Title & Author: Gassert R, Dietz V. "Rehabilitation robots for the treatment of sensorimotor deficits: a neurophysiological perspective." *Journal of NeuroEngineering and Rehabilitation,* Vol 15, No 46, June 2018

Summary: This paper addresses the different types of rehabilitation robots that are used to help people in physical therapy. The organization of the paper divides the field into two sections, upper and lower extremities. In each section the authors address how different brain and nerve injuries can impact the recovery as well as how the respective functions can be repaired. The discussion of therapy includes of a variety of characteristics including analysis of how much weight bearing the patient should do versus the assistive devices, how soon after injury should the treatment begin, and what sort of design considerations need to go into each type of device. While much of the recovery seems to be spontaneous these robotic therapists can provide an opportunity for taking advantage of neuroplasticity to regain motor control as they can perform numerous repetitions of the recovery motions at a variety of impedance levels.

Strengths: Where the authors succeed is by making up for what many of the included papers lack. The holistic approach to discussion of solutions makes for a more helpful read. When considering the solutions presented the authors provide the medical basis for what needs to be done to see patient improvement so that the designs are presented in context. This makes it a much stronger resource as a review because it helps to address a systematic shortcoming in the field. Providing the medical motivation for various therapeutic strategies also makes the ways that robots can benefit the field clearer. Like addressing how increased repetitions of exercises can improve outcomes and then mentioning that robotic therapy can greatly increase the number of repetitions a person can perform.

Weaknesses: Due to the lack of strong basis for the best approach to therapy, most of the robotic approaches do not really seem to hold clear benefits. It is an issue that the paper addresses several times, but spinal and brain issues are complicated, and as such so is the treatment of these issues. So, while lots of these robotic systems show potential uses for therapy the reasons why are often unclear or only partially understood, and additionally many of these systems don’t see clinical use. It seems as though much of the included material is not significant in terms of medical benefit or at least hasn’t seen much practical usage. This makes it difficult to determine the impact of the works that are discussed. Additionally, while the added context of the medical background for the work is beneficial, there is very little discussion of any of the robots included nor any depictions of them. This makes the paper read more scientifically than as an engineering paper which seems odd given its primary focus. It is tough to determine what ideas have been implemented, or what trends the field has seen, or even just what works well.

Novelty: The novelty of this paper is primarily its strength. By looking at robots from a primarily medical perspective as opposed to an engineering perspective allows the authors to add to the field’s discussion. This different lens also leads to discussion on the overall strengths and weaknesses of robotics for use in therapy. This couples with the analysis of the current state of the art in robotic therapy to provide a resource that can help guide new research developments.