# Adaptive Person-Centered Rehabilitation Gaming

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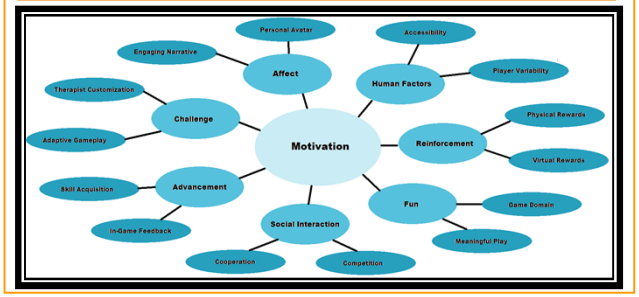
## INTRODUCTION

In the realm of physical activity and exercise, games have made breakthroughs through the release of motion based controls and interfaces. For years, the implications of this evolution in game design have made ripples across the realm of serious gaming research. The benefits of a system in which user motion drives a game naturally point toward its potential in promoting the completion of rehabilitation therapy. This problem space requires multidisciplinary applications of serious gaming, utilizing research findings in motivation from cognitive psychology, interaction dynamics from social behavioral research, and effective motion capture and representation methods in computer science, as well as literature in serious game design.

## GAMES FOR STROKE REHABILITATION

The domain of stroke rehabilitation has seen a surge in serious game development over the last decade. Interest arises from a critical need in the area of motivation for stroke rehabilitation patients to complete both clinical and at-home therapy. This has led to a series of research experiments to determine which aspects of game development can be leveraged to facilitate progression of these individuals through rehabilitation and therapy.

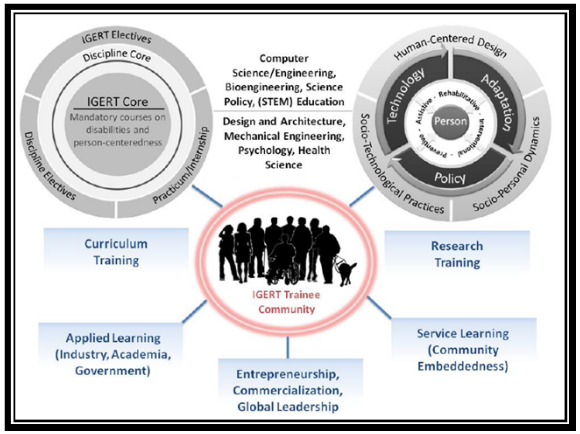
While recovery and improvement of function has been the primary target of most work in this field, there is not nearly as much work in the area of motivation. Motivation is as essential as improvement in a successful serious game; one aspect cannot be achieved without the other. The elements which comprise motivation can be linked directly with elements of game design, as indicated below:




## ALLIANCE FOR PERSON-CENTERED ACCESSIBLE TECHNOLOGIES (APAcT)

The "Alliance for Person-centered Assistive Technologies" (APAcT) IGERT was recently awarded to the research partnership of Arizona State University (ASU) and California State University Long Beach (CSULB). The APAcT IGERT brings together teaching and research faculty and graduate students from computer science, engineering, disabilities studies, policy, education, public health, science and technology from ASU and CSULB to implement a novel person-centered approach to research on design, development and application of accessible technologies.

The explicit goals of this program include designing, developing and implementing person-centered technologies and practices in order to ensure that each person with a disability is included as a fully participating member of society. Each project is highly interdisciplinary with implications for policy, business, education, public health, design and technology.




## CONTRIBUTORS

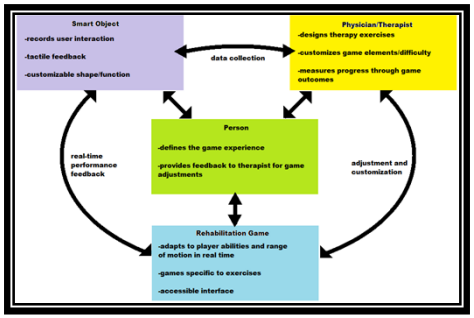
Principal Investigator: Sethuraman Panchanathan, Arizona State University
IGERT Faculty: Troy McDaniel, Arizona State University
IGERT trainee (vibrotactile cueing project contribution) Eric L. Luster, Arizona State University
IGERT trainee (poster design): Arash Tadayon, Arizona State University

## REFERENCES

[1] Luster, E., McDaniel, T., Fakhri, B., Davis, J., Goldberg, M., Bala, S. and Panchanathan, S. "Vibrotactile cueing using wearable computers for overcoming learned non-use in chronic stroke," in *Rehab 2013 Workshop*, 7th International Conference on Pervasive Computing Technologies for Healthcare, 5-8 May 2013. (to appear)

## DESIGN AND FUTURE WORK

A successful design incorporates accessibility, social play, guided multi-modal feedback, and most importantly, adaptation of the game difficulty to the player's level of skill, an attribute which is potentially the most person-centered in serious game design. Through a combination of these elements, as well as feedback from therapists and interaction with smart objects, the needs established in previous studies on at-home rehabilitation games can be met for the targeted player-base, and criteria for long-term motivation established by the studies are met. In future work, the author aims to implement these design elements in the creation of a set of games designed for at-home stroke rehabilitation therapy. User studies will determine if the proposed design effectively motivates long-term commitment to this therapy.




## VIBROTACTILE CUEING FOR OVERCOMING LEARNED NON-USE IN CHRONIC STROKE

As part of a framework for advancing stroke rehabilitation therapy, a cueing system has been developed which utilizes vibrotactile feedback to remind patients to complete daily exercises and provides data on performance to therapists who can track a patient's progress and customize the system accordingly [1]. This system Is designed to prevent "learned non-use" in an individual undergoing rehabilitation therapy. A pilot study shows promise for the system's ease of use and effectiveness for daily use. This system will be integrated with the gaming interface to improve the quality and effectiveness of at-home rehabilitation programs.