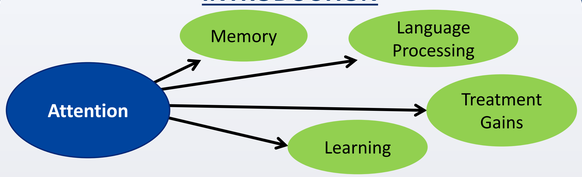
Inter- and Intra-Individual Variability in Non-Linguistic Attention in Aphasia

Sarah Villard & Swathi Kiran

Boston University, Sargent College of Health and Rehabilitation Sciences

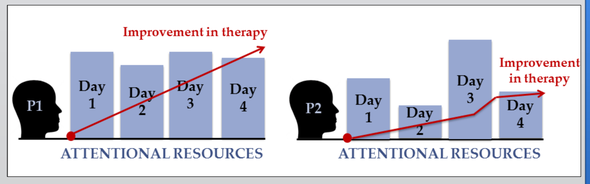
INTRODUCTION



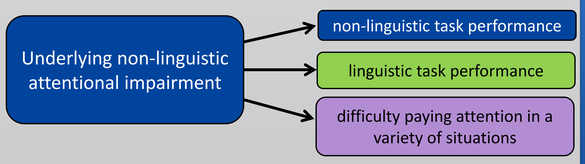
- Attention is a prerequisite to other cognitive skills and processes.
- A number of studies have identified impairment s in one or more types/aspects of attention processing in persons with aphasia (PWA) relative to healthy controls; variability among PWA has also been noted (e.g. Tseng, McNeil, & Milenkovic, 1993; Hunting-Pompon, Kendall, & Moore, 2011; Murray, 2012).
- Many studies on attention in aphasia have used linguistic tasks and have found PWA as a group to have poorer attention than controls on these tasks (e.g. Murray, 2000; Hula, McNeil, & Sung, 2007).
- Several studies have used purely non-linguistic tasks and have also found PWA as a group to have poorer attention and/or attention allocation than controls (Robin & Rizzo, 1989; Erickson, Goldinger, & LaPointe, 1996).
- It has also been suggested that an impairment in attention allocation may underlie or influence language impairment in aphasia (McNeil, Odell, & Tseng, 1991; Hula & McNeil, 2008).
- The present study looks systematically at five types of non-linguistic attention in aphasia.

Between-Session Intra-Individual Variability (BS-IIV) in task performance:

High BS-IIV has been noted in other neurologically impaired populations (e.g. Stuss et al, 1994); however, this has not been examined in attention in aphasia. We suggest that BS-IIV could impact treatment outcomes:



RATIONALE



OBJECTIVES

RESEARCH QUESTION 1: How does task complexity/difficulty on a non-linguistic attention task impact reaction time in PWA and in age-matched control participants?

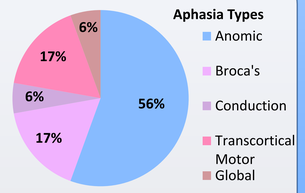
RESEARCH QUESTION 2: How does task complexity/difficulty on a non-linguistic attention task impact between-session intra-individual variability (BS-IIV) in reaction time in PWA and in age-matched control participants?

RESEARCH QUESTION 3: What kinds of *inter*-individual variability in BS-IIV are present within the PWA group?

PARTICIPANTS

Participants.

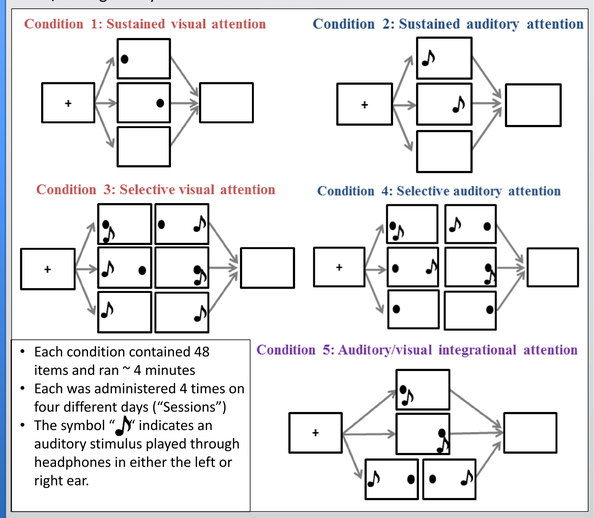
- 18 individuals with chronic aphasia from a unilateral stroke (6F, mean age = 63.4, sd = 7.5)
- 5 age-matched controls (3F, mean age = 65.3, sd = 5.9)



METHODS

Experimental Task.

- Five conditions, each assessing a different type of non-linguistic attention.
- Participant was instructed to press a key to indicate whether the target was on the left, on the right, or absent . For Condition 5, the target was L/R congruency between the two stimuli.



- Each condition contained 48 items and ran ~ 4 minutes
- Each was administered 4 times on four different days ("Sessions")
- The symbol "♪" indicates an auditory stimulus played through headphones in either the left or right ear.

DATA ANALYSIS

	Session 1	Session 2	Session 3	Session 4	
sustained visual	RT	RT	RT	RT	→ COV
sustained auditory	RT	RT	RT	RT	→ COV
selective visual	RT	RT	RT	RT	→ COV
selective auditory	RT	RT	RT	RT	→ COV
auditory/visual integrational	RT	RT	RT	RT	→ COV

task difficulty/complexity ↕

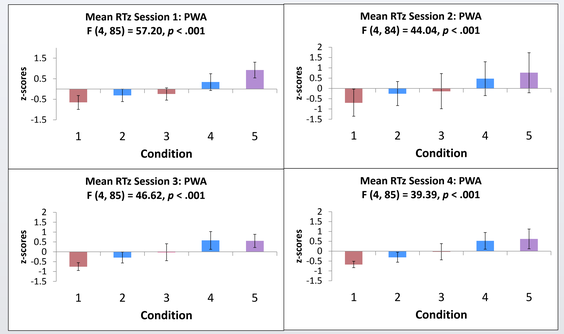
between-session intra-individual variability ↔

- **For RQ1**: raw RTs for correct E/R responses → RTz
- **For RQ2 and RQ3**: raw RTs for correct E/R responses → COV [stdev/mean]

RESULTS

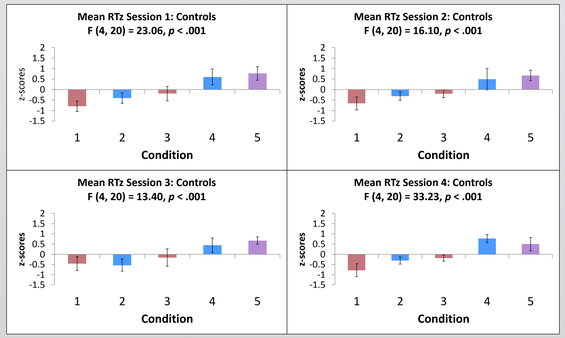
RESEARCH QUESTION 1*: Effect of task difficulty/complexity on response time*

1 x 5 ANOVA for each Session determining the effect of Condition on RTz:



Tukey post-hoc analyses for the PWA group consistently revealed:

- a complexity effect: Condition 3 > Condition 1; Condition 4 > Condition 2 ($p < .05$)
- a modality effect: Condition 4 > Condition 3; Condition 2 > Condition 1) ($p < .01$)
- Condition 5 vs. Condition 4: no significant difference.

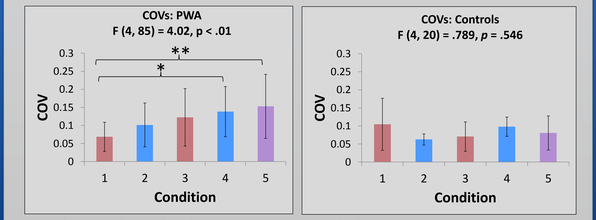


Tukey post-hoc analyses for the control group consistently revealed:

- a complexity effect: Condition 5 > Conditions 1, 2, and 3 ($p < .01$)

RESEARCH QUESTION 2*: Effect of task difficulty/complexity on between-session intra-individual variability in response time.*

A 2 x 5 (Group x Condition) ANOVA revealed a significant main effect of Group ($F (1, 105) = 5.084$, $p < .05$), such that PWA COVs > control COVs. The effect of Condition on COV was then analyzed separately for each group:



Post-hoc analyses for the PWA group revealed:

*Condition 4 > Condition 1 ($p < .05$); **Condition 5 > Condition 1 ($p < .01$).

This result indicates that selective auditory attention and auditory/visual integrational attention – the two most complex types of attention – each elicited more BS-IIV than sustained visual attention, the simplest type.

RESEARCH QUESTION 3*: Inter-individual differences among PWA.*

Exploratory k-means cluster analysis examining inter-individual differences in BS-IIV among PWA.

Final Cluster Centers

	Condition 1 COV	Condition 2 COV	Condition 3 COV	Condition 4 COV	Condition 5 COV
Cluster 1	0.066	0.168	0.044	**0.219**	**0.327**
Cluster 2	0.107	0.138	**0.244**	0.173	0.123
Cluster 3	0.056	0.078	0.095	0.113	0.134

PWA Cluster Membership

	Condition 1 COV	Condition 2 COV	Condition 3 COV	Condition 4 COV	Condition 5 COV
P8	0.068	0.245	0.079	**0.232**	**0.402**
P16	0.063	0.091	0.010	**0.207**	**0.252**
P2	0.058	0.233	**0.202**	0.170	0.079
P9	0.061	0.027	**0.245**	0.203	0.117
P17	0.203	0.144	**0.235**	0.074	0.117
P18	0.104	0.147	**0.295**	0.247	0.180
P1	0.066	0.082	0.100	0.159	0.172
P3	0.035	0.066	0.049	0.017	0.045
P4	0.060	0.076	0.102	0.106	0.142
P5	0.062	0.120	0.089	0.164	0.170
P6	0.066	0.060	0.056	0.059	0.116
P7	0.091	0.047	0.147	0.047	0.293
P10	0.063	0.121	0.088	0.175	0.144
P11	0.023	0.022	0.051	0.166	0.078
P12	0.061	0.076	0.081	0.179	0.143
P13	0.014	0.100	0.055	0.072	0.066
P14	0.088	0.094	0.131	0.161	0.074
P15	0.045	0.076	0.188	0.052	0.162

Associations between COV and performance on standardized measures.

A bivariate Pearson correlation matrix was conducted on Condition 1 COV, Condition 5 COV , WAB Aphasia Quotient, BNT score, and CLQT score. An association approaching significance was found between WAB AQ and Condition 5 COV ($r = -.441$, $p = .067$).

CONCLUSIONS

- On a non-linguistic attention task, increased task complexity elicits slower response times for both PWA and age-matched controls.
- Increased task complexity also elicits a higher degree of between-session intra-individual variability for PWA (but not for controls).
- This suggests that PWA may have difficulty maintaining consistent attention levels from day to day, particularly in situations that require more complex types of attention (e.g. when asked to attend to auditory information while visual information is also present), a finding which could have implications for prognosis in therapy.
- Additionally, PWA were found to exhibit a higher degree of between-session intra-individual variability than controls overall.
- Within the PWA group, several different patterns of intra-individual variability were found, suggesting *inter*-individual variability within this group. One sub-group was characterized by high variability on both selective auditory and auditory/visual integrational attention, another sub-group was characterized by high variability on selective visual attention, and a third sub-group exhibited generally lower variability.
- This is the first demonstration of between-session intra-individual variability in PWA on a purely non-linguistic task.
- Future studies should directly investigate the link between intra-individual variability in non-linguistic attention and treatment outcomes.

SELECTED REFERENCES

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