

Introduction

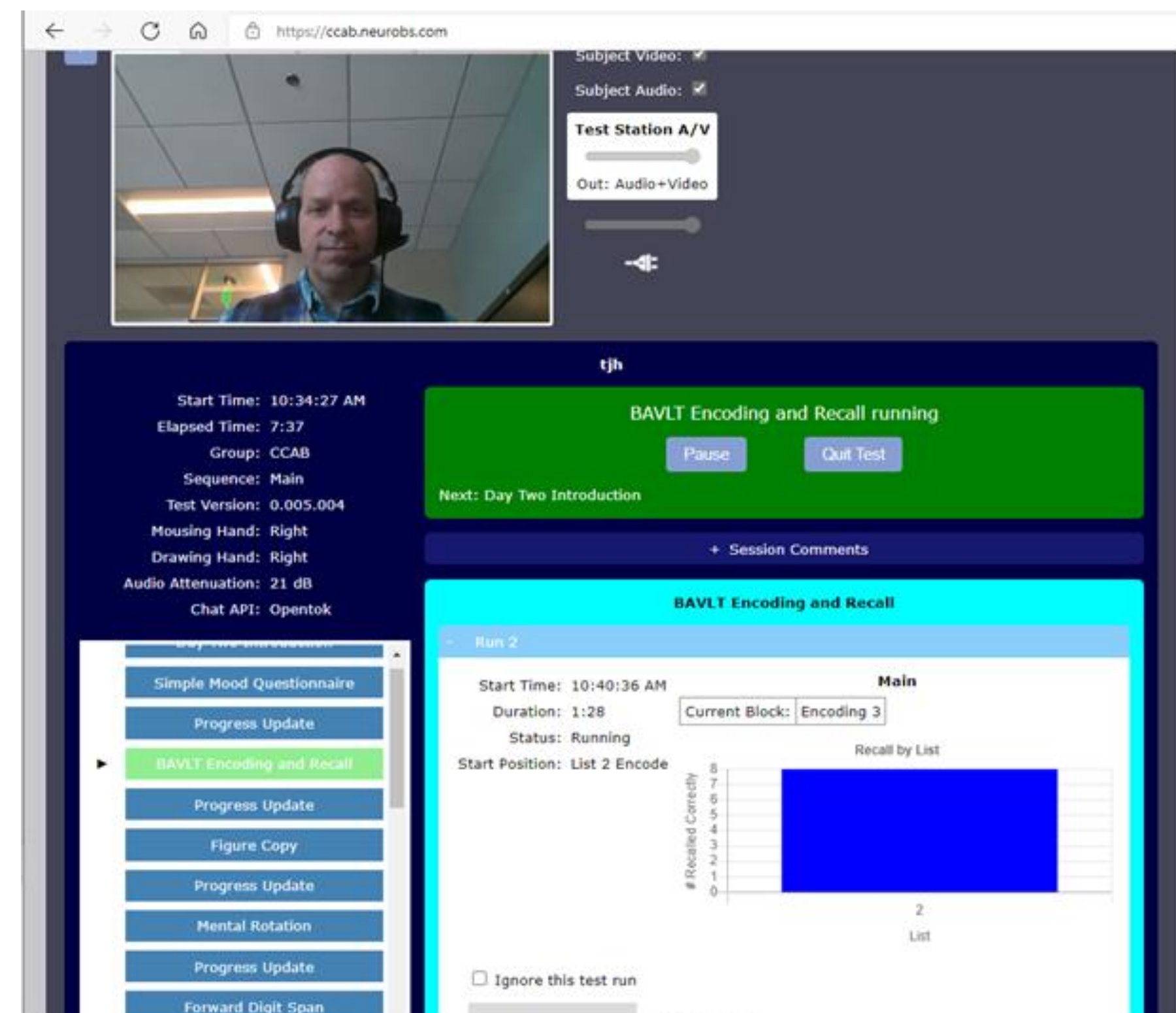
- Computerized cognitive assessments are an efficient and sensitive method of identifying cognitive impairments in aging populations [1]
- This study examines the feasibility and reliability of remote, home testing with the California Cognitive Assessment Battery (CCAB)

Methods

- Participants:
 - 185 healthy military veterans (ages: 60-89, 18% female)
- California Cognitive Assessment Battery (CCAB):
 - Automated set of cognitive tests & psychological questionnaires
 - Remote, at-home longitudinal testing
 - Automatic scoring, including consensus automated speech recognition (CASR) for the transcription of responses on verbal tasks (e.g., list-learning memory tasks, picture description, verbal fluency)



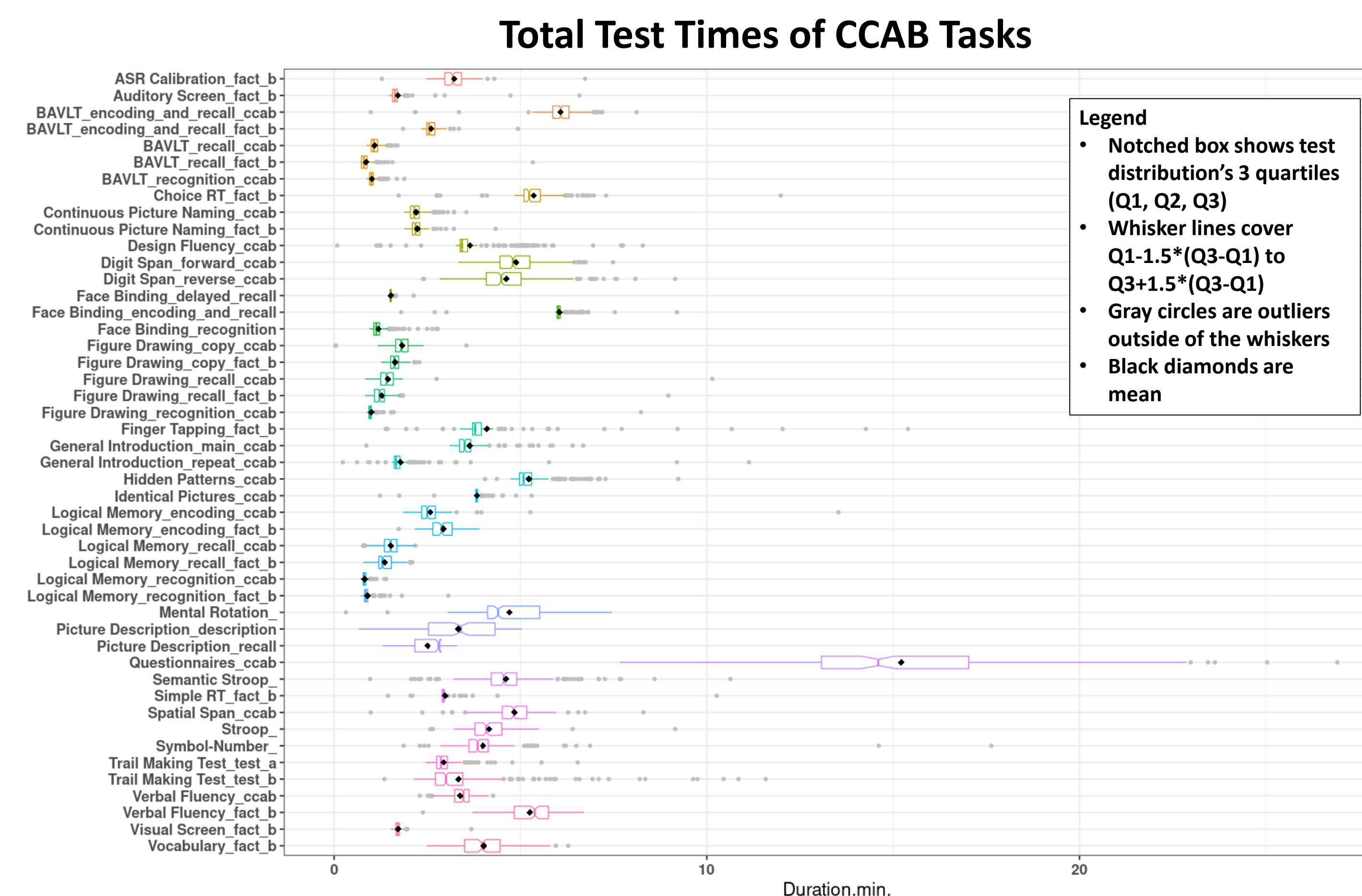
CCAB Test Kit with headset, gaming mouse, tablet, modem, and adapter



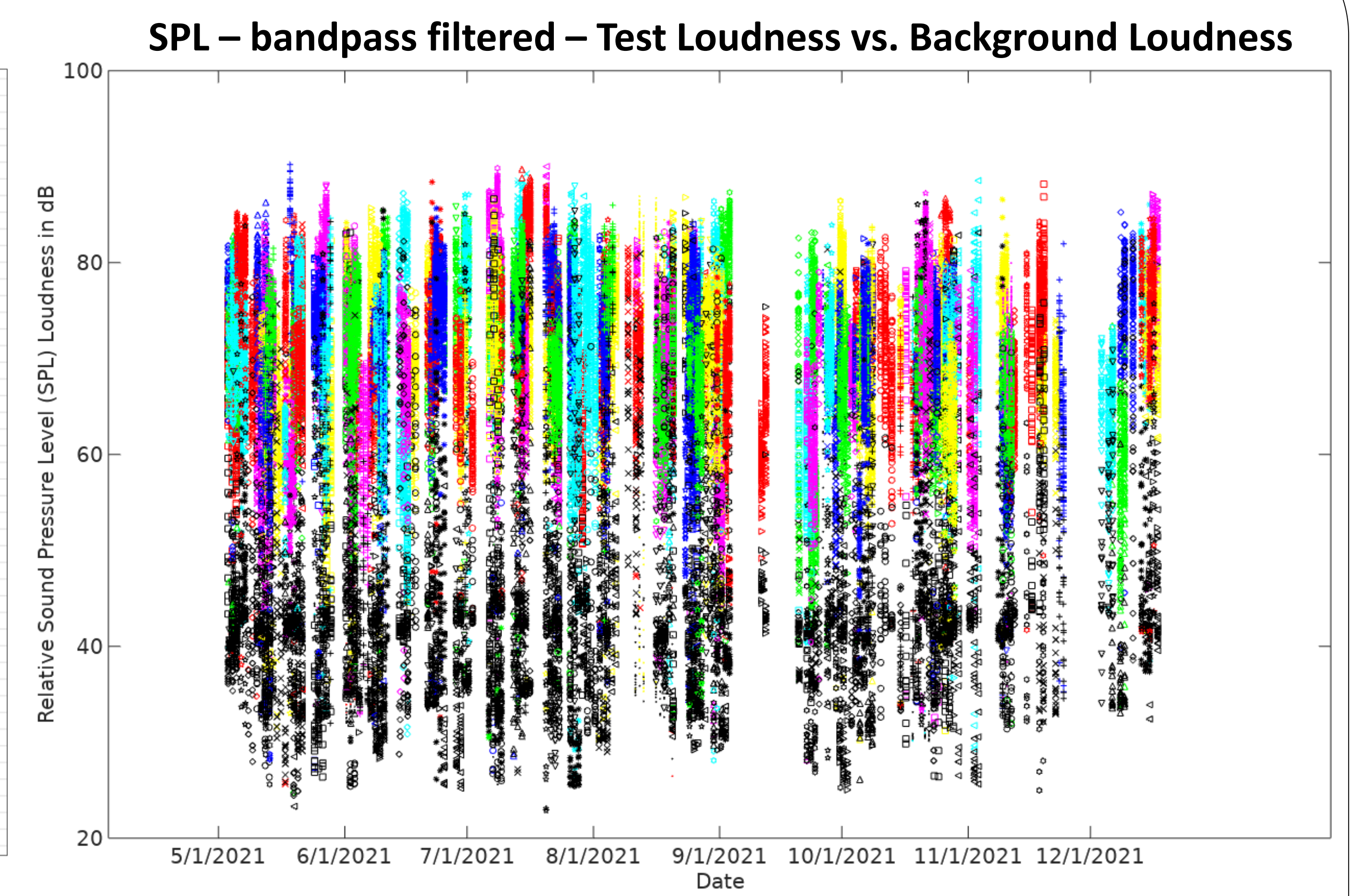
Examiner view during a CCAB test via web portal. Audio and video of the participant is always available. Chat is available between tests. Full control of test flow is available on the top and left. Provisional scores are available on the bottom right. Test low performance warnings and hardware error logs are also displayed immediately

- Procedures:
 - Testing sessions under audio/visual supervision and assistance via web-based examiner interface
 - Battery was administered 3 times within one week to assess test-retest reliability
 - Reaction times, word onset latency, response accuracy, error types, and speech samples were collected and analyzed

Results

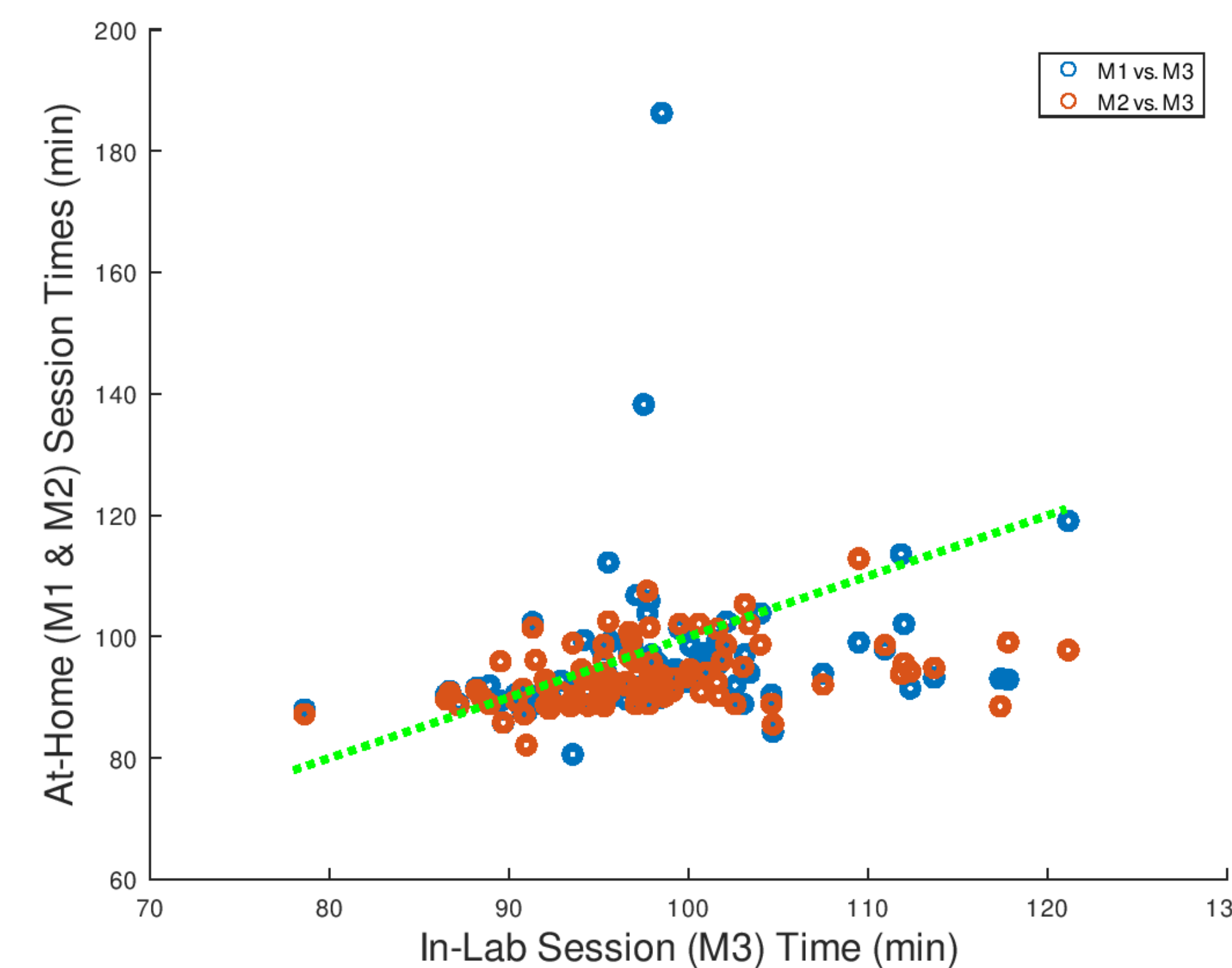


Notched box and whisker plots of total test times of CCAB tasks. Times include software and hardware failures, extra test training, instructions, examiner interventions, home testing disruptions, unplanned breaks, test failures

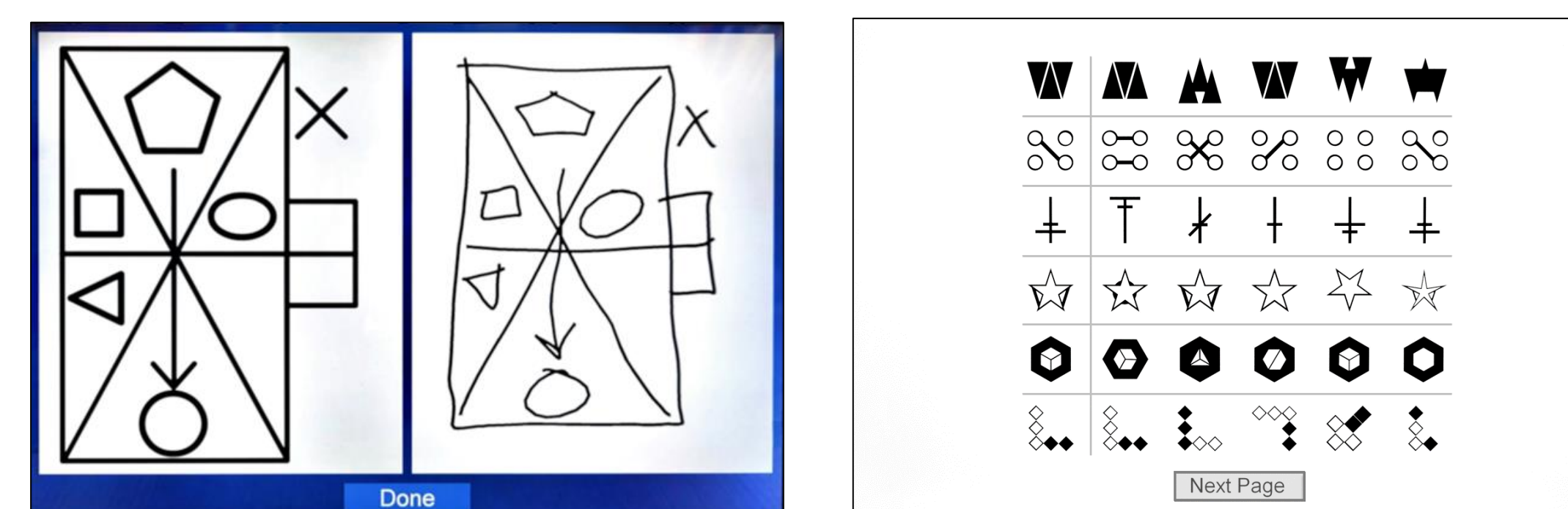


Loudness of CCAB speech samples (colored symbols) and background noise samples (black) recorded between tests using the kit headset. One color/symbol used per participant

At Home vs. In-Lab Session Times



At-Home vs. In-Laboratory repeated session times scatterplot for a subset of 123 participants. The M3 In-Lab testing session is compared to both the first (M1, blue) and second (M2, red) at-home session with an identity line (green) for comparison. Spearman correlations (ρ) between M1 vs. M3, 0.49, and M2 vs. M3, 0.41, are lower than that for M1 vs. M2, 0.68



Screenshot of a CCAB test station while a participant is performing a Figure Copy (left) and Picture Matching (right) trial using the touchscreen

Discussion

- Participant experience was generally favorable:
 - 98% of participants completed all three testing sessions
 - 99% of all tests in those sessions completed successfully
- Mid-year software and examiner procedure refinements of a small subset of CCAB tests resulted in a 42% decrease in test failures and a 6% decrease in repeated tests
- Individual test times were highly uniform across participants, with low session test time variability
- Recorded speech levels were sufficient to support CASR transcript generation for scoring verbal tasks, even amidst home background noise
- In 123 participants with repeat testing at 6 months, similar test battery characteristics were found under laboratory conditions
- The CCAB shows promise as an objective, reliable automated digital assessment tool to evaluate cognitive functioning in adults both at home and in the laboratory or clinic

References

- [1] Chan, J., Yau, S., Kwok, T., & Tsoi, K. (2021). Diagnostic performance of digital cognitive tests for the identification of MCI and dementia: A systematic review. *Ageing Research Reviews*, 72, 101506. <https://doi.org/10.1016/j.arr.2021.101506>

