Background: Language is assessed in few computerized batteries for the evaluation of early dementia. Batteries that include a language test fail to assess spontaneous speech production and comprehension. Yet, deficits in these functions can be the earliest presenting symptoms in Frontotemporal dementia (FTD) and Alzheimer Disease (AD). We designed Sentence Production (SP) as a subtest for our new computerized battery, Cognitive Testing on Computer (C-TOC), with the aim of simulating as closely as possible on computer the production of speech. In this study we tested SP’s sensitivity to speech and language difficulties characteristic of aphasia syndromes.

Methods: C-TOC was designed to combine a highly usable test platform with valid test paradigms in the detection of dementia syndromes. C-TOC records clicking-and-moving mouse responses, and therefore allows for the assessment of productive behaviours. The SP subtest requires the description of pictures by selecting words from an array that includes phonemic and semantic lures, and by ordering the selected words into sentences on the screen. For two items, the production of non-canonical sentence structures is forced. SP is scored for semantic units, phrases, word count, time per word, and syntax. The entire C-TOC battery including SP, and neuropsychological tests (NPT) of language were given to subjects with aphasia and cognitively normal controls. Results: Participants included 9 subjects with aphasia, M age=66, SD=11.1; 4 females/5 males, and a mix of etiologies: 5 FTD (1 behavioural-variant, 4 semantic dementia), 1 AD and 3 stroke, and 15 AD, 6 MCI, 6 AD. Correlations with NPT ranged from r=0.4 to 0.8. C-TOC test scores discriminated the diagnostic groups on visual memory, language, visuo-spatial and executive function tests (NCTI=0.05, ANOVA p.<0.5, SNK 2 subsets). Conclusions: C-TOC has been carefully designed to have a highly usable interface for seniors and those with cognitive impairment. The battery’s test paradigms are sensitive to mild levels of cognitive impairment. Future research will determine the battery’s utility in a variety of settings including clinic offices and the home environment.

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Background: Computer-based cognitive testing offers an important alternative to current approaches in facing the growing demand for evaluation of cognitive concerns. We report on the design and initial validation studies of C-TOC, a test battery created at the interface of cognitive and computer science, neuropsychology, and neurology. C-TOC was developed to satisfy three a priori criteria: high validity for the detection of cognitive impairment, a usable human-computer interface and culturally fair test contents. Methods: We designed the C-TOC prototype to have comprehensive domain coverage. Test paradigms were developed to engage both receptive and productive skills. The latter include sentence production, free recall, and visuo-construction and are often not assessed on computer. C-TOC was designed iteratively in 3 cycles of consultation with representatives of end users and of a cultural advisory panel. Convergent validity was investigated by computing correlation coefficients between C-TOC subtests and comparable neuropsychological tests (NPT). Concurrent validity was examined by using ANOVA and Student Newman Keuls (SNK) post hoc to compare test scores of clinic patients with No Cognitive Impairment (NCI), Mild Cognitive Impairment (MCI) and Alzheimer Disease (AD). Results: Usability evaluations with 27 participants aged 55 to 87, with a mix of diagnoses (7 normal controls, 6 NCI, 8 MCI, 6 mild dementia) and computer knowledge (1 none, 8 low, 14 moderate, 4 high) revealed problems with instructions, practice trials, screen layout, consistency and intuitiveness of navigation buttons. Cultural advisors identified test format, use of language, and lack of computer skills as challenges. Based on this input, we refined test content and interface from C-TOC.v1 to C-TOC.v4. Validation was undertaken with 26 participants (5 NCI, 15 MCI, 6 AD). Correlations with NPT ranged from r=0.4 to 0.8. C-TOC test scores discriminated the diagnostic groups on visual memory, language, visuo-spatial and executive function tests (NCTI=0.05, ANOVA p.<0.5, SNK 2 subsets). Conclusions: C-TOC has been carefully designed to have a highly usable interface for seniors and those with cognitive impairment. The battery’s test paradigms are sensitive to mild levels of cognitive impairment. Future research will determine the battery’s utility in a variety of settings including clinic offices and the home environment.