T.D. Parsons, A.A. Rizzo, J. Brennan, T.M. Silva, E. Zelinski. Assessment of executive functioning using virtual reality: virtual environment grocery store. Gerontechnology 2008; 7(2):186. Longitudinal studies indicate that declines in cognition increase with advancing old age[1]. Assessment of subtle losses in early stages of decline has been an elusive goal. While standard neuropsychological measures have adequate predictive value, their ecological validity may diminish predictions about real world functioning. Virtual environments (VEs) are now being developed and tested focus on component cognitive processes including: attention processes[2], spatial abilities[3], memory[4], and executive functions[5]. The increased ecological validity of neurocognitive batteries using VEs may aid differential diagnosis. Executive function is assumed to represent a high level ability independent of other types of cognition, as it has been observed to underlie performance in a number of other functions, including problem solving and memory and it declines with age. **Methods** To assess executive ability, we developed a Virtual Environment Grocery Store (VEGS) that builds upon the multiple-errands test (MET)[6]. This measure involves a number of brief, shopping-type errands that must be completed in a real environment following certain rules that require problem solving[7]. Activities in the VEGS are designed to parallel the MET. Tasks include navigating through a virtual grocery store by following specified routes though the aisles, finding and selecting items needed to prepare simple meals, such as making a peanut butter and jelly sandwich, pricing and selecting other items so that no more than a budgeted amount is spent, and performing a prospective memory task when a certain individual is encountered. Difficulty is increased over trials by adding distractions: for instance, increasing the number of items to store shelves, adding background music, and increasing its loudness. The VEGS runs on open-source NeuroVR VE platform that includes an editor and a player that provide an interactive rendering system based on OpenGL. The NeuroVR Editor makes use of Blender and an integrated suite of three dimensional creation tools. Subjects navigate and interact within the VEGS using the NeuroVR Player. Our prototype currently puts the subject in a non-immersive modality, in which the VE is displayed using a desktop monitor. The user interacts with the VE using the keyboard arrows and a mouse to make selections. **Discussion** Preliminary work with an older adult indicates that the task is engaging yet challenging. Assessment of executive functioning in aging may be enhanced in VEs by better control of the perceptual environment, more consistent stimulus presentation, and by more precise and accurate scoring. Further, older adults can be evaluated in an environment that simulates the real world, not a contrived testing environment.

References

1. Schaie KW. San Diego: Academic Press; 1996
2. Parsons TD, Bowerly T, Buckwalter JG, Rizzo AA. Child Neuropsychology 2007;13:363-381
3. Parsons TD, Larson P, Buckwalter JG, Rizzo AA. Neuropsychologia 2004;42:555–562
4. Parsons TD, Rizzo AA. Cyberpsychology and Behavior 2008;11:16–24
5. Elkind JS, Rubin E, Rosenthal S, Skoff B, Prather P. CyberPsychology and Behavior 2001;4:489-496
6. Law A, Logie RH, Pearson DG. Acta Psychologica 2006;122:27-44
7. Shallice T, Burgess PW. Brain 1991;114:727–741

Keywords: cognitive aging, executive functioning, virtual reality, ecological validity
Address: University of Southern California, USA; E: tparsons@usc.edu