Story telling after right-sided stroke: Using real-time speech measures to identify the deficit

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1. Introduction

Stroke is a global health problem [1]. In right-sided stroke, speech and related difficulties can be subtle (see Figures 1A, 1B). As a result, affected people may be under-identified by professionals, resulting in reduced access to rehabilitation, yet with major impact on their lives which has been under-estimated [2].

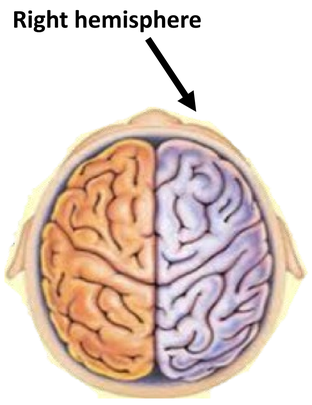

Figure 1A. The right-side or hemisphere of the brain

- **Slowed speed of thinking**
- **Speech fluency**
- Attention and memory difficulties
- Literal interpretation
- Reduced reasoning and problem-solving skills
- Cognitive fatigue
- Impaired social communication skills
- Reduced insight

Figure 1B. Impairments associated with damage to the right hemisphere

2. Purpose of the present study

Previous studies found that survivors of right-sided stroke are slower when they think than both healthy individuals and survivors of left-sided stroke [3, 4]. Some studies also found that people after a right-sided stroke may produce fewer words and may be less fluent than age-matched, healthy speakers when telling a story [5].

The present study applied a **novel method** to measure the fluency of right-sided stroke survivors in story-telling. This method captures the speed by which participants tell a story in real-time. This approach may be a more sensitive way of identifying possible subtle speech difficulties that may otherwise be overlooked [6].

References
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3. Aim

To compare the speed by which right-sided stroke survivors and healthy speakers tell stories using real-time speech measures.

4. Method

Participants: Ten people who have had a right-sided stroke and 10 healthy controls similar in age, education, and ethnicity, all from the Right Hemisphere Damage Bank [7].

Analyses: Recordings of participants telling the story of Cinderella were transcribed in speech analysis software PRAAT [8]. PRAAT also identified boundaries of **speech segments** and **silent pauses (see Figure 2)**, which were refined manually to maximise accuracy.

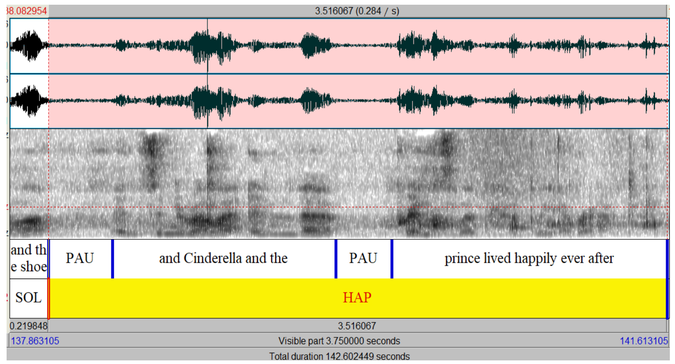

Figure 2. Transcription and analysis of audio recording in PRAAT

The durations of these segments and the number of words in the story were then used to calculate the following three **real-time measures.**

Speech rate: word count divided by total duration of the story. This measure retains silent pauses which are believed to be the time taken to plan speech.

Articulation rate: word count divided by actual speaking time (i.e., total duration of story minus silent pauses). This measure removes the planning time.

Word rate: word count divided by word duration (i.e., actual speaking time minus filled and silent pauses, mazes and repetitions). This measure is pure word rate as it only contains the informative parts of speech.

5. Results

The results are shown in figure 4. A between-group Mann-Whitney U test revealed that speech rate, articulation rate and word rate were **not significantly** different between the right-hemisphere group and the healthy speakers involved in this study.

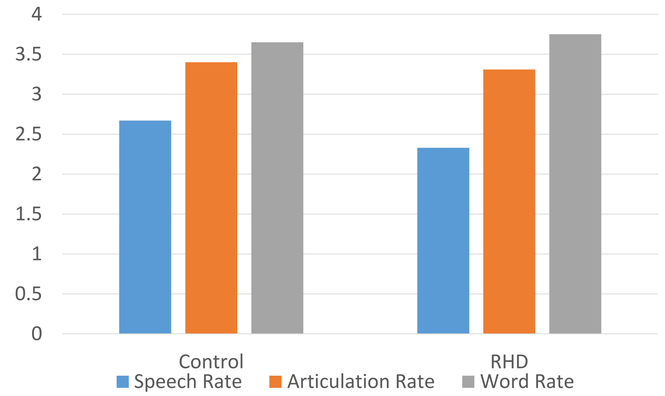

Figure 4. Bar chart of real-time speech measures in milliseconds (Control = healthy speakers, RHD = right-sided stroke group).

6. Discussion

Using a novel method this project accurately measured for the first time the speed of real-time, story-telling in people affected by right-sided stroke. The results revealed that real-time speech measures between people affected by right-sided stroke and healthy speakers were similar. Possible reasons may be as follows:

- **Processing speed deficits may not extend to speech**; past clinical impressions of the speech-rate of right-sided stroke survivors may not be as accurate as previously believed.
- **Speech conditions**; it is possible that different results may be seen if a time-limit was applied to the task. For example, only allowing 2 minutes to tell the story would impose greater demands which may reveal processing speed differences in right-sided stroke survivors.
- **Sample size**; the small number participants may account for differences between the two groups not being statistically significant.

Speech difficulties experienced by right-sided stoke survivors are under-researched and often under-identified. Future studies using our novel approach would broaden our understanding of the effects of right-sided stroke on communication, and contribute to improving access to support for affected people.

Acknowledgments
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