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CLINICAL MANIFESTATIONS

POSTER PRESENTATION

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NEUROPSYCHOLOGY

Procedural practice effects in remote digital memory assessment

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Abstract

Background: Frequent and remote cognitive assessment may improve sensitivity to subtle cognitive decline associated with preclinical Alzheimer's disease (AD). However, repeated testing can result in unintended inflation of scores, due to practice effects. The objective of this study is to evaluate the extent of sessions with non-identical stimuli on performance and determine if study design or amyloid PET status moderates the impact of practice.

Method: Participants were recruited from longitudinal aging cohorts to complete medial temporal lobe-based memory paradigms (Object-In-Room Recall [ORR], Mnemonic Discrimination for Objects and Scenes [MDT-OS 1-back and 2-back], Complex Scene Recognition [CSR]) using the neotiv application at repeated intervals over one year. Participants were randomized to a task schedule (biweekly 1 task or bimonthly burst) for a total of 24 ten-minute remote sessions. In both groups, participants completed each task 6 times; the interval between identical tasks was eight weeks (Table 1). Linear mixed effects models were used to assess the impact of practice on task performance and the interaction of practice with (1) task schedule group or (2) amyloid status. Models contained person-level random intercepts and covariates of age, gender, education, and device type (tablet or smartphone).

Results: Task schedule group did not differ by demographic characteristics (Table 2, n = 133, mean age = 68.2, 67% female, 87% white, 97% cognitively unimpaired). The interaction of practice x task schedule group was only significant for the MDT-OS (Table 3, $\beta = 0.01$, $p = 0.032$). The main effect of practice was significant for the ORR ($\beta = 0.20$, $p = 0.002$) and CSR ($\beta = 0.001$, $p<0.001$) tasks. The interaction of practice x amyloid PET result was not significant in any models. The main effect of practice was significant in all models (Table 3, ORR: $\beta = 0.21$, $p = 0.004$; CSR: $\beta = 0.01$, $p<0.001$; MDT-OS: $\beta = 0.01$, $p = 0.034$).

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Conclusion: Practice effects were present, indicating that procedural practice benefited task scores, despite non-repeating stimuli. The MDT-OS group x practice interaction indicated that participants in the burst design group had lower scores at their initial MDT-OS visit, but increased performance with practice at a higher rate. No main effects or interaction of amyloid result was observed, possibly due to limited availability of data and few elevated participants.

Task schedule				
BIWEEKLY		BIMONTLY BURST		
Week	Task	Month	Day	Task
1	Object-In-Room Recall [ORR] (Retrieval after 90 min delay)	1	1	Object-In-Room Recall [ORR] (Retrieval after 90 min delay)
3	Complex Scene Recognition (Retrieval after 90 min delay)		2	Complex Scene Recognition (Retrieval after 90 min delay)
5	Mnemonic Discrimination Task [MDT] – Level 1		3	Mnemonic Discrimination Task [MDT] – Level 1
7	Mnemonic Discrimination Task [MDT] – Level 2		4	Mnemonic Discrimination Task [MDT] – Level 2
9	Object-In-Room Recall [ORR] (Retrieval after 90 min delay)	3	1	Object-In-Room Recall [ORR] (Retrieval after 90 min delay)
11	Complex Scene Recognition (Retrieval after 90 min delay)		2	Complex Scene Recognition (Retrieval after 90 min delay)
13	Mnemonic Discrimination Task [MDT] – Level 1		3	Mnemonic Discrimination Task [MDT] – Level 1
15	Mnemonic Discrimination Task [MDT] – Level 2		4	Mnemonic Discrimination Task [MDT] – Level 2
17	Object-In-Room Recall [ORR] (Retrieval after 90 min delay)	5	1	Object-In-Room Recall [ORR] (Retrieval after 90 min delay)
19	Complex Scene Recognition (Retrieval after 90 min delay)		2	Complex Scene Recognition (Retrieval after 90 min delay)
21	Mnemonic Discrimination Task [MDT] – Level 1		3	Mnemonic Discrimination Task [MDT] – Level 1
23	Mnemonic Discrimination Task [MDT] – Level 2		4	Mnemonic Discrimination Task [MDT] – Level 2
25	Object-In-Room Recall [ORR] (Retrieval after 90 min delay)	7	1	Object-In-Room Recall [ORR] (Retrieval after 90 min delay)
27	Complex Scene Recognition (Retrieval after 90 min delay)		2	Complex Scene Recognition (Retrieval after 90 min delay)
29	Mnemonic Discrimination Task [MDT] – Level 1		3	Mnemonic Discrimination Task [MDT] – Level 1
31	Mnemonic Discrimination Task [MDT] – Level 2		4	Mnemonic Discrimination Task [MDT] – Level 2
33	Object-In-Room Recall [ORR] (Retrieval after 90 min delay)	9	1	Object-In-Room Recall [ORR] (Retrieval after 90 min delay)
35	Complex Scene Recognition (Retrieval after 90 min delay)		2	Complex Scene Recognition (Retrieval after 90 min delay)
37	Mnemonic Discrimination Task [MDT] – Level 1		3	Mnemonic Discrimination Task [MDT] – Level 1
39	Mnemonic Discrimination Task [MDT] – Level 2		4	Mnemonic Discrimination Task [MDT] – Level 2
41	Object-In-Room Recall [ORR] (Retrieval after 90 min delay)	11	1	Object-In-Room Recall [ORR] (Retrieval after 90 min delay)
43	Complex Scene Recognition (Retrieval after 90 min delay)		2	Complex Scene Recognition (Retrieval after 90 min delay)
45	Mnemonic Discrimination Task [MDT] – Level 1		3	Mnemonic Discrimination Task [MDT] – Level 1
47	Mnemonic Discrimination Task [MDT] – Level 2		4	Mnemonic Discrimination Task [MDT] – Level 2

Table 1. Task frequency group design. Biweekly = Group 1, Bimonthly Burst = Group 2.

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	Frequency Group 1 (N=61)	Frequency Group 2 (N=72)	p-value	Overall (N=133)
Age at Neotiv Baseline, Mean (SD)	68.1 (7.87)	68.3 (7.09)	0.85	68.2 (7.43)
Female, n (%)	43 (70.5%)	46 (63.9%)	0.53	89 (66.9%)
Race			0.46	
American Indian or Alaska Native	7 (11.5%)	3 (4.2%)		10 (7.5%)
Black or African American	2 (3.3%)	3 (4.2%)		5 (3.8%)
Unknown	1 (1.6%)	1 (1.4%)		2 (1.5%)
White	51 (83.6%)	65 (90.3%)		116 (87.2%)
Years of Education, Mean (SD)	16.3 (2.55)	16.7 (2.28)	0.38	16.5 (2.40)
Positive Family History, n (%)	38 (62.3%)	38 (52.8%)	0.38	76 (57.1%)
Amyloid PET			0.98	
Non-elevated	40 (66.7%)	39 (54.2%)		79 (59.8%)
Elevated	8 (13.3%)	9 (12.5%)		17 (12.9%)
Missing	12 (20.0%)	24 (33.3%)		36 (27.3%)
Diagnosis, n (%)			0.59	
MCI	1 (1.6%)	3 (4.2%)		4 (3.0%)
Normal	60 (98.4%)	69 (95.8%)		129 (97.0%)

Table 2. Sample characteristics of participants who have completed at least 1 task. Group 1 = biweekly 1 task schedule, Group 2 = bimonthly burst task schedule.

Task Frequency Group:									
	ORR			CSR			MDT-OS		
Predictors	*β*	*CI*	*p*	*β*	*CI*	*p*	*β*	*CI*	*p*
Retrieval Time	-0.00	-0.00, -0.00	**<0.001**	-0.00	-0.00, -0.00	**<0.001**			
Baseline age[c]	-0.18	-0.26, -0.11	**<0.001**	-0.00	-0.01, 0.00	0.161	-0.00	-0.01, -0.00	**0.001**
Gender [Male]	-0.66	-1.87, 0.55	0.286	-0.07	-0.13, -0.02	**0.008**	0.05	0.01, 0.09	**0.016**
Education Years	-0.06	-0.29, 0.18	0.647	0.01	-0.00, 0.02	0.051	-0.01	-0.01, 0.00	0.128
Device [Tablet]	1.52	0.39, 2.66	**0.009**	0.01	-0.05, 0.06	0.848	0.01	-0.03, 0.05	0.533
Practice	0.20	0.07, 0.32	**0.002**	0.01	0.01, 0.02	**<0.001**	0.00	-0.01, 0.01	0.543
Frequency Group [2]	0.38	-0.73, 1.49	0.503	-0.01	-0.06, 0.04	0.733	-0.04	-0.09, 0.00	0.051
Practice * Frequency Group [2]							0.01	0.00, 0.02	**0.032**

Amyloid Status:									
	ORR			CSR			MDT-OS		
Predictors	*β*	*CI*	*p*	*β*	*CI*	*p*	*β*	*CI*	*p*
Retrieval Time	-0.00	-0.00, -0.00	**<0.001**	-0.00	-0.00, -0.00	**<0.001**			
Baseline Age[c]	-0.12	-0.21, -0.03	**0.010**	-0.00	-0.01, 0.00	0.346	-0.00	-0.01 – -0.00	**0.007**
Gender [Male]	-0.51	-1.81, 0.80	0.446	-0.06	-0.12, -0.00	**0.048**	0.05	0.01 – 0.10	**0.028**
Education Years	-0.12	-0.39, 0.14	0.365	0.01	-0.00, 0.02	0.106	-0.01	-0.02 – 0.00	0.072
Device Type [Tablet]	1.14	-0.10, 2.38	0.072	-0.00	-0.06, 0.05	0.866	-0.01	-0.05 – 0.04	0.800
Practice	0.21	0.07, 0.35	**0.004**	0.01	0.01, 0.02	**<0.001**	0.01	0.00 – 0.01	**0.034**
Amyloid Status [elevated]	0.54	-1.06, 2.14	0.509	0.06	-0.01, 0.13	0.105	0.04	-0.01, 0.10	0.126

Table 3. Linear mixed effects model results. Models included a random intercept term. Non-significant interaction terms were removed from models to better represent the main effects of terms. Practice was operationalized as number of exposures to the task – 1. Task Frequency Group schedules: 1 = biweekly 1 task schedule, 2 = bimonthly burst task schedule. Device Type was either smartphone (reference group) or tablet. [c]Baseline age was centered at 68.2 (SD=7.43)