The Bay Area Verbal Learning Test (BAVLT)

Background: Verbal learning tests are sensitive measures of memory decline in pre-clinical Alzheimer's Disease with recall scores correlating with amyloid and tau burden (Bejanin et al., 2017). Here we describe a digital version of the Bay Area Verbal Learning Test (BAVLT) (Woods et al., 2017)— a brief (8.5 minute), fully automated verbal learning test administered from participants' homes.

Method:
The BAVLT was administered to 399 healthy adults (41.5% female, Age = 64.4 years, ±15.0) from their homes using a tablet-based testing interface (Figure 1). Participants underwent two test sessions on successive days and were remotely monitored via the test interface's remote proctoring function.

Participants were instructed to remember two lists — each with 12 words in four semantic categories. List A was presented three times with immediate recall after each presentation, followed by a single presentation and recall of distractor List B, then an uncued recall of List A. Thirty minutes later, participants completed a List A delayed recall, followed by a 2-choice List A recognition test (Figure 2).

Results:
The BAVLT showed excellent test-retest reliability (r = 0.86 total, r = 0.73 delayed). Multiple regression analysis of total recall scores revealed significant effects of age ($p < 10^{-13}$) (Figure 2), gender ($p < 10^{-11}$), vocabulary ($p < 10^{-15}$), and education ($p < 0.03$), with these four variables aggregately accounting for 37.4% of variance. Total recall scores improved over list presentations and increased by 0.97 standard deviations on repeat testing ($p < 10^{-15}$) (Figure 3).

Conclusion: At-home administration of the BAVLT demonstrated excellent psychometric properties that are similar to those of well-established verbal learning tests such as the CVLT (Delis et al., 1987).

Figure 1a. BAVLT responses are recording and analyzed using Automatic Speech Recognition engines.
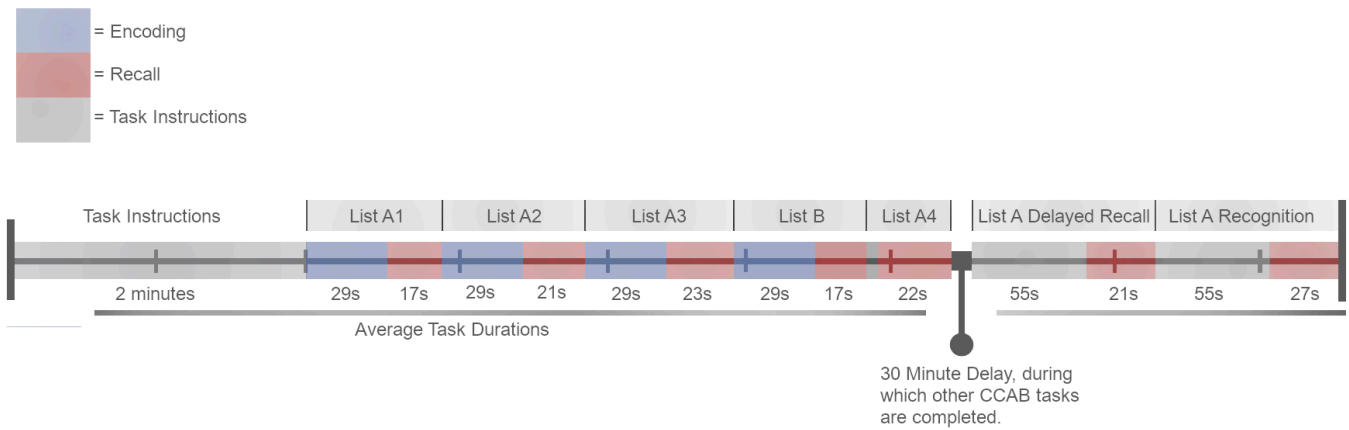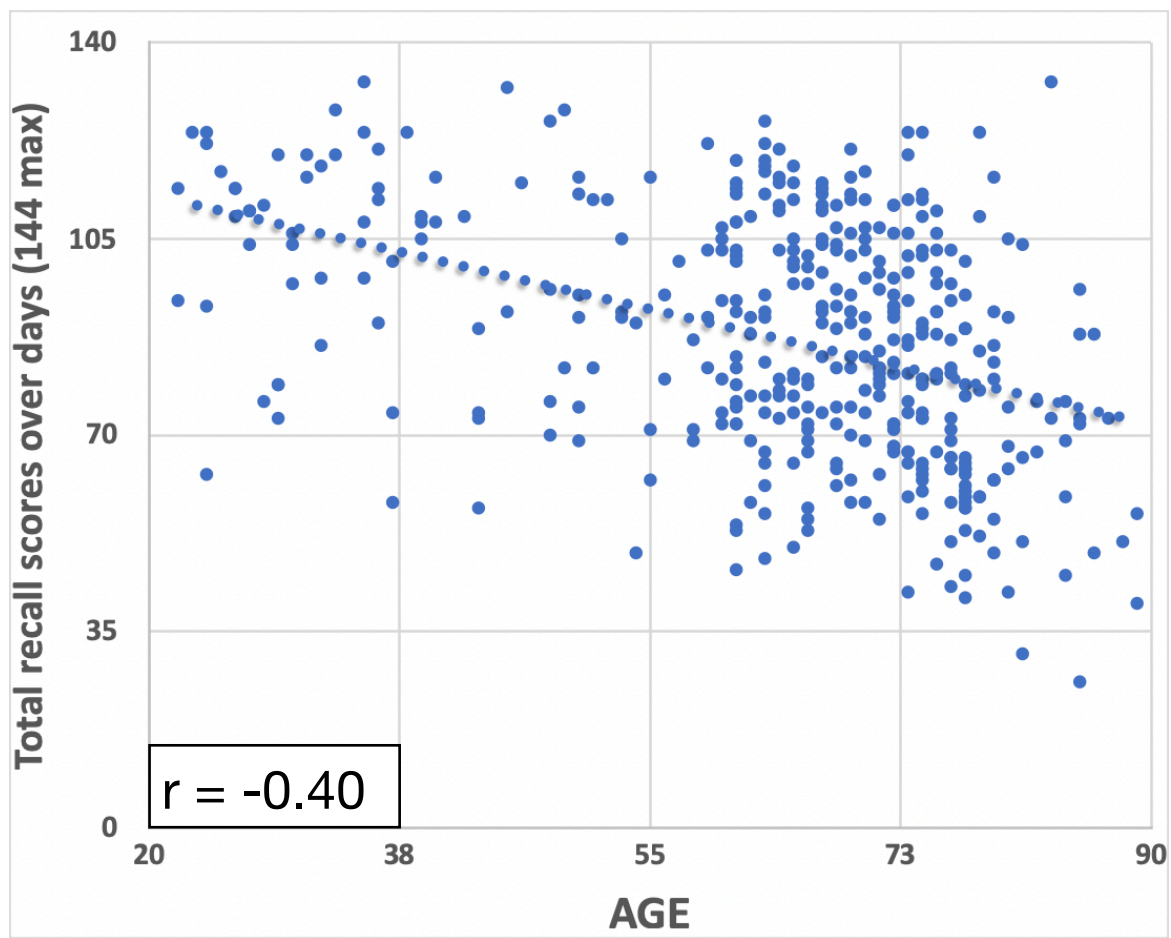
Figure 2. The time course of BAVLT test conditions.

Figure 3. Age effects on total BAVLT recall scores summed across six recall trials and two days of testing.
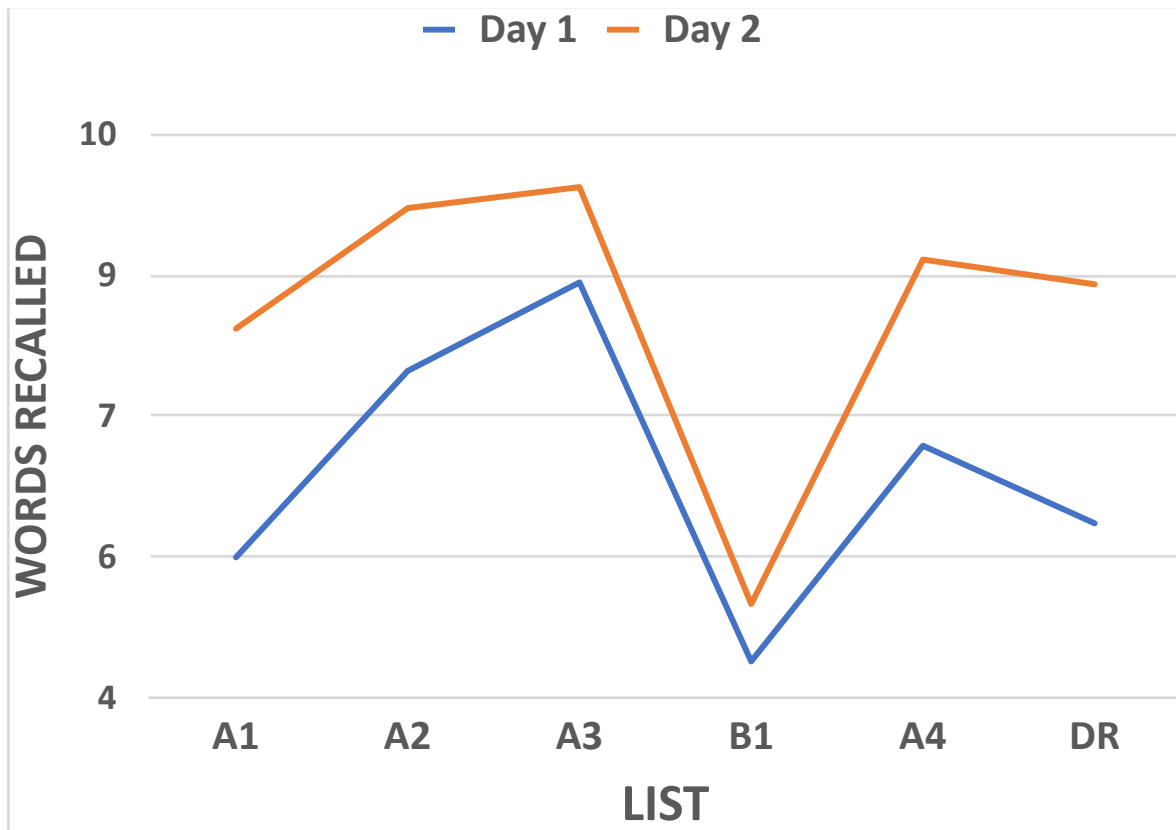
Figure 4. Mean scores of recall trials on Day 1 (blue line) and Day 2 (red line). Error bars show standard errors of the mean.