

Remote Unsupervised Administration of the Online Repeatable Cognitive Assessment (ORCA) is Feasible and Acceptable

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Background

Clinical-pathological models of Alzheimer’s disease (AD) place disruption of memory as one of the earliest symptoms.

Recent studies of preclinical and emergent AD indicate that learning impairment is more severe than memory dysfunction in early AD^{1,2}.

The Online Repeatable Cognitive Assessment (ORCA) assesses learning of associations over 5 sessions on 5 days, with abnormal learning curves across the 5 sessions evident in both preclinical and emergent AD.

Previous studies with ORCA were conducted in well-studied AD study cohorts who attended the study site on some visits and implemented a version of the test that involved learning of associations between 50 English words and 50 Chinese characters across the 5 sessions^{1,2,3}.

This study had two aims:

1. Determine feasibility and acceptability of a remote and unsupervised ORCA in study naive adults across versions of increasing difficulty and duration.
2. Validate learning curves developed from a version of ORCA that implements culturally neutral associations.

Method

Sample:

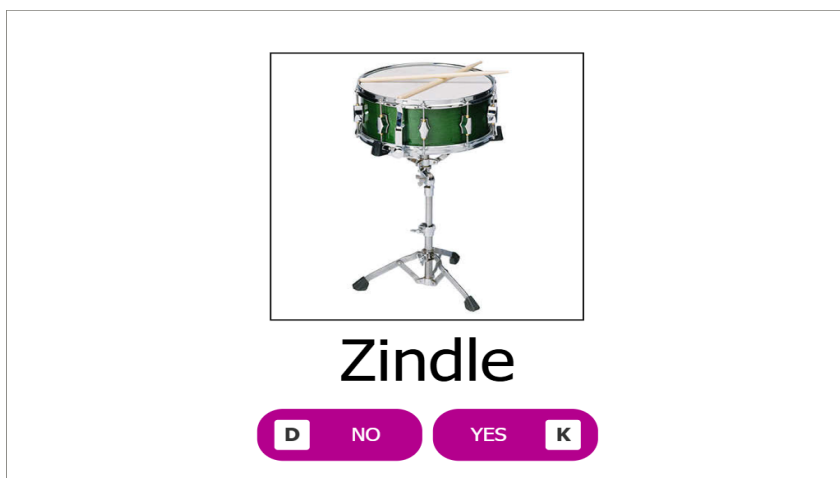
299 adults (mean (SD) age = 51.09 (16.81, range 19 to 85) were enrolled and randomized to one of three ORCA versions. 63% of the sample were female, 70% identified as White, and 56% had completed at least a 4-year college degree.

Measures:

ORCA: Assessed learning across sessions, as described previously. However, to-be-learned associations consisted of non-sense words and concrete visual objects (e.g., Figure 1). Versions requiring learning of 30, 40, or 50 associations were constructed.

Within each block, every object appeared twice with its correct paired word and once each with two randomly selected incorrect words from the same stimulus set. Incorrect pairings were unique across sessions to prevent learning of incorrect associations.

Figure 1: ORCA Example Trial



Procedure:

Participants received a daily email link to the same ORCA version (ORCA30, ORCA40, or ORCA50) for up to 8 days, with reminder emails sent at 4 and 8 hours if the session was not completed.

Participants were instructed to complete one session per day and finish five sessions within an 8-day study window.

ORCA was completed remotely on a laptop, tablet, or desktop, and participants were asked to use the same device for all sessions.

At study completion, participants completed a Cognitive Debriefing survey.

Analyses & Results

Analyses:

Feasibility & Acceptability were defined by:

- Mean (SD) unique ORCA sessions attempted in the 8-day study period.
- Proportion of sessions completed fully.
- Mean (SE) accuracy across sessions and exponent of learning curve.
- Individual accuracy across sessions.
- Proportion of individuals that did not evidence learning across sessions.

Cognitive debriefing was conducted to determine individual experiences with and understanding of ORCA after completing the study.

Results:

Participants completed ORCA on a median of 5 days and attempted a median of 5 sessions, with adherence not differing across ORCA versions (Table 1).

Session completion was uniformly high (>90%) across ORCA versions (Table 1).

Table 1: ORCA Adherence and Completion

	ORCA30	ORCA40	ORCA50
Median (Range) Days (Per Participant)	5 (4)	5 (4)	4 (4)
Median (Range) Sessions (Per Participant)	5 (4)	5 (6)	5 (5)
% (n) Sessions Completed (Overall)	94.3% (n=397)	91.6% (n=394)	95.2% (n=380)

Figure 1 shows the mean (SE) performance at each session for the total sample for each ORCA version. Exponents describing each curve were consistent across ORCA versions (i.e. overlapping 95% CIs) and were consistent with those observed previously for the ORCA50 Chinese character version in middle-aged adults ($e=0.24$ 95%ile xx-xx)³.

Figure 1: Mean (SE) Accuracy by Session & ORCA Version

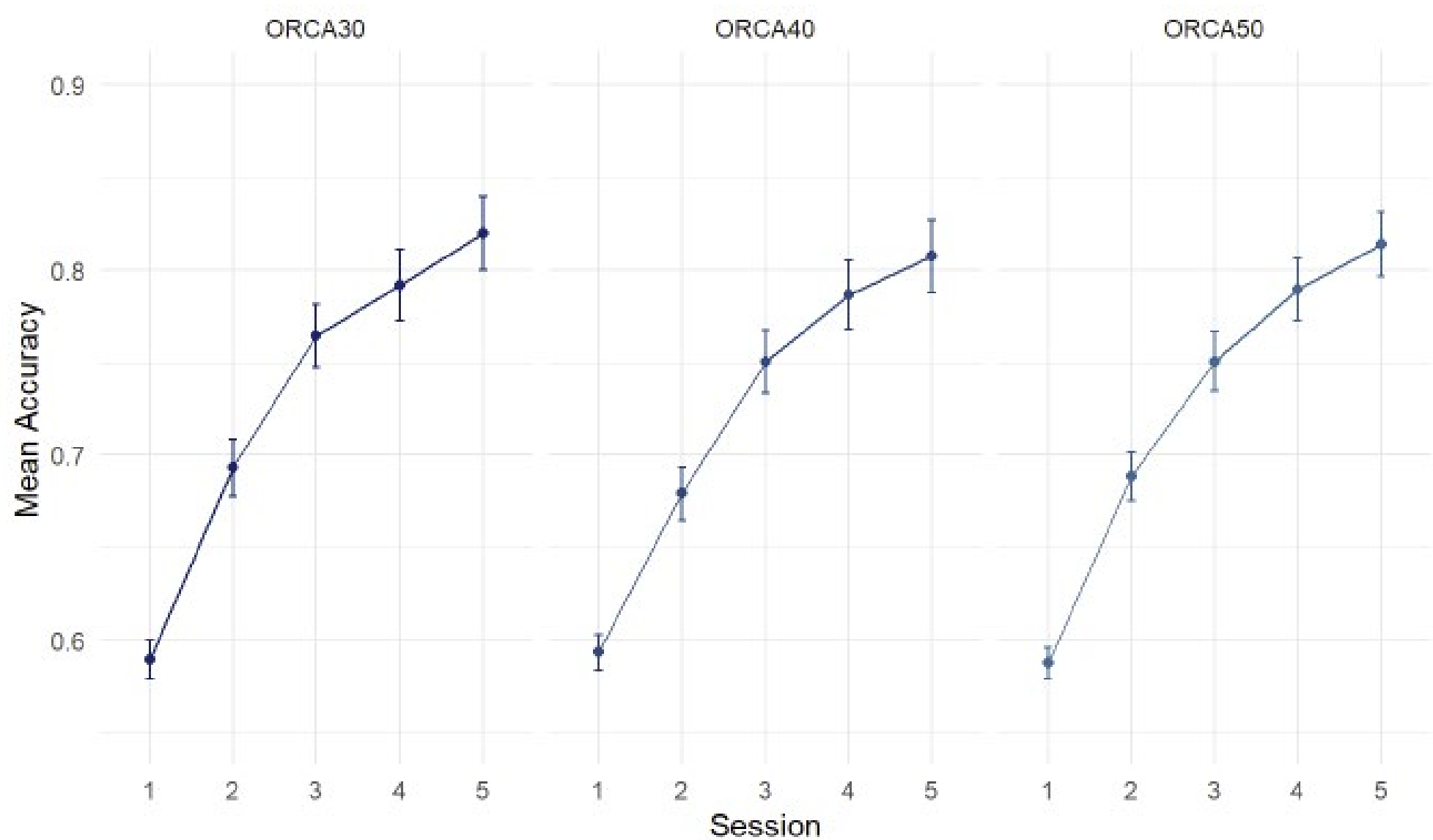
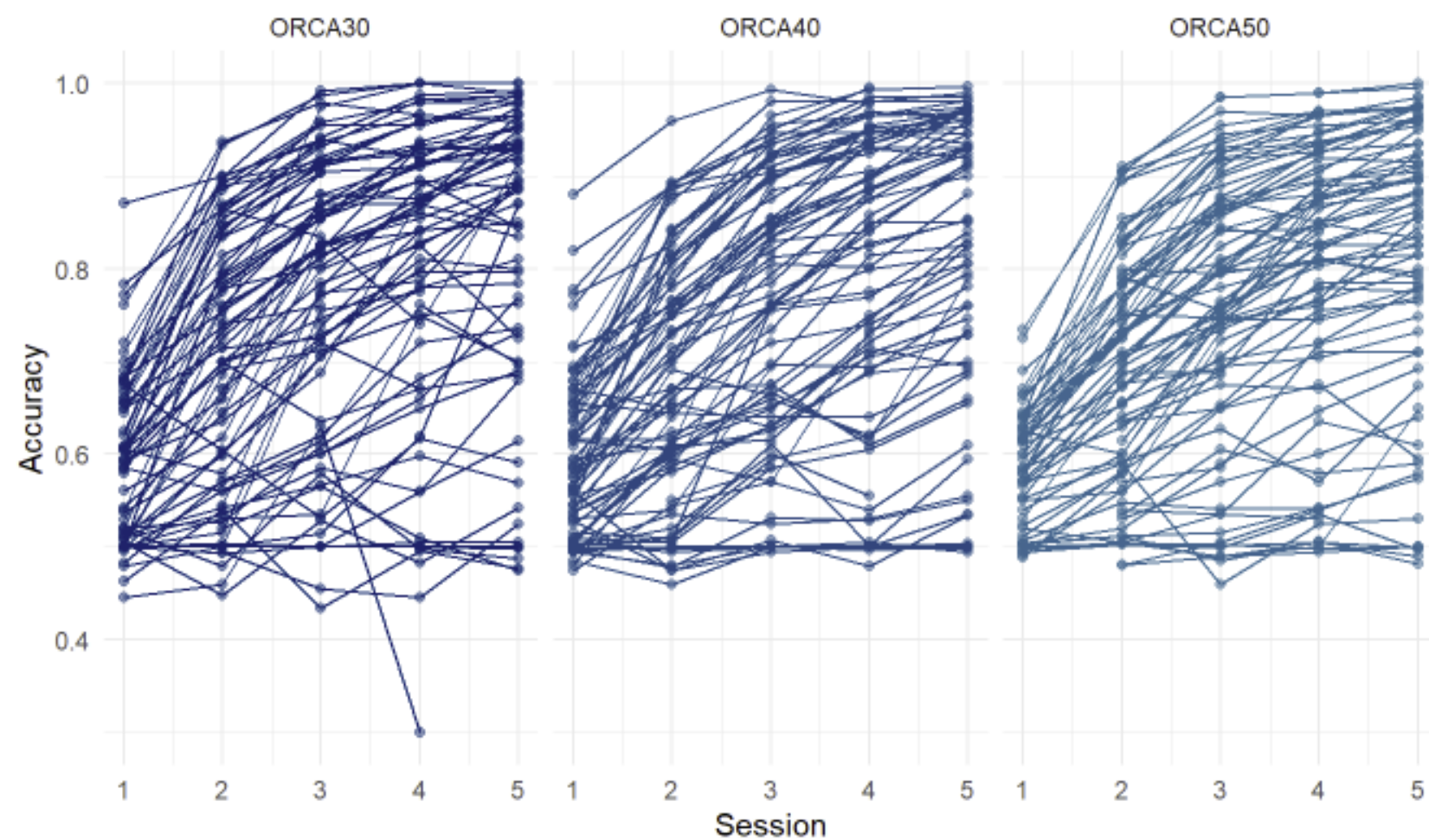


Figure 2 shows the individual learning trajectories for each participant across the 5 sessions.

Figure 2: Individual Accuracy by Session & ORCA Version



Results cont.

Non-learners were defined as participants whose performance on the final session was less than 60%. For the sample that completed their assigned ORCA sessions (n = 248), 16.5% (n=41) were classified as non-learners.

The frequency of non-learner classification did not differ between ORCA version (χ -square (2) = 0.07, p = 0.97).

Table 2: Cognitive Debriefing Survey Responses

	Strongly Disagree OR Disagree	Neutral	Strongly Agree OR Agree
Displayed clearly on device	0%	1%	83%
Instructions clear and easy to understand	11%	8%	64%
Easy to access on device	2%	2%	81%
Easy to make responses on device	2%	4%	78%
Amount of time for daily testing was acceptable	5%	10%	69%
Willing to take ORCA on consecutive days	4%	7%	74%
Willing to be contacted for future studies	2% No		83% Yes

Responses to the Cognitive Debriefing Survey are summarized in Table 2. Overall, the majority of participants rated ORCA positively in terms of ease of use and acceptability of test requirements.

N=47 16% of participants did not complete the Cognitive Debriefing Survey.

Conclusion

- ORCA was feasible and acceptable to deliver remotely and unsupervised.
- Adherence to daily testing and testing sessions completion rates were high across ORCA versions, demonstrating feasibility and acceptability.
- The majority of participants provided positive ratings for both usability and acceptability of ORCA across all items in the Cognitive Debriefing, further supporting the acceptability of ORCA.
- A clear learning pattern across the 5 sessions was evident for most participants (>80%) across all 3 ORCA versions, providing evidence of the validity of the testing paradigm in this version that uses object-nonsense word pairings for the to-be-learned associations.
- Future analyses will seek to understand patterns of performance that differentiate individuals who do not comply with the test from those with impaired learning.

References

1. Lim YY, Baker JE, Bruns L Jr, Mills A, Fowler C, Fripp J, Rainey-Smith SR, Ames D, Masters CL, Maruff P. Association of deficits in short-term learning and A β and hippocampal volume in cognitively normal adults. Neurology. 2020 Nov 3;95(18):e2577-e2585. doi: 10.1212/WNL.0000000000010728. Epub 2020 Sep 4. PMID: 32887774.
2. Lim YY, Baker JE, Mills A, Bruns L Jr, Fowler C, Fripp J, Rainey-Smith SR, Ames D, Masters CL, Maruff P. Learning deficit in cognitively normal APOE ϵ 4 carriers with LOW β -amyloid. Alzheimers Dement (Amst). 2021 Mar 16;13(1):e12136. doi: 10.1002/dad2.12136.
3. Lim YY, Mills A, Norfolk M, Rosenich E, Maruff P. Factors influencing rates of unsupervised assessment of short-term learning in cognitively unimpaired adults. J Alzheimers Dis. 2025 Jan;103(2):441-451. doi: 10.1177/13872877241302491.