Estimating the speed-accuracy tradeoff "Sweet Spot" in language performance for people with aphasia: replication and extension of a diffusion-model based approach

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Introduction

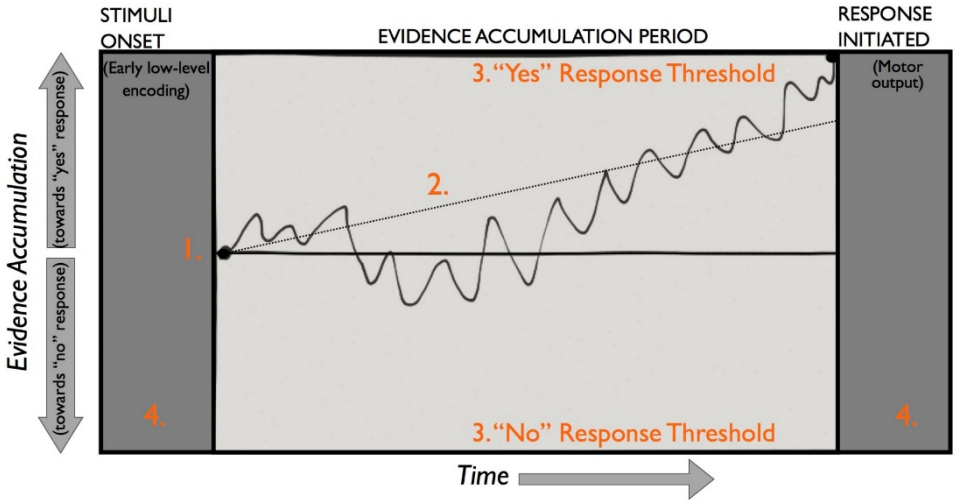
- Speed-accuracy tradeoffs (SATs)

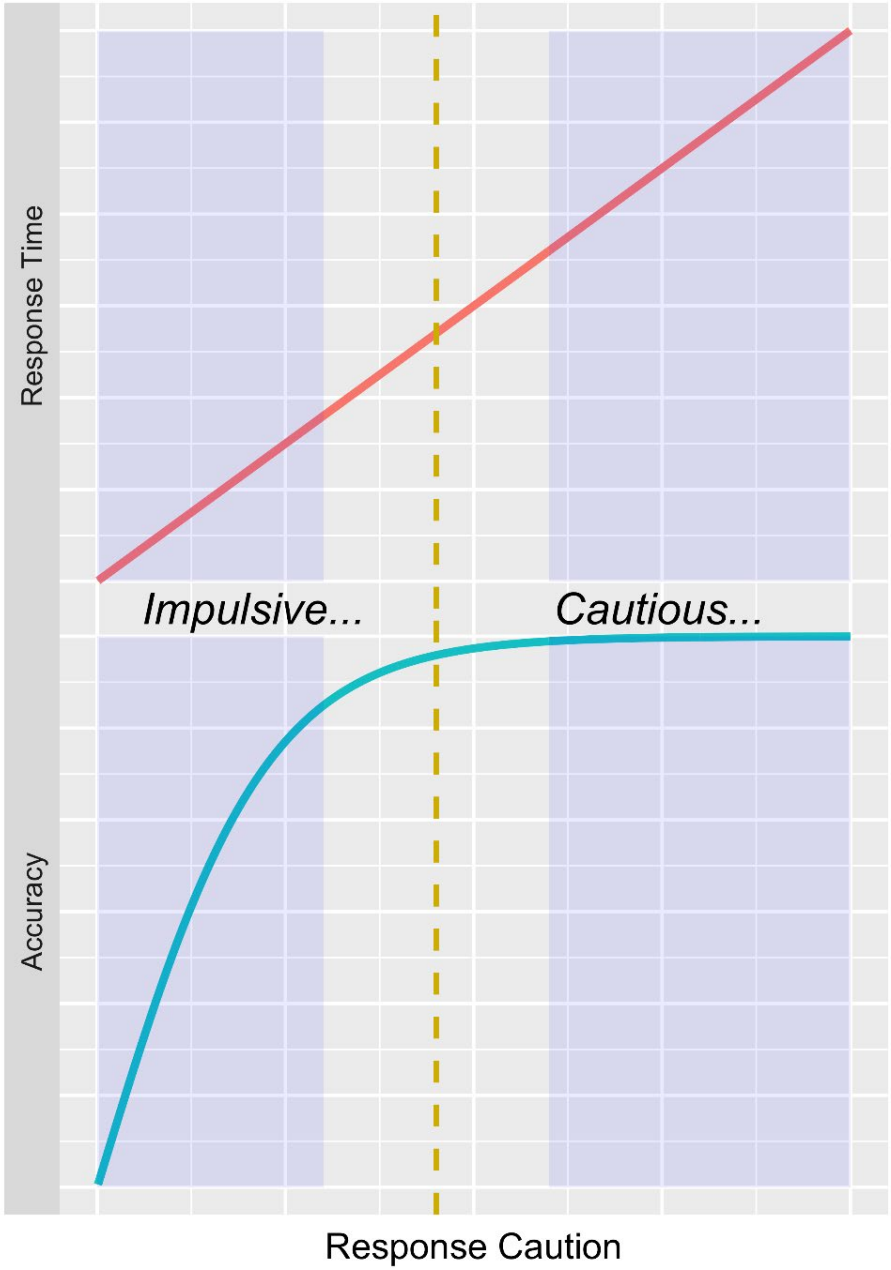
  ↑ time ↑ accuracy (Ratcliff, 1987; Wickelgren, 1977)

- 40% people with aphasia set maladaptive SATs (Evans et al., 2019)

  SATs were characterized using the Point of Adaptive Returns (PAR), the "sweet spot."

- ***Limitations***: preliminary findings, PAR reliability is unknown, needs ecologically-valid tasks.





Aims

1a. Replicate estimation of SATs on a second sample

1b. Evaluate test-retest reliability of PAR.

2a. Evaluate the diffusion model SATs in SFV responses.

2b. Investigate change in PAR and response threshold adaptation over time in response to training

- Investigate whether PWA's SFV "sweet spot" is associated with naming treatment outcomes.

Method

- 9 PWA in a multiple baseline study
  - 9-10 sessions of SFV
  - Computer-based speed and accuracy feedback + metacognitive training.
- 320-trial lexical decision task
  - 3-5 baseline points

	Sex	Age	MPO	Comp of Spoken Language CAT	Comp of Written Language CAT	Repetition CAT	Naming CAT
p1	M	63	259	52	51	47	48
p2	M	73	194	48	53	47	53
p3	M	68	21	55	58	55	59
p4	M	70	522	53	53	52	54
p5	M	70	39	55	50	53	49
p6	F	71	8	57	55	52	54
p7	M	70	9	44	35	60	46
p8	M	54	18	49	51	47	53
p9	M	72	58	49	61	46	55

Method

1a. (Replication). Model fit on a second sample (Ratcliff et al., 2002)

1b. (Test-retest). PAR correlation between baselines 1-2 and 2-3

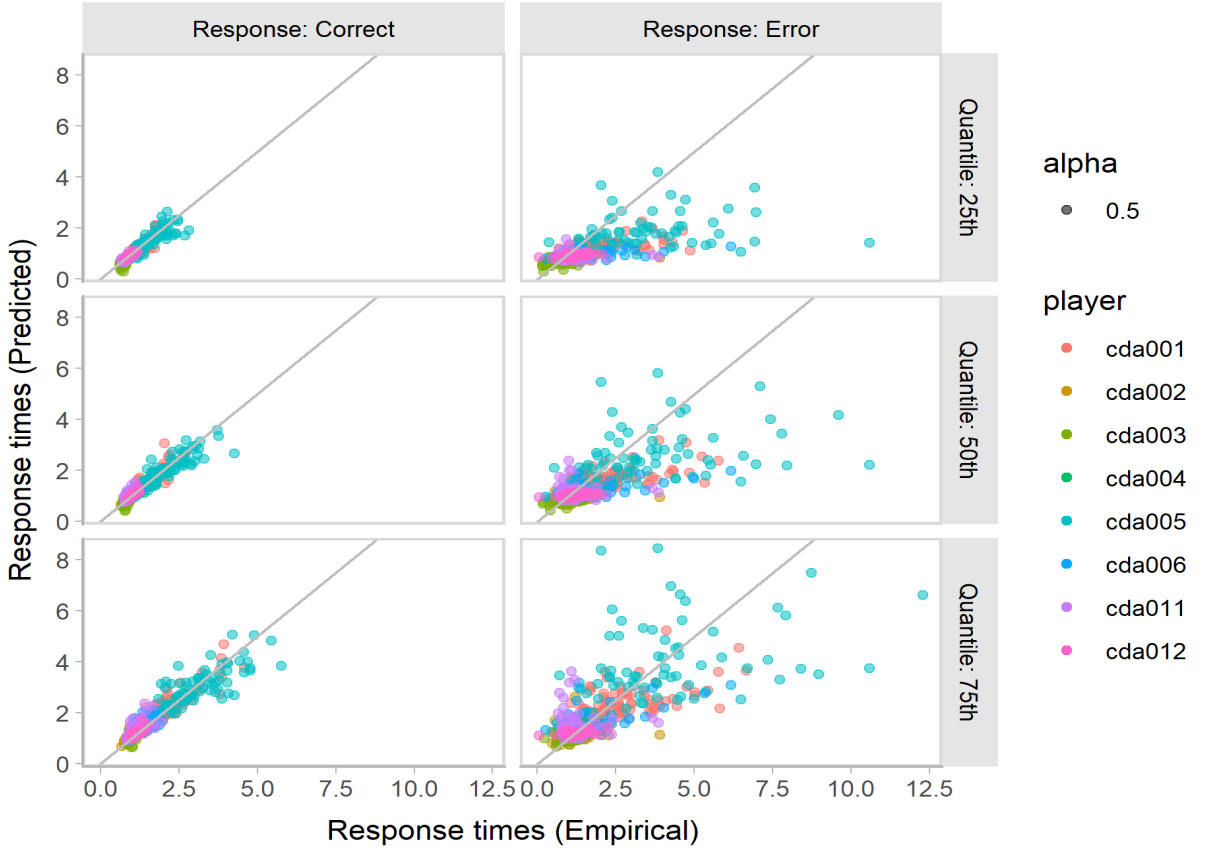
2a. (+ Ecological). Model fit on SFV responses.

2b. (PAR over time). Examination of PAR and response threshold adaptation for SFV over time and correlation with treatment effect sizes.

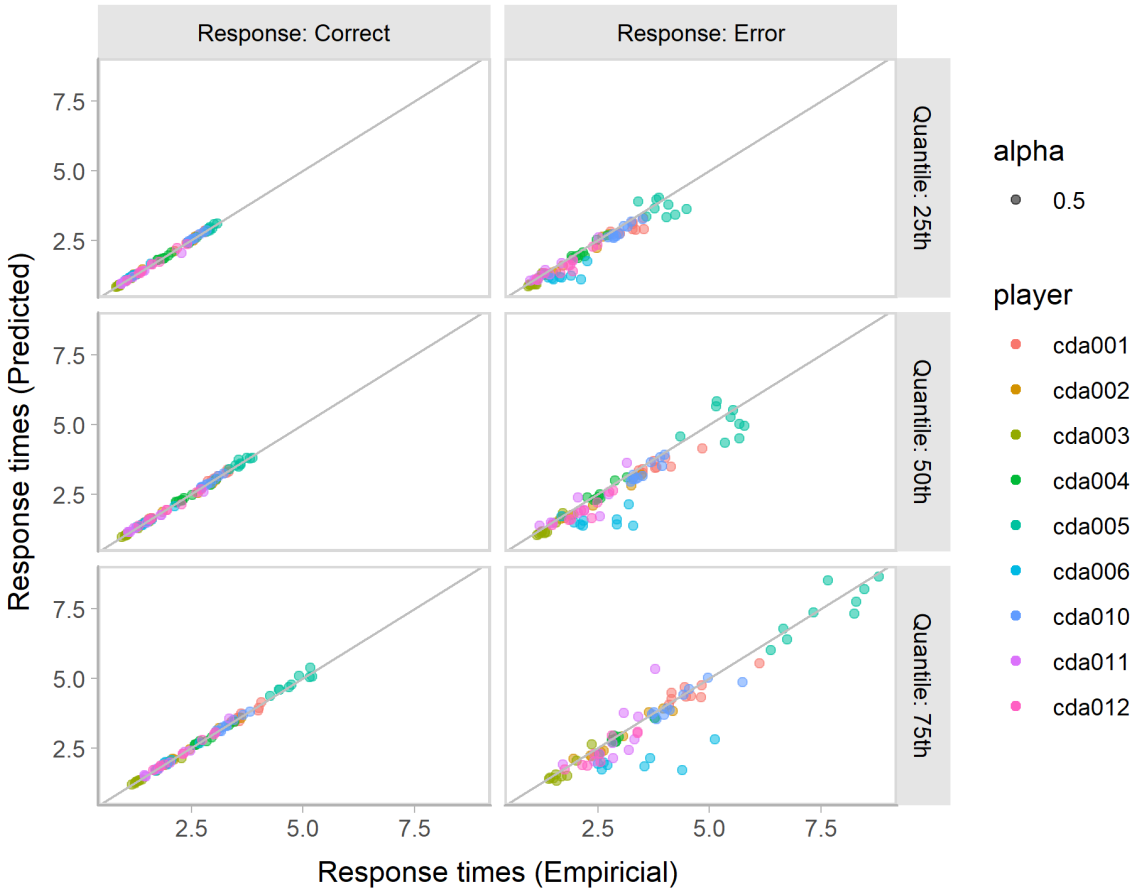
Results

1a. Model fit was acceptable on a second LD sample

1b. PAR correlation between baselines 1-2 (r=0.62, p=.08) and 2-3 (r=0.94, p<.001)

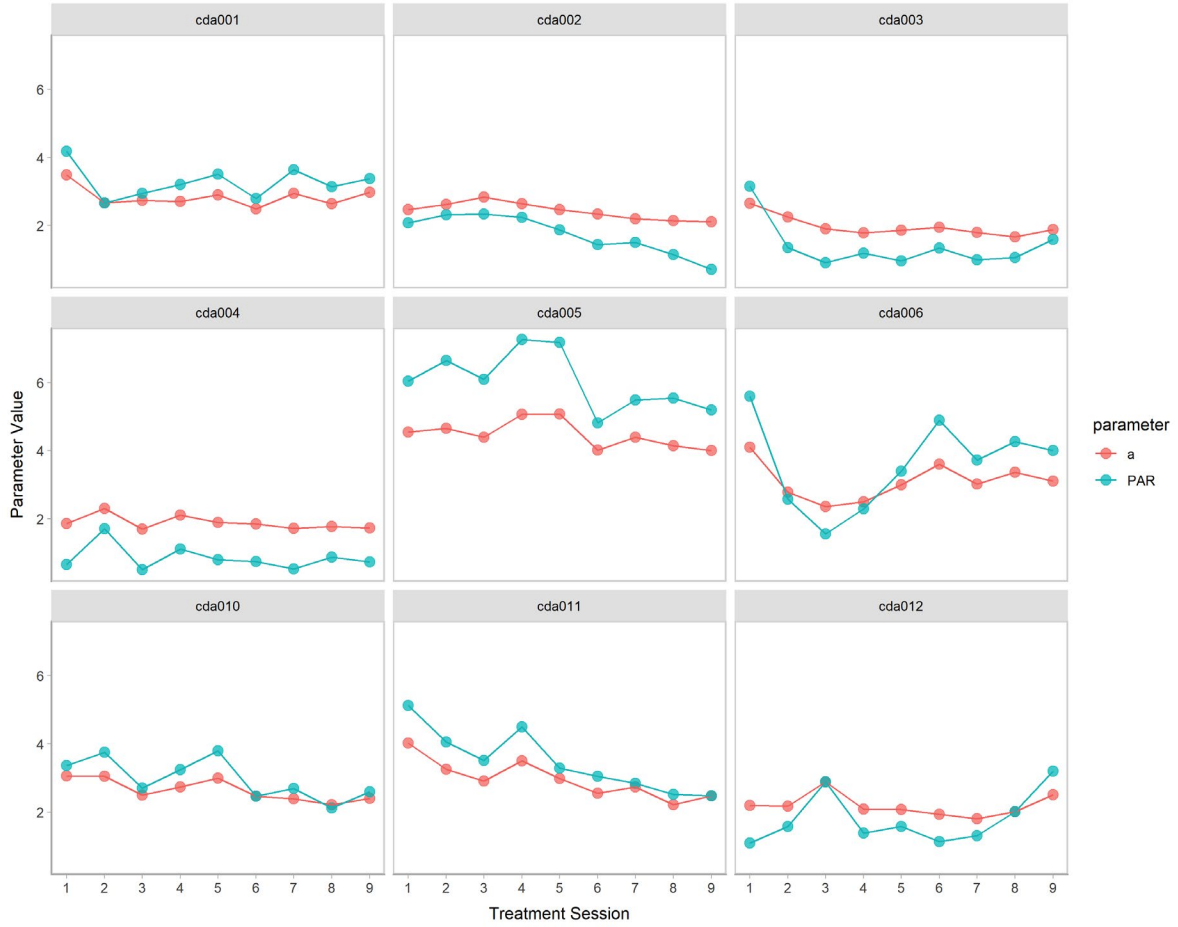


Parameter	Mean LD	Std dev. LD	Mean SFV	Std dev. SFV
Response threshold separation (a)	2.07	0.78	2.71	0.80
Starting point (z_r)	0.48	0.07	0.47	0.04
Drift rate (v_upper)	1.61	0.76	1.35	0.37
Drift rate (v_lower)	-1.56	0.67	-1.32	0.33
Non decision response time (t_o)	0.61	0.17	1.39	0.67
szr	0.19	0.09	0.08	0.11
st_o	0.20	0.03	0.80	0.48
sv	0.37	0.11	0.55	0.24



Response	Mean Absolute Error	Correlations (r)
Correct	0.038	0.99
Error	0.311	0.96

2a. Model fit was acceptable on SFV responses.



2b. Response caution (*a*) and PAR declined over time (Ratcliff et al., 2006).
No relationship between response threshold adaptation and effect sizes for:
trained items (r=-0.42;p=.58)
related items, (r=-0.13;p=.81)
unrelated items (r=0.28;p=.58)

Discussion

- Successful replication of previous findings
- Diffusion model fit LD and SFV data well, especially for correct responses.
- Moderate correlation (baselines 1-2), strong correlation (baselines 2-3). Once familiarized with the task, PAR is a reliable measure of SAT optimality.
- Successful extension of the diffusion model and PAR to SFV.
- PWA became less cautions over time, without improvements in threshold optimality. It may indicate a stable trait measure, rather than a malleable factor.
- Diffusion model can help to understand SAT for people with aphasia

References & Acknowledgements

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