

Developing a Digital Training System for Acquired Dysarthria: the *ISi-Speech* Project

Hendrike Frieg^a, Ute Ritterfeld^b, Juliane Muehlhaus^{a, b}, & Kerstin Bilda^a

a. Speech and Language Therapy, Department of Applied Health Sciences, Hochschule für Gesundheit,
b. School of Rehabilitation Sciences, Department of Language and Communication, TU Dortmund University

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Background

- Speaking is a key factor for successful communication and participation in society
- Speech motor impairments, such as dysarthria, have a significant impact on everyday communication due to reduced speech intelligibility
- Neurologic diseases, e.g. stroke or Parkinson's disease, are often associated with dysarthria
- Health insurance often covers only a limited set of treatment units for speech therapy, e.g. two sessions a week
- Sustainable effects for treatment of dysarthria have primarily been shown using intensive treatment approaches like LSVT LOUD® (e.g. Fox, Ebersbach, Ramig, & Sapir, 2012)
- Increase of frequency often fails due to a lack in human resources or cost coverage
- This is where **technology** comes into play
 - in the interaction with a speech pathologist
 - as a supplement tool for autonomous training
- In autonomous speech training, **feedback** on correct execution is of utmost importance
- Objective and motivating feedback may nowadays be based on **automatic speech recognition**, helping to boost awareness of intelligibility limitations and optimizing speech performance



Fig. 1. *ISi-Speech* is designed as a training system to be worked on with personal computer, laptop, tablet pc or smartphone.

Aim

- Joining efforts to develop a **digital training system** for people with dysarthria in an interdisciplinary team of engineers for speech signal processing and informatics, media designers and researchers from the fields of speech pathology and psychology
- Challenge is to develop an **automatic speech recognition system** applicable to distorted speech and to integrate this system into a speech therapy application that incorporates the motivational potential contributing to frequent and autonomous usage

Therapy material

- The *ISi-Speech* training system covers evidence-based and best clinical practice exercises for treatment of articulation, prosody and pitch range, speech rate, vocal volume, and resonance.
 - Articulation**: repetition and reading tasks, clear and exaggerated articulation (e.g. Park, Theodoros, Finch, & Cardell, 2016) of words, phrases, sentences and texts
 - Prosody**: metrically controlled sentences, poems or lyrics, rhythmic entrainment exercises (cf. Späth et al., 2016), utterances with specific empathic stress patterns
 - Speech rate**: virtual metronome, pacing board
 - augmented **vocal volume** & **vocal vigilance**
- Treatment options with *ISi-Speech* are numerous, but each patient shall focus on only one to two variables at a time to maximize outcome (Atkinson-Clement, Sadat, & Pinto, 2015).



Fig. 2-4. Exemplary *ISi-Speech* exercises on speech rate, vocal volume and prosody.



Fig. 5-7. *ISi-Speech* exercise on intelligibility in a participative dialog.



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Disclosure

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