three peer-reviewed abstracts published:

- » Barnett, M. D., Shorter, S. S., & Parsons, T. D. (In preparation). Comparison of episodic memory performance on a traditional and virtual reality measure of memory.
- » Shorter, S., Coldiron, A., Reed, C., Glover, T., Gutierrez, R., Rodriguez, D., Moore, J., Parsons, T., & Barnett, M. (2020). Comparison of performance on the Virtual Environment Grocery Store and the CVLT-II: A-184. *Archives of Clinical Neuropsychology*, 35(6).
- » Persin, M. J., Hardesty, D., Lee, D. C., Tran, N., Bayer, C., Childers, L. G., Moore, J. M., Parsons, T. D., & Barnett, M. D. (2021). A-168 Neural network for the Virtual Environment Grocery Store for detection of neurocognitive impairment among older adults. *Archives of Clinical Neuropsychology*, 36(6), 1223. <https://doi.org/10.1093/arclin/acab062.186>
- » Hardesty, D. R., Chek, C., Persin, M., Barr, E., Sasser, H., Glover, T., Coldiron A., Parsons, T. D., & Barnett, M. D. (2021). A-12 Relationships between performance on the virtual environment grocery store and adaptive functioning among older adults. *Archives of Clinical Neuropsychology*, 36(6), 1052. <https://doi.org/10.1093/arclin/acab062.30>

We have also submitted several poster presentations from the study data.

- » Persin, M.J., Hardesty, D., Lee, D.C., Tran, N., Bayer, C., Childers, L., Moore, J.M., Parsons, T. D., & Barnett, M. D. (Accepted). Neural network for the Virtual Environment Grocery Store for detection of neurocognitive impairment among older adults. Abstract accepted for poster presentation at the National Academy of Neuropsychology 2021 Conference.
- » Hardesty D., Chek, C., Persin, M., Barr, E., Sasser H., Glover, T., Coldiron, A., Parsons, T. D., & Barnett, M. D. (Accepted). Relationships between performance on the Virtual Environment Grocery Store and adaptive functioning among older adults. Abstract accepted for poster presentation at the National Academy of Neuropsychology 2021 Conference.
- » Shorter, S. S., Coldiron, A. M., Reed, C. M., Glover, T. L., Gutierrez, R. M., Rodriguez, D., Moore, J. M., Parsons, T. D., & Barnett, M. D. (2020, October). Comparison of performance on the Virtual Environment Grocery Store and the CVLT-II. Poster presented at the 40th Annual Conference Virtual Edition (due to COVID-19) of the National Academy of Neuropsychology.

- » Helphrey, J. H., Sawyer, J. D., Bennett, L. J., Sandlin, A. M., Smith, L. N., Flores, E. V., Parsons, T. D., & Barnett, M. D. (2020, February). A preliminary study of activity level in relation to performance on prospective memory tasks in a virtual environment. Poster presented at the International Neuropsychological Society's 2020 annual meeting in Denver, CO.
- » Bennett, L. J., Sawyer, J. D., Coldiron, A. M., Reed, C. M., Flores, E. V., Markey, C. E., Parsons, T. D., & Barnett, M. D. (2020, February). Paces in different places: A preliminary study of the relationship between physical activity and navigation in a virtual environment. Poster presented at the International Neuropsychological Society's 2020 annual meeting in Denver, CO.

#### **4. Impact**

We believe that this study will make an impact by piloting two new virtual environments for use among older adults with neurocognitive impairment.

#### **5. Changes/Problems**

The only significant changes have been clinic policies related to COVID-19 (e.g., temperature checking, social distancing, etc.). COVID-19 has created many problems, the largest of which was a period of closure for the Memory Assessment and Research Center (MARC), the study site, in spring and summer of 2020. The MARC is now re-opened, but COVID remains a significant challenge. Recruitment at local health care providers has been made more difficult. COVID precautions (e.g., social distancing, wiping down equipment, etc.) have limited our capacity to run research participants. We have also had fewer TBI patients than suspected.

#### **6. Products**

None

#### **7. Participants & Other Collaborating Organizations**

**Name: Michael Barnett**

**Project Role: Principal Investigator**

**Researcher Identifier: ORCID ID 0000-0002-0571-4884**

**Nearest person month worked: 2.0**

**Contribution to Project:** The PI oversaw all aspects of the grant. PI supervised the graduate student. PI worked with Co-PI and graduate student in scoring of much of the neuropsychological assessment results gained from the preliminary data collection. PI met regularly with study personnel to develop the database, clean the data, and analyze the data. Given results from the preliminary data collection, the PI supervised and



directed refinement of the study protocol and establishment of the report format. An initial paper on preliminary results was started and will continue on into next quarter; this should include both a conference presentation paper and a submission to a peer-reviewed journal.

**Name: Thomas Parsons**

**Project Role: Co-Principal Investigator**

**Researcher Identifier: ORCID ID 0000-0003-0331-5019**

**Nearest person month worked: 1.8**

**Contribution to Project:** The co-PI supported PI and graduate student scoring of much of the neuropsychological assessment results gained from the preliminary data collection. Co-PI met regularly with study personnel to develop the database, clean the data, and analyze the data. Given results from the preliminary data collection, the co-PI worked with PI to refine the study protocol and establish the report format. An initial paper on preliminary results was started and will continue on into next quarter; this should include both a conference presentation paper and a submission to a peer-reviewed journal.

**Name: Jennifer Sawyer**

**Project Role: Graduate Student**

**Researcher Identifier: None Available**

**Nearest person month worked: .45**

**Contribution to Project: Ms. Sawyer helped with recruiting and running participants.**

## **8. Special Reporting Requirements**

None

## **9. Appendices**

None