Supplementary information for

Tracking response dynamics of sequential working memory in patients with mild Parkinson's disease

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1. Relationships between response dynamics and clinical features

We explored correlations between response dynamics and other clinical features (e.g., disease duration, duration of motor symptoms). Significance was considered at $p<0.002$ (Bonferroni correction for twenty-four tests).

Table S1 presents the correlation coefficients between mouse tracking parameters and clinical features. There was no significant correlation.

Table S1: Correlations between mouse tracking parameters and clinical features (*r* and *p* values)

Mouse tracking parameters		Disease duration	Duration of motor symptoms	MDS-UPDRS Part I	BDI	RBDSQ	ESS
Pure recall	IT	*r*=-0.21	*r*=-0.25	*r*=0.12	*r*=-0.19	*r*=-0.16	*r*=-0.17
		p=0.19	*p*=0.12	*p*=0.46	*p*=0.24	*p*=0.33	*p*=0.28
	MT	*r*=0.13	*r*=0.15	*r*=0.06	*r*=0.21	*r*=0.14	*r*=0.30
		p=0.44	*p*=0.34	*p*=0.73	*p*=0.20	*p*=0.40	*p*=0.06
	AUC	*r*=0.00	*r*=-0.06	*r*=0.13	*r*=0.00	*r*=-0.13	*r*=-0.05
		p=0.99	*p*=0.72	*p*=0.43	*p*=0.99	*p*=0.41	*p*=0.77
Ordering time		*r*=-0.13	*r*=-0.16	*r*=0.27	*r*=0.03	*r*=0.06	*r*=-0.10
		p=0.43	*p*=0.31	*p*=0.10	*p*=0.85	*p*=0.73	*p*=0.54

Note: IT, initiation time; MT, movement time; AUC, area under the curve; MDS-UPDRS: Movement Disorder Society-sponsored revision of the Unified Parkinson's Disease Rating Scale; BDI, Beck Depression Inventory-II; RBDSQ, REM Sleep Behaviour Disorder Screening Questionnaire; ESS, Epworth Sleep Scale.

2. Distribution analysis of the initiation and movement times

We performed an exploratory distribution analysis divided by quartiles. First, we divided PD patients into three subgroups (fastest, medium, slowest) according to the initiation time averaged across trial types. For each subgroup, we examined whether the patients had longer initiation times than healthy controls using repeated-measures ANOVAs (one-tailed, $p<0.017$ Bonferroni correction for three ANOVAs). The ANOVA had two factors, Group (PD subgroup, healthy control) and Trial Type ('pure recall', 'reorder & recall').

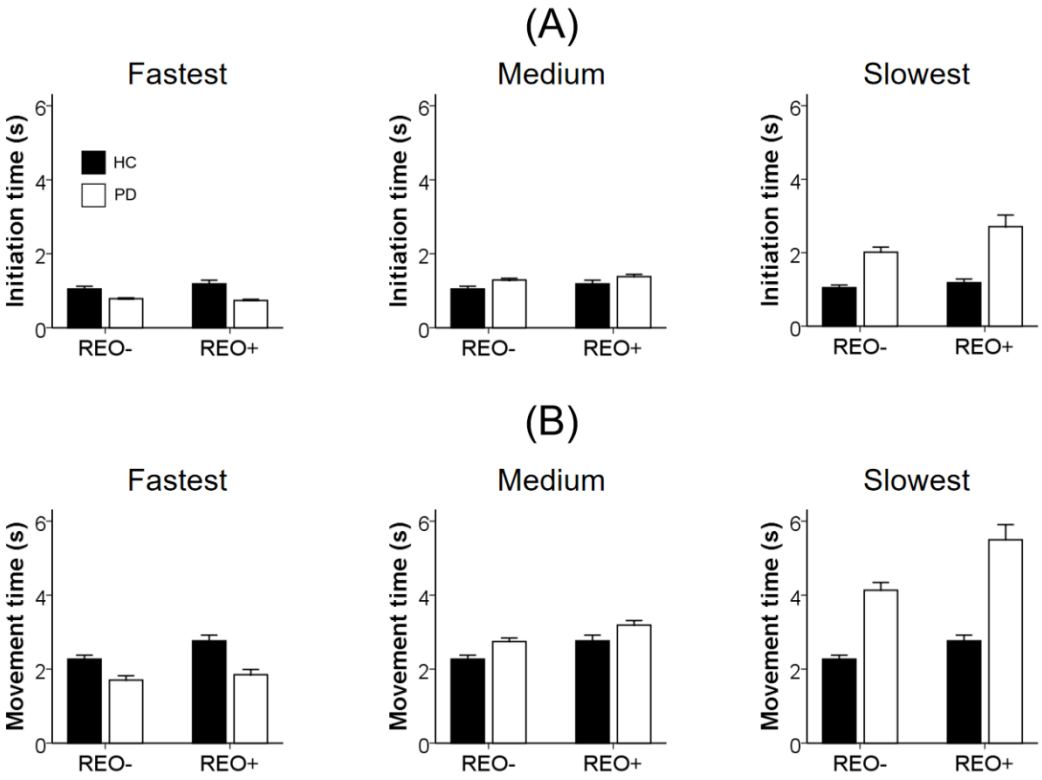
Fig.S1A shows the distribution analysis of the initiation time. For the slowest PD subgroup *versus* healthy controls, the main effects of Group ($F(1, 48)=39.47$, $p<0.001$, $\eta_p^2=0.45$) and Trial Type ($F(1, 48)=35.00$, $p<0.001$, $\eta_p^2=0.42$) and the interaction between Group and Trial Type were found ($F(1, 48)=15.88$, $p<0.001$, $\eta_p^2=0.25$). For the medium PD subgroup *versus* healthy controls, the main effect of Trial Type was found ($F(1, 58)=10.85$, $p=0.001$, $\eta_p^2=0.16$), but no main effect of Group ($F(1, 58)=3.14$, $p=0.041$, $\eta_p^2=0.05$) or interaction ($F<1$). For the fastest PD subgroup *versus* healthy controls, there was no main effect of Group ($F(1, 48)=4.47$, $p=0.02$, $\eta_p^2=0.09$) or Trial Type ($F(1, 48)=1.02$, $p=0.16$, $\eta_p^2=0.02$) or interaction ($F(1, 48)=4.25$, $p=0.02$, $\eta_p^2=0.08$). The slowest PD subgroup had longer initiation times than health controls, especially for 'reorder & recall' trails.

Second, we divided PD patients into three subgroups (fastest, medium, slowest) according to the movement time averaged across trial types. For each subgroup, we examined whether the patients had longer movement times than healthy controls using repeated-measures ANOVAs (one-tailed, $p<0.017$ Bonferroni correction for three ANOVAs). The ANOVA had two factors, Group (PD subgroup, healthy control)

and Trial Type ('pure recall', 'reorder & recall').

Fig.S1B shows the distribution analysis of the movement time. For the slowest PD subgroup *versus* healthy controls, the main effects of Group ($F(1, 48)=69.91$, $p<0.001$, $\eta_p^2=0.59$) and Trial Type ($F(1, 48)=41.96$, $p<0.001$, $\eta_p^2=0.47$) and the interaction between Group and Trial Type were found ($F(1, 48)=9.18$, $p=0.002$, $\eta_p^2=0.16$). For the medium PD subgroup *versus* healthy controls, the main effects of Group ($F(1, 58)=5.48$, $p=0.012$, $\eta_p^2=0.09$) and Trial Type were found ($F(1, 58)=52.26$, $p<0.001$, $\eta_p^2=0.47$), but not interaction ($F<1$). For the fastest PD subgroup *versus* healthy controls, the main effects of Group ($F(1, 48)=8.08$, $p=0.004$, $\eta_p^2=0.14$) and Trial Type were found ($F(1, 48)=13.66$, $p<0.001$, $\eta_p^2=0.22$), but not interaction ($F(1, 48)=4.11$, $p=0.024$, $\eta_p^2=0.08$). The slowest PD subgroup had longer movement times than healthy controls, especially for 'reorder & recall' trials. The medium PD subgroup had longer movement times regardless of the trial type.

Fig.S1: The distribution analysis of (A) the initiation time and (B) movement time in PD patients and healthy controls (HC). The patients were divided into three subgroups according to the initiation or movement time. Error bars indicate standard errors. REO-, pure recall; REO+, reorder & recall.


(A)
Fastest
Medium
Slowest
Initiation time (s)
HC
PD
REO-
REO+
(B)
Movement time (s)