

Developing a Technology-Based Speech Intervention for Acquired Dysarthria

A Psychological Approach

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Acquired Dysarthria & Parkinson's Disease

- Dysarthria = speech motor impairment that result from neuromuscular control disturbance (Enderby, 2013)
- Dysarthria affecting respiration, phonation, resonance, articulation (Enderby, 2013)
- Dysarthria as symptom of people with Parkinson's Disease (PD)
- Prevalence PD in Germany: 150-200/100.000 (Ziegler & Vogel, 2010)

Psychological Effects of Dysarthria

Speech motor impairments as substantial risk for social isolation
(Gage et al., 2014)

- Negative changes in self-identity and relationships
- Social and emotional disruptions
- Feelings of stigmatization

(Dickson et al., 2008)

Conventional Speech Therapy

- Promote communication skills via dialogic face-to-face situation

- Articulation
- Speech rate
- Prosody
- Vocal loudness
- Respiration
- Voice
- Functional communication

- Evidence-based therapy: Lee Silverman Voice Treatment (LSVT®)
(Fox, Ebersbach, Ramig, & Sapis, 2012)

Challenges in Speech Therapy

Treatment

- Limited sessions
- Low frequency

but studies (Fox, Ebersbach, Ramig, & Sapiro, 2012; Spielman, Ramig, Mahler, Halpern, & Gavin, 2007) demonstrated:

High frequency Speech Therapy is effective
(2-4 Sessions/week á 60min)



Technology-based intervention

High frequency

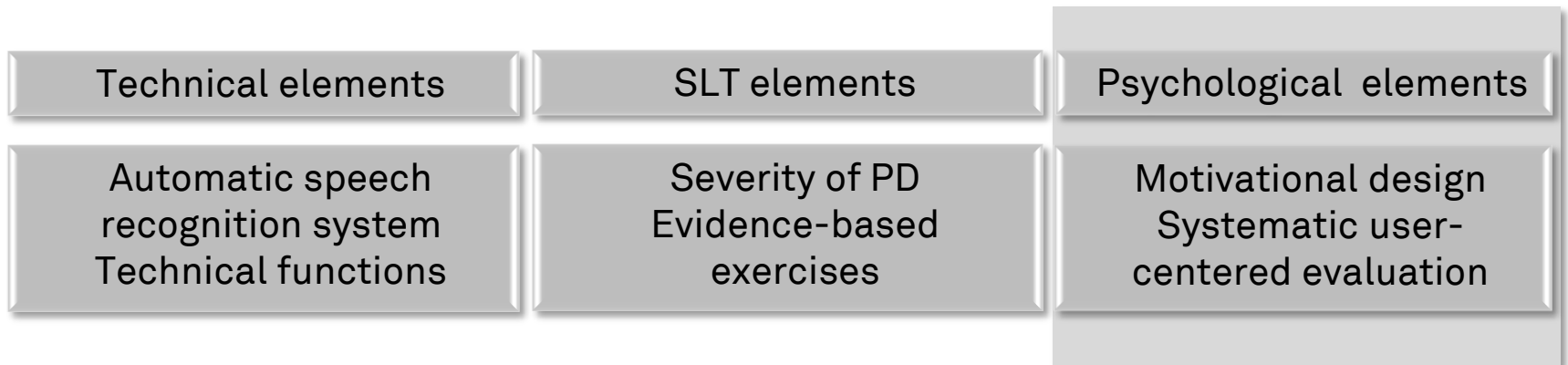
Individual tailoring

Highly specific training

ISi-Speech project

Approach

- Interdisciplinary team
 - Engineers for speech signal processing and informatics
 - Psychologists
 - Clinical Linguists & Speech and Language Therapists (SLT)
 - Media designers



Theory-based design

- Using psychological models/theories to improve:

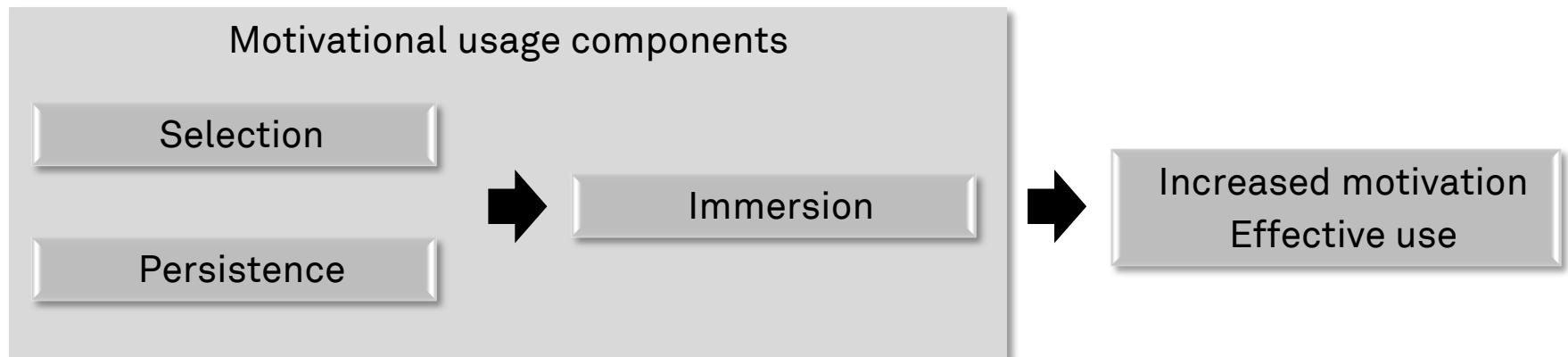
Attractiveness

Intuitive usability

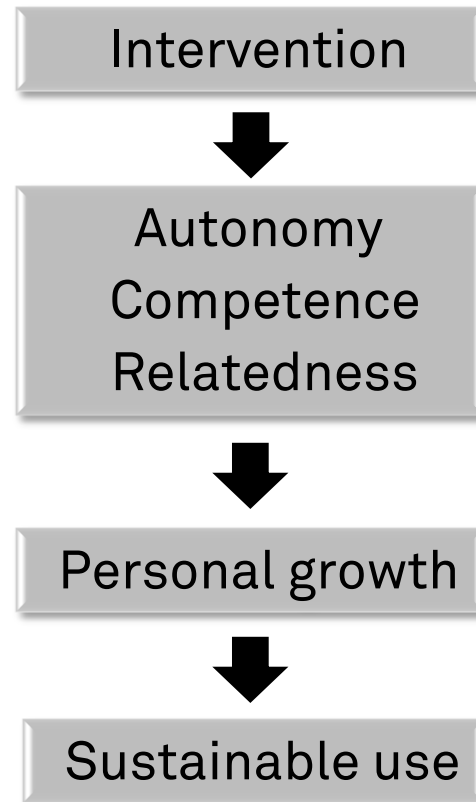
Convincing effectiveness

(Vishwanath, 2015)

- Theories and models for motivation play an important role to increase motivation and effective use (Ritterfeld, 2016)



Motivational approach: Self-determination theory (SDT)



(Deci & Ryan, 2012; Ryan, Patrick, Deci, & Williams, 2008)

User-centered evaluation

- User-centered and model-based evaluation for sustainable use (Staggers, 2014)
 - Early and central focus on users in design and development of technology
 - Iterative design
 - Systematic measure of interactions between user and technology
- Considering the seven principles of user participation (Bühler, 2001)
- Investigation of a systematic model-based evaluation instrument using items from standardized scales and ad-hoc items

Principles of user participation

| Principles (Bühler, 2001) | ISi-Speech project |
|---------------------------|---|
| Partnership | German Parkinson Association |
| User organisation based | Members of the German Parkinson Association |
| Equal payment | Compensation for expenses |
| Accessibility | Project cloud |
| Qualified staff | User experienced team |
| Sound plan | Work package user participation |
| Early involvement | Involved in discussion project idea |

Systematic model-based evaluation instrument

Predictors

Mediating variables

Outcomes

Psychological functionality

Handling of technical systems for elderly people

Technical functionality/ Usability

Feedback components

Gamification elements

Para-social relationship

Enjoyment

Self-determination

Cognitive demand

Emotions

Technology use

User perception

Effectiveness

Gender

Education

SLT

Onset PD

Severity PD

Technical biography

Moderators

Summary

- Considering psychological approaches for the development of technology-based interventions facilitate
 - Activity
 - Engagement
 - Social interaction
 - Scaffolding

- Evaluation instruments for new technologies need to consider not only technical functionality, but also psychological functionality!

Thank you for your attention!

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References

- Bühler, C. (2001). Empowered participation of users with disabilities in universal design. *Universal Access in the Information Society*, 1(2), 85-90. doi: 10.1007/s102090100011
- Deci, E. L., & Ryan, R. M. (2012). Self-Determination Theory. In P. A. M. van Lange, A. W. Kruglanski, & E. T. Higgins (Eds.), *Handbook of Theories of Social Psychology* (Vol. 1, pp. 416-459). London: Sage Publications.
- Dickson, S., Barbour, R. S., Brady, M., Clark, A. M., & Paton, G. (2008). Patients' experiences of disruptions associated with post-stroke dysarthria. *Int J Lang Commun Disord*, 43(2), 135-153. doi:10.1080/13682820701862228
- Enderby, P. (2013). Disorders of communication: dysarthria. *Handb Clin Neurol*, 110, 273-281. doi: 10.1016/b978-0-444-52901-5.00022-8
- Fox, C., Ebersbach, G., Ramig, L.O., & Sapir, S. (2012). LSVT LOUD and LSVT BIG: Behavioral treatment programs for speech and body movement in Parkinson Disease. *Parkinsons Dis* 3, 919-46.
- Gage, H., Grainger, L., Ting, S., Williams, P., Chorley, C., Carey, Borg, N., Bryan, K., Castleton, B., Trend, P., Kaye, J., Jordan, J., & Wade, D. (2008). Health Services and Delivery Research Specialist rehabilitation for people with Parkinson's disease in the community: a randomised controlled trial. NIHR Journals Library, Southampton UK.
- Ritterfeld, U. (in press). Psychologische Grundlagen. In K. Bilda, J. Mühlhaus, & U. Ritterfeld (Eds). *Neue Technologien in der Sprachtherapie* [New Technologies in Speech and Language Therapy]. Stuttgart: Thieme.
- Ryan, R.M., Patrick, H., Deci, E.L., & Williams, G.C. (2008). Facilitating health behaviour change and its maintenance: Interventions based on self-determination theory. *Health Psychol Rev*, 10, 2-5.
- Spielman, J., Ramig, L.O., Mahler, L., Halpern, A., & Gavin, W.J. (2007). Effects of an extended version of the lee silverman voice treatment on voice and speech in Parkinson's disease. *Am J Speech Lang Pathol*, 16, 95-107 .
- Staggers, N. (2014). Improving the User Experience for Health Information Technology Products. In R. Nelson & N. Staggers (Eds.), *Health informatics: an international approach* (pp. 334-350), Mosby: Elsevier.
- Vishwanath, A. (2015). The psychology of the diffusion and acceptance of technology. In S. S. Sundar (Ed.) *The Handbook of the Psychology of Communication Technology* (pp. 313-331). Wiley: Sussex, UK.
- Ziegler, W. & Vogel, M. (2010). Dysarthrie. Verstehen-untersuchen-behandeln [Understanding-testing-intervene]. Stuttgart: Thieme.