Preface

Gamification is the process of integrating game components and game development methods into solutions that aim to address serious issues including business problems and social or healthcare challenges. The gamified solutions target our natural instinct to seek competition and achievement using traditional gamification approaches such as points collecting, virtual currencies, achievement budgets, or levels with increasing difficulty are used within game community.

Application of gamification principles outside the entertainment industry is not a new concept. Serious games have been used in a whole range of domains such as to enhance consumer commitment, providing employee reward, learning, time management, return on investment or quality of data. Specifically, the military, the airline industry, and the medical field have adopted virtual reality to train solders, pilots, and surgeons using gamification concepts. The serious games industry has been growing steadily since its inception. Consulting company Gartner estimates that in 2016 the businesses will spend nearly 3 billion dollars on gamification.

Use of gamification in healthcare industry has been viewed as a promising way to stimulate health and wellness among various target groups. In many of the projects that involved gamification, some of the main goals are to involve patient population in better management of their health and to strengthen motivation in clinical practice. Applications in wellness area that target daily exercise routines by turning physical activity into a game are great examples of use gamification principles in clinical care. Another example is the use of gamification to develop effective solutions that target smoking cessation and medical adherence. Nowadays, mobile phones, tablets and smart watches are becoming popular platforms that are affordable and powerful enough for the majority of health games. Furthermore, we observe high adoption rates in the emerging internet of things market along with persuasive gadgets. Many physiological parameters are seamlessly integrated into mobile wearables such as heart rate monitors, pulse oximeters, blood pressure cuffs or glucometers. All these developments combined provide an environment that facilitates effective and timely the delivery of gamified solutions that are sophisticated and relevant.

The overall objectives of this book are (1) to present the current state of health games and use of gamification in healthcare and (2) to advance understanding with respect how health games contribute to patients’ self management of care and adherence to care. This book also explores future opportunities of using gamification in eHealth, particularly in mHealth, and discusses challenges and limitations of gamification.

The book is divided into 6 parts. Part I presents a selection of chapters that discuss use of gamification to address patient adherence issues from theoretical and practical perspectives. Part II includes a selection of chapters that discuss applications targeting motor and speech rehabilitation. Part III includes chapters that discuss various aspects of commercial exergames and their use in interventions. Part IV
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presents a selection of serious games that target psychiatry domain. Chapters in part V discuss use of gamification in interventions that aim to establish healthy dietary habits. Part VI presents two chapters that describe serious games for various application areas.

Part one includes six chapters that present theoretical and practical aspects of patient adherence. Chapter 1 describes ethical challenges related to online health games echo some of the concerns already identified for online games and online spaces, operationalized in the particular context of health applications. The authors summarize and address these challenges, ranging from the “out of the game” ethical challenges to the “in game” ethical challenges, and suggest practical recommendations in order to implement efficient, safe, and ethical online health games. Chapter 2 presents an overview of the research and practice related to the application of theories in games for health. The author discusses relevant theoretical frameworks, explores their ability to dictate game design, and advocates the use of theoretical concepts from behavior change and health communication for improved design and evaluation of game design. Chapter 3 explores how gamification as a mode of information exchange could shed light onto health literacy issues. The author argues that games can be a natural platform to deliver information to consumers, and that gamification can contribute to overcome health literacy issues. Chapter 4 investigates how gamification of existing technologies that support self-management of clinical conditions can improve patient adherence to medical advice. The authors discuss the role of intrinsically and extrinsically motivating game mechanics to build an ongoing therapeutic alliance with the patient. This chapter also presents a case study that provides design guidelines for a gamified self management solution for the condition of pediatric incontinence. Chapter 5 tackles the difficult task of clearly defining components and uses of gamification in healthcare for increased patient engagement of health information technologies. The authors identify relevant research and examples of gamification in regards to health promotion and prevention, discuss strategies to gamify a health application, and summarize current research in the area of gamification for health prevention. Chapter 6 presents the new Mechanics, Dynamics, Aesthetics, and Outcomes (MDAO) Framework after discussing common pitfalls and best practices for making serious games for clinical practice. Using MDA as a base for understanding how to create engaging experiences, MDAO framework describes how to design a game that is intrinsically motivating and effective by focusing on the interplay between outcomes and other vectors of design.

Part two covers techniques of virtual reality in rehabilitation healthcare on motor and speech area. Chapter 7 reviews the current state of gamification in rehabilitation healthcare, defines terminology used in the field, discusses concepts that support gamification as well as challenges, limitations and future opportunities of gamification in rehabilitation healthcare. With regard to future opportunities, the author provides specific recommendations for healthcare providers, rehabilitation healthcare services consumers, and game designers/programmers/engineers. Chapter 8 explores the potential for a combined gamification and evolutionary computation approach in facilitating continuous speech and language therapy. The authors report from a pilot study of a word-finding game for aphasic individuals, and they evaluate the genetic algorithm of the game, in particular, the ability of the genetic algorithm to discern the perceived complexity of individual words. Chapter 9 targets injuries to the hand and role of gamification technology in hand rehabilitation, which aims to return people to their pre-injury roles and occupations. The authors present the Leap Motion as a tool for hand rehabilitation and discuss how gamification can increase participation in hand-rehabilitation systems. Chapter 10 reviews a methodology of computer-based cognitive training, which has been widely used and tested to maintain and improve the cognitive performance of older people. The authors provide a summary of the literature on computer based cognitive training, use of gamification in training, and the DOREMI project that aims
to design cognitive training games for older people with cognitive impairment, using a user-centered design process to ensure that the gamification tools used to motivate participation are effective, meaningful, and user-friendly.

Part three targets commercial and non-commercial serious exergames and their potential benefits for patients. Chapter 11 considers group dynamics principles as one way to influence motivation within exergames to help realize better health outcomes. The authors illustrate how group dynamics principles can be applied to exergames and how different task structures within groups (e.g., conjunctive, additive, and coactive tasks) can influence motivation. Chapter 12 provides a state-of-the-art of online social exergames for seniors, providing glimpses of senior users’ opinions and games limitations. The authors emphasize the motivational techniques, as well as the impact that the exergames have to seniors. They explore future opportunities and discuss the challenges and limitations of gamification in eHealth interventions for physical training and rehabilitation. Chapter 13 targets a systematic review and meta-analysis of research studies that quantify the effectiveness of active videogames as obesity prevention interventions aimed at children and adolescents. The authors report that the average effect of active videogames on children and adolescents was small to medium-sized and significant. The review results support that active videogames can have positive effects on BMI among children/adolescents. Chapter 14 reports an assessment of commercial exergames on the market to understand if a gap exists in appeal between exergames and non-exergame video games. Through analysis of literature, customer reviews about top 10 exergames and non-exergame video games, and a survey that reflects people’s perceptions of exergames and non-video games, the authors try to identify factors affecting the appeal of different video games. The authors conclude with a set of recommendations for game designers to improve the appeal of exergames. Chapter 15 presents a characterization of the muscle activation during a swimming exergame and compares the level of activation during different conditions where healthy subjects were asked to play bouts of exergame using Xbox360 and Kinect. Muscle activation was monitored for desired muscles on dominant upper limb using wireless electromyography system. An investigation of muscular coordination was also conducted to provide activation sequences of studied muscles.

Part four includes three chapters dealing with the application of serious games in psychiatry. Chapter 16 presents the design process of an online game called SAGA that is developed to help players suffering from Post-Traumatic Stress Disorder (PTSD). Although effective treatments for PTSD are available, engaging patients who are suffering from common symptoms like depression and avoidance in addition to PTSD in these treatments is proven to be challenging. The authors describe the design decisions made while developing this game that educates players about effective therapy by allowing players to create and edit stories to illustrate how exposure therapy works so that they can successfully engage in evidence-based treatment. Chapter 17 highlights the low utilization of mental health services and presents the role gamification technology can play in addressing the needs of patients suffering from mental health disorders. The authors provide examples of games targeting mental health improvement and awareness that have been thoroughly evaluated and conclude the chapter by introducing their personal experience in developing a game targeting prevention and early intervention for eating disorders in Europe. Chapter 18 affords a background and rationale for the use of gamification in the treatment of selective mutism (a psychiatric disorder characterized by a withdrawal of speech in situations during which speech might be expected typically). The authors provide case-study data and an outline of the development of a prototype tablet PC application developed to assist in the treatment of selective mutism.
Part five highlights innovative approaches on promoting healthy dietary habits using gamification. Chapter 19 describes the current state of the field of diabetes-related serious games. The authors discuss various tendencies in the field of diabetes-related games through a review of systematic reviews performed between 2012 and 2014. Based on this review, significant gameplay features of games for health are identified. Chapter 20 reviews a card game that allows the players to reflect and discuss dietary habits. The results of a study that demonstrate the effectiveness of the game are reported. The authors discuss how the game could be computerized and the benefits of computerization. The authors stress the importance of communication (in addition to mere competition) as an important scope of future health games. Chapter 21 presents a case study that portrays the process of designing and developing an interactive digital mobile game (Missão Kid) designed to motivate children to adopt exercise and healthy food habits. Missão Kid is an example and represents a differential tool for the promotion of a healthy lifestyle among children by combining digital game elements with health awareness in a fun and motivating fashion.

Part six consists of two chapters focused on various applications of serious games. Chapter 22 provides a framework that describes how game thinking and game mechanics, can be integrated into a collaborative navigation system for visually impaired persons in order encourage them to travel independently. The authors describe the development of a system that supports independent navigation in unknown places by mediating help from another visually impaired person who is familiar with the particular place. Furthermore, the system uses a thermal user interface to introduce an additional communication channel and to improve usability. The final chapter presents an overview of the design of an interactive medical/biological training environment using a multi-modal user interface. The authors introduce the physics-based models of the objects interacting in the virtual scenes and discuss the implementation of the dexterity enhancing training tasks combined with the associated definitions of metrics, which can be used as a part of score keeping operation.

It is without doubts that pervasive computing is changing the way patients and providers reach healthcare services. In this book, several useful mobile applications, mainly for patients, are covered ranging from gathering clinical data to self-administration as in case of obesity management mentioned by Makhlysheva in review chapter 21. As the field of gaming evolves, the emerging ubiquitous gaming where people are connected through virtual worlds to their physical surroundings will provide different opportunities for gamification. We expect that exergames will expand over the next decade, particularly, with wearable devices as smart watches or glasses. Last but not least, we believe that social media will have a greater impact in the health industry. Application of social communication and psychology through general or tailored approaches will increase adherence to treatment, and will raise awareness of specific diseases supporting social integration. Readers interested in technological development of psychiatry should definitely pay attention to chapters 16-18.