Valorisation Addendum

This chapter discusses the social and economic relevance of the work presented in this thesis. Potential target groups for whom the novel assessment and treatment methods might be of interest are identified, together with planned activities and products derived from the study results. The innovation of the results is shown, complemented with a schedule for their implementation.

Relevance

This thesis examined different virtual reality (VR) tools to assess and treat motor and cognitive impairment in sub-acute and chronic stroke patients with and without symptoms of visuo-spatial neglect (VSN). Two research projects within this thesis showed the potential of newly developed stroke assessment tools in patients without VSN: the Virtual Peg Insertion Test (VPIT) investigating upper extremity motor function, and the Zürich maxi mental status inventory (ZüMAX) assessing cognition. Subsequent projects have demonstrated that neglect exergames are feasible and safe for stroke patients with VSN symptoms, also providing potentially valuable user feedback from patients and therapists for further future development. Therefore, application of such VR technologies in stroke rehabilitation is promising. Finally, this thesis explored everyday life experiences of persons with right hemispheric stroke and unilateral spatial neglect near the end of inpatient rehabilitation.

Annual health and social care costs are still increasing in countries with advanced economies such as Switzerland. Not surprisingly, the purchasers, such as health care insurances and cantons, are trying to find solutions for addressing this trend. Unfortunately, some of these efforts include staff reductions, which has substantial consequences not only for the health professionals involved, but also for their patients. Scientists and clinicians are, therefore, obligated to find solutions to nevertheless provide the best treatment options for patients. The use of VR technologies as a complement to existing conventional rehabilitation is a viable solution. The neglect exergames of the REWIRE consortium, for example, could provide aspects of continued domestic daily rehabilitation without the presence of a therapist. This provides the patient with individualized and progressive training to improve motor and cognitive skills post-stroke, resulting in greater independence in activities of daily living and, thus, improved quality of life. Furthermore, such enhanced training might possibly
prolong independent living at home, thus reducing or even avoiding further costs of extra care at home and transfer to nursing home care. From therapists’ perspectives, the use of these VR-based exergames provides a novel evidence-based treatment option for those stroke patients who are capable and willing to do more than conventional therapy. Its use allows the therapist to supervise the patient either during regular face-to-face meetings, or even via internet (e.g., Skype). Supervision via internet might avoid extra costs of traveling to the patient’s home, or vice-versa to the therapist’s practice for the patient. Additionally, the use of evidence-based assessment tools, such as the Zürich maxi mental status inventory (ZüMAX) or the Virtual Peg Insertion Test (VPIT) presented in this thesis, provide an overview of the patient’s progress. This is not only more motivating for the patient, but can further be of use for the therapists to prove the purchasers that their therapy is effective.

**Target groups**

The results presented in this thesis are of interest to multiple target groups. They are informative for health care purchasers, as they provide feasible, low-cost therapy options as an adjunct to conventional face-to-face therapy. The results from the users’ perspectives study about newly developed VR-based games for rehabilitation can be of interest for game designers. Such feedback is crucial for the development of effective, user-friendly and client-centered video games. The work of this thesis is also of interest for health care professionals, such as physical or occupational therapists, as it offers them novel and evidence-based ways of treating and assessing stroke patients. Furthermore, the findings inform health care professionals regarding personal experiences of orientation in and reorganization of life of inpatients after a first right hemispheric stroke with unilateral spatial neglect symptoms. Cultivating such an awareness of patient experiences could promote effective strategies for care focused on what is most relevant to the individual during rehabilitation. As the results of this thesis aim to further developing the treatment of stroke symptoms, they are not only of interest for stroke survivors, but also for their relatives. This further development might increase the families’ confidence that efforts are made both to improve rehabilitation, and to enhance understanding of the lived experience of stroke. Finally, other similar patient groups, such as people with a traumatic or non-traumatic brain injury (e.g., brain tumor, hypoxia) could profit from the assessment and treatment options presented in this thesis.
Activities, products and innovations

The newly developed REWIRE neglect exergames for stroke patients can be called innovative, as they were field-tested for the first time in this target group. They have shown to be a potential extension to conventional stroke therapy. Further activities are planned to enhance the use of those exergames; for example, the activation of the competition and networking option among stroke users. The idea is that patients can win notional rewards (‘medals’) for their achievements while playing the games, and can share scores with other users if wanted (competition). The option to create an online social network platform among patient users is another future planned activity, aiming both for enhanced training motivation and for avoidance of the social isolation, which occurs in persons restricted in mobility. To address some of the more specific requirements of the primary target group studied in this thesis – for example, having difficulties with reading – the development of an audio user manual for the exergames would facilitate independent use. Another project is the provision of further education for therapists and other health professionals who are interested in using the REWIRE platform and exergames with their patients. However, several steps need to be taken before the platform and its games would be ready for commercial and broad use within rehabilitation clinics and practices. Until then, the results of this thesis can be disseminated at national and international conferences and published in scientific journals.

Schedule for implementation of the results

A possible schedule for the implementation of the thesis results is presented in Figure 1. This schedule has potential for success, albeit with possibilities of failure also. For example, a possible success might be that knowledge from proposed future research may be useful for commercial activities with spin-off ventures. Such cooperation might be guided and supervised by experts in the field of stroke rehabilitation. Moreover, depending on the future research findings, the experts could create new spin-off ventures interested in dissemination and further development of findings. Additionally, the schedule affords the opportunity for future students to gain experience in a promising and evolving new research area. These students can spread the findings among other students, contributing to the growing community of researchers in the area, both within Switzerland and beyond. Potential risks for successful implementation of results might be difficulties in finding third-party funding, together
with the race against time. It might be that the further development and testing of the REWIRE neglect exergames might not keep pace with the fast growing VR-therapy commercial market. A further risk might be the high development costs of a disposable VR-therapy product.

Figure 1. Schedule for implementation of the results.

- **Generating third-party funding**
  - Possible stakeholders: Swiss National Fond; stroke associations; rehabilitation clinics

- **Further development of the REWIRE platform and neglect exergames**
  - Collaborators: Game designers of the REWIRE consortium; patients; therapists

- **Doing more research (RCT) dissemination of the findings at conferences**
  - Research assistants: PhD- and master students
  - Collaborators: Rehabilitation clinics

- **Marketing of the REWIRE platform and exergames**
  - Possible customers: Rehabilitation clinics; therapy practices; hospitals