From Features to Fluency: Predicting Perceived Speech Fluency of Preschool Children for Language Proficiency Assessments

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Background

- Common practice in Germany: Language Proficiency Assessment (LPA) for preschool children [1]
- Most applied LPA methods: test for children's vocabulary size, grammar skills [2, 3], and morphology [4]
- Speech fluency correlates with language proficiency, e.g. [5], [6], [7] → opportunity to enhance LPAs

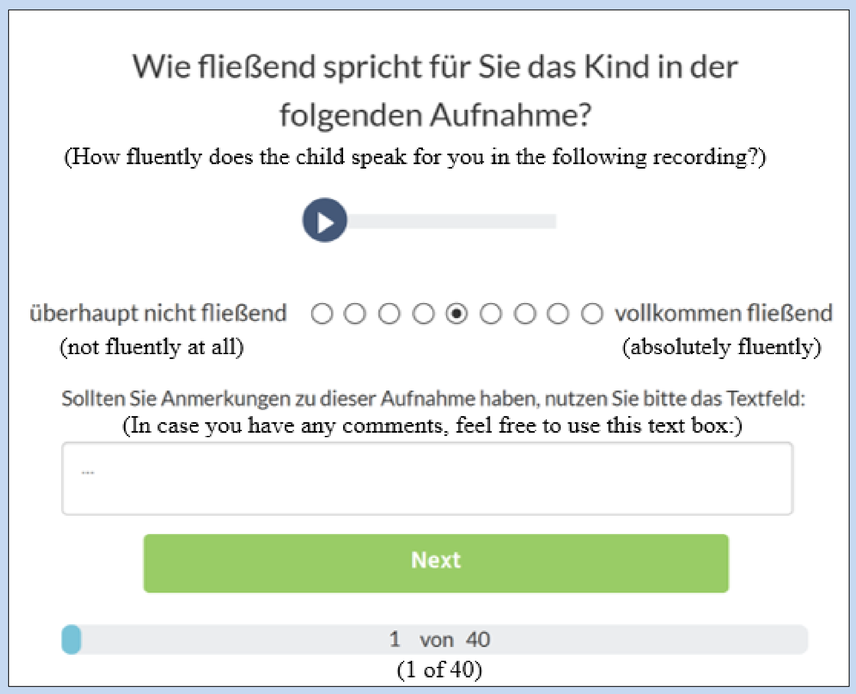
Aim

- Development of individual fluency profiles for LPA
- Previous study [8]: overview of various aspects of child's fluency, but no information on their actual influence on speech fluency
- Human perceptual assessment of child's fluency
- Find influence of fluency features to make profiles usable for LPA

Data & Methodology

- Data acquisition with *WUSCHEL* [9], a game-based task in a custom-made app: children interact with virtual character, answer questions to progress through coherent scenes
- 28 scenes, 2 answers each => 560 segments (ø 3.23 s of pure articulation time per segment)
- 2 seconds minimal articulation time: 320 stimuli from 10 children
- Age 4;6 - 5;6 years, 5 with L1 German, 5 with L2 German

- 32 German L1 raters, background in linguistics
- Online: rate perceived overall fluency of child in presented audio (no definition given, no special instructions), see screenshot
- 1st round: 20 different stimuli in random order
  2nd round: same stimuli in same order again
- 2 separate ratings of 20 different stimuli per rater => 1280 fluency ratings

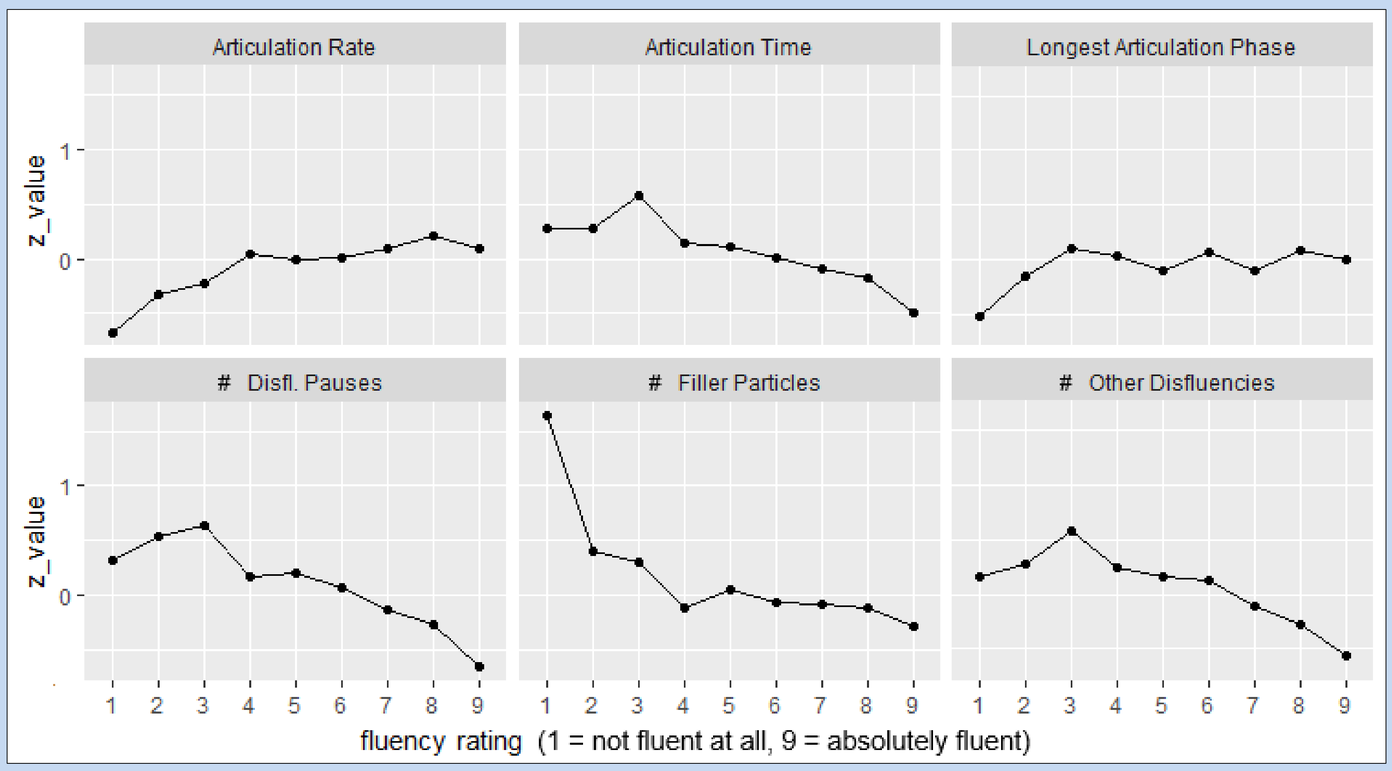


Results

- Moderate agreement between raters (κ = 0.512), substantial agreement within raters (κ = 0.669)
- Significant effects in a CLMM (Cumulative Link Mixed Model):
  - Number of disfluent pauses (negative)
  - Number of other disfluencies (negative)
  - Articulation rate (positive)

- Number of filler particles: high decline from rating of 1 to rating of 2

Predictors	Odds Ratios	CI	p
Number of disfluent pauses	0.45	0.30 - 0.69	**<0.001**
Disfluent pause duration	0.75	0.50 - 1.14	0.180
Number of other disfluencies	0.46	0.34 - 0.62	**<0.001**
Articulation time	1.09	0.70 - 1.70	0.711
Number of filler particles	0.82	0.61 - 1.10	0.179
Articulation rate	1.32	1.04 - 1.69	**0.025**
Longest articulation phase	1.07	0.78 - 1.48	0.675



Discussion

- Decent agreement between, substantial agreement within raters → unified overall assessment of child's speech fluency possible
- Sheer amount of disfluent pauses more influential than their duration
- Excessive use of filler particles seems to lead to complete loss of fluency, moderate use seems to be tolerated
- Strong effect of "other disfluencies"
- Articulation rate: only significant positive effect

Next steps

- Further pause analysis: location might play important role [10]
- More detailed analysis of "other disfluencies"
- Involve LPA stakeholders to reflect their practical expertise
- Use results to add weights to [8]'s fluency profiles to
  - create an algorithm to derive an overall fluency score
  - predict perceived fluency to enhance (automatic) LPA

[1] Lisker (2010). Sprachstandsfeststellung und Sprachförderung im Kindergarten sowie beim Übergang in die Schule. Expertise im Auftrag des Deutschen Jugendinstituts. **[2]** Schulz & Tracy (2011). Linguistische Sprachstandserhebung – Deutsch als Zweitsprache (LiSe-DaZ): Language Test for Children with German as a Second Language. **[3]** Gagarina et al. (2019). Main: Multilingual assessment instrument for narratives – revised. ZAS Papers in Linguistics, 63, 20. **[4]** Mayr & Ulich (2003). Sismik – Sprachverhalten und Interesse an Sprache bei Migrantenkindern in Kindertageseinrichtungen. **[5]** De Jong et al. (2021). Praat scripts to measure speed fluency and breakdown fluency in speech automatically. Assessment in Education: Principles, Policy & Practice, 28, 456–476. **[6]** Ginther et al. (2010). Conceptual and empirical relationships between temporal measures of fluency and oral English proficiency with implications for automated scoring. Language Testing, 27, 379–399. **[7]** Iwashita et al. (2008). Assessed levels of second language speaking proficiency: How distinct? Applied Linguistics, 29, 24–49. **[8]** Kany & Trouvain (2025). Annotations of disfluencies in child speech. Elektronische Sprachsignalverarbeitung 2025 (ESSV 2025), 247-254. **[9]** Weidinger et al. (in press). Assessing multilingual children from a usage-based perspective: The WUSCHEL approach. Usage-based approaches to multilingualism: Language acquisition, language contact, multilingual language use. **[10]** Kahng, J. (2018). The effect of pause location on perceived fluency. Applied Psycholinguistics, 39, 569-591.