Aphasia therapy software: research, development, and implementation

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SUMMARY
This thesis describes research on the topic of digital aphasia therapy, which is a clinically relevant and rapidly developing field of research. Digital aphasia therapy has long been proposed as a potentially accessible and efficacious addition to regular speech and language therapy. This dissertation focuses on different facets of this topic, including software development and user research.

Chapter 1 provides a brief overview of the evolution of this field since it first emerged in the 1980s. It then describes how there is a relative paucity of software targeting verbs and sentences, despite the clinical relevance of these topics and the rapidly increasing accessibility of aphasia therapy software. This chapter ends with an outline of the research aims of this dissertation and a brief summary of the subsequent chapters.

Chapter 2 describes a systematic literature search that provides an overview of aphasia therapy software described in the research literature. The resulting references were briefly summarised and the clinical availability of the software was established through reading the literature, internet searches, and contacting researchers/developers. It was found that the majority of software (65%) was (likely) currently clinically unavailable. Next, we contacted the researchers/developers of the software that was found through the literature search, in order to ask about their experiences and advice regarding the development and subsequent dissemination of aphasia therapy software. This was done through a survey, with questions on demographics, the software development process, and what had happened to the software since its first publication. Experiences of our respondents (n = 35) varied considerably, although some recurring themes could be identified. Some of the most frequently reported themes were 1) that software development can be expensive and insufficient funds are a frequent barrier for clinical availability; 2) commercialisation is new and intimidating for researchers but necessary in order to reach a clinical audience; 3) co-design is a valuable source of feedback; 4) collaborating with software developers can be difficult and requires a bridge between approaches; and 5) evidence-based software should target a clinical need while being mindful of existing software. Our results highlight the complexity of translating digital aphasia therapy research to clinical practice, but this process is essential in order for the aphasia community to optimally benefit from research in this area.

Given the importance of considering the perspectives of stake-holders in the design process, Chapter 3 reports on a survey that was conducted with Dutch and Australian speech and language therapists. The goal of this survey was to describe the experiences and preferences of speech and language therapists with regards to aphasia therapy apps. The 64 respondents (35 from The Netherlands and 29 from Australia) were overwhelmingly positive about aphasia therapy apps, with many already using such apps regularly with their clients. Those who did not currently use aphasia therapy apps were open to adopting
such apps in the future, indicating that uptake of such software may well continue for the foreseeable future. This observation was supported by the fact that we did not find consistent effects of a number of demographic variables (age, country, and availability of speech and language services in clients’ hometown) on participants’ attitudes towards aphasia therapy apps, which further indicates widespread support for these apps among speech and language therapists. Nevertheless, participants did indicate that there were some barriers to the use of aphasia therapy apps, such as financial accessibility and insufficient user friendliness, which should be addressed by those developing aphasia therapy apps in the future.

The findings of the survey informed the development of a new aphasia therapy app, Action!, which is introduced in Chapter 4. Action! targets verbs and sentences and was developed for independent use by people with aphasia. This chapter describes the development of this app, focusing on the theoretical foundations underpinning it, the development process and the design choices that were made throughout this process, the app’s interface, the development and evaluation process of the treatment items, as well as the nine treatment steps that are available in the app.

Chapter 5 describes a therapy study, which aimed to investigate the usability and efficacy of the newly developed Action! app that was introduced in Chapter 4. Two individuals with varying degrees of verb and sentence processing impairments used Action! at home for a two-week period, with treatment content customised to their specific impairments as determined through detailed pre-treatment assessments. Both participants enjoyed using the app and, while experiencing minor issues, found the app easy to use and would recommend it to other people with aphasia. Data collected by the app showed that both participants used the app frequently and were able to access its main functionality effectively (e.g. through using cues). In terms of efficacy, the first participant (who was treated on past and future tense) did not show significant improvements following the treatment, most likely due to ceiling effects following the two pre-treatment assessments. The second participant (who was treated on finite, present tense) did show improved outcomes after treatment, with lexical retrieval improving for treated items, while tense improved for both treated and untreated items. These gains were, however, not maintained at four weeks post-onset. These results are encouraging as they show Action!’s potential to serve as a user-friendly, efficacious app that targets verb and sentence processing.

Chapter 6 briefly summarises the content of the previous chapters and reflects on the previously established research aims of the dissertation. It discusses the results in the context of the wider research literature on this topics and also describes implications of the results of this dissertation, both in terms of clinical recommendations as well as future research.
By addressing several aspects of digital aphasia therapy, this thesis aimed to aid future researchers in this field. Chapters 2 and 3 resulted in concrete recommendations with regards to the development of aphasia therapy software and addressing user needs, which can be used to improve software development and commercialisation. Chapters 4 and 5 subsequently provided a detailed account of the development of a new aphasia therapy app, as well as a pilot study that focused on the usability and efficacy of this new app. While technologies will continue to change, this dissertation addresses some fundamental issues related to the development of aphasia therapy software and in doing so will hopefully contribute to future clinical and research endeavours.