Between-Session Intraindividual Variability in Phonological, Lexical, and Semantic Processing in Post-Stroke Aphasia: a Pilot Study

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Between-session intraindividual variability in phonological, lexical, and semantic processing in post-stroke aphasia: A pilot study
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Introduction
Neurolinguistics and cognitive neuropsychology have a long-standing tradition to focus on mean-level performance measures such as accuracy and mean reaction times. However, several recent neuropsychological studies suggest that intraindividual variability (IIV) – within-person variations in performance over time – may characterize behavior better than mean performance (Hultsch et al., 2008). Despite the common clinical observation that people with aphasia often produce marked variations in their day-to-day performance on a variety of tasks, only a few empirical studies have investigated IIV in aphasia (Duncan et al., 2016; Laures, 2005; Naranjo et al., 2018; Stark et al., 2016; Villard & Kiran, 2015, 2018), and to our best knowledge, no study has systematically investigated IIV in language processing in post-stroke aphasia. The aims of the current study were to investigate (1) IIV in language processing (i.e., phonological, lexical, and semantic processing) across days, and (2) the relationship between IIV in language processing and mean accuracy and standardized measures of language in post-stroke aphasia.

Methods
Thirteen people with post-stroke aphasia (5 female, mean age = 61.23 years, mean post-onset = 1.81 years) participated in the study. Participants were assessed on four different days (mean time between session 1 and 4 = 5.38 days) using the same set of six auditory experiments on each day. The experiments tested phonological, lexical, and semantic processing with and without WM demand (henceforth: 1. PHON, 2. PHON-WM, 3. LEX, 4. LEX-WM, 5. SEM, 6. SEM-WM, respectively; for details on task procedures, instructions, and stimuli, see Table 1). In addition, the Western Aphasia Battery (WAB) and the Comprehensive Aphasia Test-Hungarian (CAT-H) were administered to assess participants' language profile and aphasia severity. To examine IIV, we calculated two coefficients of variation (COV) for each task – one for accuracy (ACC-COV) and one for reaction times (RT-COV). We investigated the associations between COV indices and mean accuracy across tasks, and the WAB and the CAT-H using Pearson's correlations.

Results
ACC-COV in PHON showed a significant negative correlation with the CAT-H ($r = -0.71$, $p = 0.01$) and a marginally significant correlation with the WAB AQ ($r = -0.50$, $p = 0.08$). ACC-COV in SEM showed a significant negative correlation with the CAT-H ($r = -0.65$, $p = 0.02$) and the WAB ($r = -0.69$, $p = 0.01$). We observed mostly negative but non-significant correlations between all other ACC-COVs and standard measures of language. We found strong negative correlations between the ACC-COV and the mean accuracy in PHON, LEX, and SEM ($r = -0.74$ to -0.79), $p <$

0.01). RT-COV in PHON and LEX showed non-significant positive correlations with the CAT-H and the WAB (r = 0.39–0.57, p = ns.).

Conclusions

People with post-stroke aphasia show IIV in language processing across days. Greater IIV in accuracy may be associated with more severe aphasia and lower mean performance in post-stroke aphasia. IIV in accuracy and RTs may be driven by different underlying mechanisms.

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Table 1. Methods of the experimental language tasks

Language processing	WM demand	Task		Abbreviation of the task	Instruction	Stimuli
Phonological	none	1	Phoneme identification	PHON	Indicating whether the phoneme string heard contains the phoneme /b/ or not	CVCV/CVCVC non-words
	present	2	Phoneme identification with two stimuli	PHON-WM	Indicating if only one of the two phoneme strings heard contains the phoneme /b/	CVCV/CVCVC non-word pairs
Lexical	none	3	Auditory lexical decision	LEX	Indicating whether the phoneme string heard is a word or a nonsense word	CVCV/CVCVC words or non-words
	present	4	Auditory lexical decision with two stimuli	LEX-WM	Indicating if only one of the two phoneme strings heard is a word	CVCV/CVCVC word, non-word, or word–non-word pairs
Semantic	none	5	Auditory animacy decision	SEM	Indicating whether the thing heard is living or non-living	CVCV/CVCVC words
	present	6	Auditory animacy decision with two stimuli	SEM-WM	Indicating if only one of the two things heard is living	CVCV/CVCVC word pairs