Developing technology-based speech interventions for patients with Parkinson’s disease

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Introduction

Acquired dysarthria is a symptom of Parkinson’s disease and poses a substantial risk for social isolation due to unsuccessful communication [1]. New technology promises high potential for empowerment of patients in the health care sector.

Research and development need to address solutions that will be accepted by patients with Parkinson’s disease.

The main goal of the project is to develop an automatic speech recognition system applicable to distorted speech and integrated in a speech therapy application that carries the motivational potential contributing to frequent and autonomous usage. Empowerment and autonomy of patients will be supported.

Challenge in SLT

A limited set of treatment sessions is funded by the health insurer in Germany. Patients have only one appointment per week in SLT.

Studies demonstrated sustainable effects for treatment of dysarthria with at least two to four 60 minutes sessions a week [2].

Face-to-face speech therapy can profit from being supplemented by technology-based intervention by:

1. enhancing the frequency of training,
2. individual tailoring,
3. specific feedback.

In his/her “new” role, the therapist carries responsibility to select, introduce, and monitor the adequate technology to ensure a persistent usage.

Isi-Speech Approach

![Image](https://example.com/image.png)

Figure 1. Work Packages in ‘Isi-Speech’.

Motivational Approach

- Psychological theories for improving: attractiveness, usability, and convincing effectiveness [3]
- Embedding Self-Determination Theory (SDT) in technology-based interventions [4]: autonomy, competence and relatedness for personal growth

![Image](https://example.com/image.png)

Figure 2. Identification of motivational components for increased motivation and effective use of technology [5].

Table 1. Implementing SDT into ‘Isi-Speech’ [6, p. 97].

<table>
<thead>
<tr>
<th>Goal</th>
<th>Example of SDT application to ‘Isi-Speech’</th>
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</thead>
</table>
| Autonomy              | The therapist introduces ‘Isi-Speech’ to his/her patient with Parkinson and advises the usage. The patient is convinced that s/he will be better understood when s/he trained at least twice a day with ‘Isi-Speech’.
|                       | Individual: “Compared to last week, distinctive articulation of p versus b has become 20% more noticeable.”
|                       | Normative: “You mastered the first two steps towards your goal of distinguishing p and b clearly.”
| Competence            | When the patient fails with his/her exercise in ‘Isi-Speech’, the therapist supports him/her to follow his/her goal.
|                       | Both pay attention to the results of two other users that are ranked on the Isi-board by the amount of clearly pronounced words p they logged over a day.

Motivational Design

![Image](https://example.com/image.png)

Figure 3. Principles of user participation.

Table 2. Principles of ‘Isi-Speech’

<table>
<thead>
<tr>
<th>Principles</th>
<th>‘Isi-Speech’</th>
</tr>
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<tbody>
<tr>
<td>Partnership</td>
<td>German Parkinson Association</td>
</tr>
<tr>
<td>User organisation based</td>
<td>Members of the German Parkinson Association</td>
</tr>
<tr>
<td>Equal payment</td>
<td>Compensation for expenses</td>
</tr>
<tr>
<td>Accessibility</td>
<td>Project cloud</td>
</tr>
<tr>
<td>Qualified staff</td>
<td>User experienced team</td>
</tr>
<tr>
<td>Sound plan</td>
<td>Work package user participation</td>
</tr>
<tr>
<td>Early involvement</td>
<td>Involved in discussion project idea</td>
</tr>
</tbody>
</table>

Systematic user-centered evaluation

- User-centered and model-based evaluation for sustainable use
- Early and central focus on users in design and development of technology
- Iterative design
- Systematic measurement of interactions between user and technology
- Considering the seven principles of user participation [7]
- Investigation of a systematic model-based evaluation instrument using items from standardized scales and ad-hoc items

![Image](https://example.com/image.png)

Figure 4. Principles of user participation.

Discussion

Our contribution intends to stimulate the discussion about prerequisites that are necessary for a successful usage of technologies in health care.

Principles such as autonomy, competence, and relatedness can facilitate activity, engagement, social interaction, and scaffolding, all contributing to potential personal growth in patients with Parkinson’s disease.

Our R&D project ‘Isi-Speech’ serves as an example for applying psychological theory into designing technology for speech intervention in patients with Parkinson’s disease.

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Contact and poster download

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References