The role of fluency and rhythm in the assessment of task delivery

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1. Introduction

Background

- Oral fluency is considered essential in the learning, teaching, and assessment of speaking skills. [1]
- Fluency is a complex and dynamic construct, leading to differing definitions. [2]
- In L2 research, fluency is narrowly defined as temporal features of speech, whereas in assessment it is often conflated with rhythm and expanded to include delivery.

Purpose

- This study examines the relative importance of temporal and rhythmic features in the assessment of task delivery.

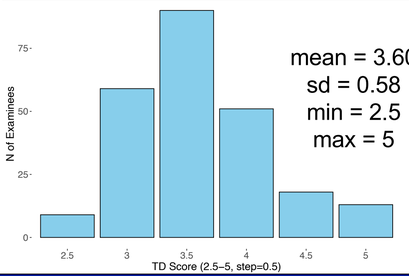
2. Data – KIT Speaking Test Corpus

The KIT Speaking Test	Our study
9 tasks: 3 photo description (Q1-3), 2 conversation summary (4, 6), 2 opinion (5, 7), and 2 structured speech (8, 9), 45-60 sec each	1 semi-structured task (Q4) and 3 spontaneous tasks (3, 5, 9).
Task Achievement (TA) and Task Delivery (TD) **scores** (by 1 native & 1 non-native rater)	**TD scores** only (which primarily evaluates fluency)
574 **participants** with scored speech samples	Top 60 only (to avoid excessive disfluency)

[5] Mostly confident AND time used well with no intrusive pauses, hesitations, or repetitions

[1] Gives up OR meaning not conveyed with delivery problems (slow speech, pauses, hesitations, repetitions)

[0] Does not start the task



mean = 3.60
sd = 0.58
min = 2.5
max = 5

Scan for further details

Link to the corpus

Segmentation

- 4 tokens x 4 tasks x 60 participants (to exclude fillers and disfluency to calculate rhythm scores) = 960 tokens, mean duration = 2.31 ms, sd = 0.93.
- Annotation by Montreal Forced Alignment [3] + manual modification.

3. Analysis

Variables of interest

speed	**articulation rate** (# of syllables / speech dur)
repair	**disfluency ratio** (freq of disfluency / syllable)
pause	mid-clause pause ratio/duration, end-clause pause ratio/duration, filled pause ratio
rhythm	ΔV/C, %V, VarcoV/C, nPVI-V/C, rPVI-C

- Calculated with automatic annotation systems [4].
- To avoid multicollinearity, the number of factors were reduced by principal component analyses.

Pause-related factors (Fig. 1)

	duration	frequency
mid-caluse pause ratio	0.342	-0.645
end-clause pause ratio	0.447	-0.070
mid-caluse pause dur	0.574	-0.123
end-clause pause dur	0.557	0.325
filled pause ratio	-0.209	-0.677

Rhythm-related factors (Fig. 2)

	Var-C	Var-V		Var-C	Var-V
ΔC	-0.518	0.006	ΔV	-0.049	0.573
VarcoC	-0.449	0.045	%V	0.215	0.388
nPVI-C	-0.458	-0.021	VarcoV	-0.031	0.532
rPVI-C	-0.515	-0.023	nPVI-V	-0.076	0.484

- Linear mixed-effects modeling was conducted, setting the **TD score** as the dependent variable.

4. Results & Discussion

- TD scores were higher for faster speech (**Fig. 3**).
- TD scores were also higher for speech with shorter and fewer pauses.
- The effect of PD appeared to be moderated when speech had higher Var-C (**Fig. 4**).
- DR seemed to negatively affect TD scores only when speech had higher Var-C (**Fig. 5**).

Fig. 3

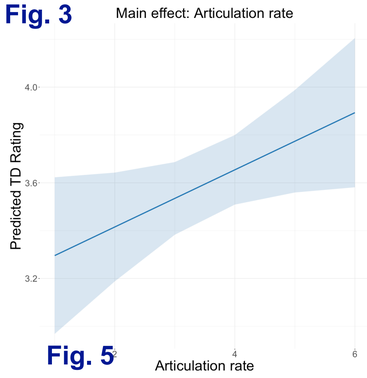


Fig. 1

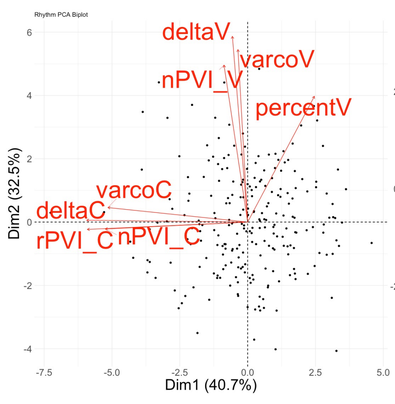


Fig. 2

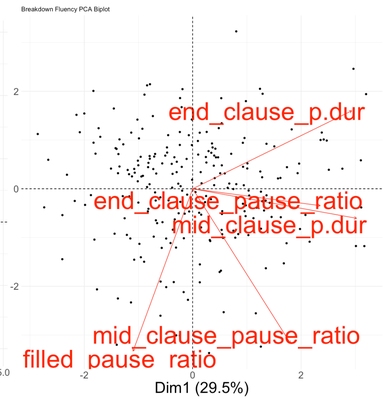


Fig. 4

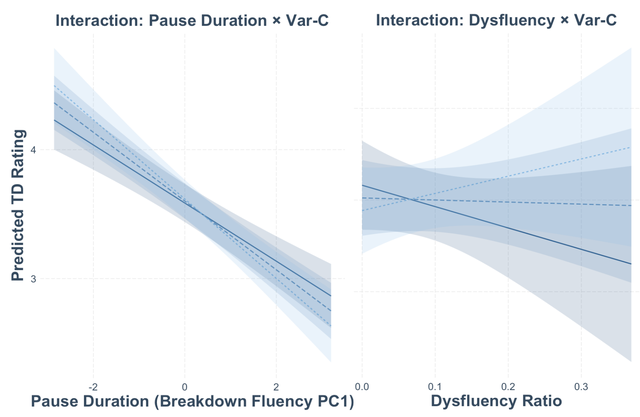


Fig. 5

	est	CI	*p*
(intercept)	3.18	2.72 −3.65	<.001*
articulation rate (AR)	**0.12**	**0.00 −0.24**	**<.05***
pause duration (PD)	**-0.27**	**-0.32 −-0.21**	**<.001***
pause frequency (PF)	**0.14**	**0.08 −0.20**	**<.001***
disfluency ratio (DR)	-0.09	-1.17 −0.99	.869
Var-C	0.06	-0.16 −0.28	.587
Var-V	0.17	-0.09 −0.43	.193
AR*Var-C	-0.01	-0.07 −0.05	.783
AR*Var-V	-0.05	-0.12 −0.02	.139
PD*Var-C	**0.02**	**-0.00 −0.05**	**.092**
PD*Var-V	0.01	-0.02 −0.04	.422
PF*Var-C	-0.02	-0.05 −0.01	.239
PF*Var-V	0.01	-0.02 −0.04	.512
DR*Var-C	**-0.47**	**-0.98 −0.05**	**.076**
DR*Var-V	-0.01	-0.64 −0.62	.976

References

[1] Kormos (2006). Speech production and second language acquisition. Mahwah, NJ: Lawrence Erlbaum Associates.
[2] Tavakoli, Nakatsuhara, & Hunter (2020). Aspects of fluency across assessed levels of speaking proficiency. The Modern Language Journal, 104, 169–191.
[3] McAuliffe et al. (2017). Montreal Forced Aligner: trainable text-speech alignment using Kaldi. In *Proc of the 18th ISCA Conf.*
[4] Matsuura, Suzuki et al. (2025). Gauging the validity of machine learning-based temporal feature annotation to measure fluency in speech automatically. Research Methods in Applied Linguistics, 4(1), 100177.