Determining Primary Progressive Aphasia Variant with Longer Reading Versus Repetition Tasks

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Introduction

Repetition and reading tasks are commonly used to evaluate primary progressive aphasia (PPA) (Lukic et al., 2019). We hypothesized that (1) the ratio of reading to repetition errors can distinguish PPA variants, and (2) due to floor and ceiling effects, ratios of errors with short sentences with common words distinguish some individuals, while ratios of errors with lengthier sentences with longer and less common words better distinguish others.

Method

We studied 210 participants (84 lvPPA, 66 svPPA, and 60 nfavPPA) on at least one sentence reading and repetition task: (1) simple sentence reading and repetition tasks (5-10 words each) from the National Alzheimer's Coordinating Center's (NACC) FTLD Neuropsychological Battery (www.naccdata.org) and (2) a new task with longer sentences (10-16 words each) including longer words with lower frequency (e.g. Japanese, intimidated). We calculated the ratio of errors (omitted, substituted or misarticulated words) in reading:repetition tasks using the simple and new sentences. We used multinomial regression to determine the ratios of reading errors:repetition errors that discriminated between variants. We used t-tests to compare reading to repetition scores for each tasks for each variant.

Results

A total of 146 individuals completed the two (reading and repetition) simple sentence tasks and 19 completed the two new sentence tasks (15 completed both simple and new). There were no significant differences between PPA variants in age or education (by ANOVA; Table 1), or sex (by chi squared) or between those who completed the simple, new, or both tasks. Using multinomial regression, the simple plus new ratio of reading:repetition errors explained more of the variance between PPA variants (pseudo $R^2 = 0.32$; p=0.03; n=15), than either the simple sentence ratio (pseudo $R^2 = 0.03$, p=0.02, n=146) or the new ratio ($R^2 = 0.22$; p=0.01; n=19). Both svPPA and lvPPA patients made significantly more total errors on the simple repetition task than the simple reading task, but the mean difference was greater for lvPPA (p<0.00001 vs. p=0.01). Only the lvPPA patients made significantly more total errors on the new

repetition than the new reading task (p<0.00001, vs. p>0.1 for the other variants) (Table 1).

Conclusion

The ratio of reading:repetition errors in the new sentence task better discriminates lvPPA from the other variants than the same ratio in the simple sentence task (from the NACC battery), but they provide complementary information. Either pair of tasks discriminates between lvPPA and nfavPPA, which is generally the hardest diagnostic distinction to make (Tippett, 2020). However, the combination of short and long sentences improves classification and distinguishes lvPPA from svPPA. SvPPA participants actually made more errors on reading than repetition in the new task. Further investigation may determine if word frequency, word length, or sentence length effects account for the differences. Larger numbers of participants who complete both pairs of tasks are needed to confirm our findings.

Refrences

https://naccdata.org/data-collection/forms-documentation/ftld-2

Lukic, S., Mandelli, M. L., Welch, A., Jordan, K., Shwe, W., Neuhaus, J., . . . Gorno-Tempini, M. L. (2019). Neurocognitive basis of repetition deficits in primary progressive aphasia. *Brain and Language, 194*, 35-45. doi:10.1016/j.bandl.2019.04.003

Tippett, D. C. (2020). Classification of primary progressive aphasia: Challenges and complexities. *F1000Research, 9*, 64. doi:10.12688/f1000research.21184.1

Table 1.

PPA type	Obs	Mean	SD	Min	Max
NfvPPA (n=60)					
Education	48	15.88	2.67	8	20
Age	53	71.34	9.07	48	90
Long sentence reading errors	4	4.75	6.18	0	13
Long sentence repetition errors	4	31	26.70	8	63
Long sentence reading: repetition ratio	**4**	**0.09**	**0.10**	**0**	**0.21**
Short sentence reading errors	55	4.55	10.24	0	6
Short sentence repetition errors	56	6.46	8.94	0	37
Short sentence reading: repetition ratio	**34**	**0.48**	**1.07**	**0**	**6**
SvPPA (n=66)					
Education	57	15.02	2.50	12	20
Age	63	67.76	8.11	48	82
Long sentence reading errors	7	36.14	28.03	1	63
Long sentence repetition errors	6	37	24.36	3	63
Long sentence reading: repetition ratio	**6**	**2.55**	**4.81**	**.03**	**12.33**
Short sentence reading errors	66	3.50	1.79	0	5
Short sentence repetition errors	62	10.56	12.05	0	39
Short sentence reading: repetition ratio	**51**	**0.73**	**1.62**	**0**	**10**
LvPPA 9 (n=84)					
Education	72	15.65	2.70	12	20
Age	83	70.86	7.73	50	88
Long sentence reading errors	10	6	13.83	0	45
Long sentence repetition errors	9	46.44	16.01	8	59
Long sentence reading: repetition ratio	**9**	**0.11**	**0.25**	**0**	**0.78**
Short sentence reading errors	79	2.41	.85	0	37
Short sentence repetition errors	80	11.35	12.09	0	37
Short sentence reading: repetition ratio	**61**	**0.20**	**0.45**	**0**	**2.85**