Preface

ABOUT THE SUBJECT

Serious games are presenting an exponentially growing impact on management, education, defense, scientific research, healthcare, emergency planning and many other areas, creating both (1) huge business opportunities and challenges generating large investments and large returns and (2) great research and development opportunities in areas ranging from design to programming, from psychology to mathematics, from management to politics, besides the specific areas of application. These opportunities and challenges must converge in order to take the maximum profit of the emerging potential of this new tool in all its domains of application.

This handbook of research represents a collection of the most recent developments in all embraced fields of knowledge or disciplines of computer games development, encompassing planning, design, development, marketing, business management, users and behavior, and applications. The handbook covers the following dimensions:

- Technological aspects, involving computing developments and requirements; programming languages; communication; human-computer interaction; algorithms; and data structures and processing.
- Serious games as a tool of change, addressing both social change and innovation in business processes or products.
- The business dimension, comprising emerging businesses; business opportunities; prospective studies; studies of impact; critical success factors.
- The human aspects, comprehending psychological aspects; behavioral effects; social effects.
- Applications of serious games, for instance healthcare, e-health, defense, industrial engineering, education, and other.

The chapters in the book include:

- discussion of the impact of this emerging domain in its wide range of applications;
- present and discuss the new technological developments;
- present practical solutions and recent developments;
- introduce the state-of-the-art technologies;
- discuss business, social and individual impact;
- Provide guidance for further research and development;
- Build bridges between research and practice.
ORGANIZATION OF THE HANDBOOK

This handbook of research is organized into eight different sections: Section 1 - Serious games as a Tool of Change; Section 2 - Technological Aspects of Serious Games; Section 3 - Psychological and Social Effects; Section 4 - Applications in Business; Section 5 - Applications in Education; Section 6 - Applications in research and development; Section 7 - Applications to Defense and Section 8 - Applications to e-Health and Healthcare. It consists of a compilation of 63 contributions to the discussion of the main issues, challenges, technologies, opportunities, and developments of serious games, in a very comprehensive way, in order to disseminate current achievements and practical solutions and applications in critical domains.

These 63 chapters are written by a group of nearly 240 authors that include many internationally renowned and experienced researchers and specialists in the domain and a set of younger authors, showing a promising potential for research and development. Contributions came from Europe, North and South America, Asia, and Australia, and are included contributions from academia, research institutions, and industry, a good, comprehensive representation of the state-of-the-art approaches and developments that address the several dimensions of this fast evolutionary thematic.

Section 1: Serious Games as a Tool of Change

Section 1: Serious Games as a Tool of Change, integrates thirteen challenging chapters with innovative applications of serious games that reflect many authors’ views on how this domain contributes to a different world.

Chapter one, “Innovation Gaming: An Immersive Experience Environment Enabling Co-creation” introduces the findings of a study on serious gaming that explores a number of issues related to the use of innovation games for enabling user co-creation in the context of collaborative innovation and experiential Living Labs.

The second chapter, “Applications of Serious Games in Geovisualization,” introduces the reader to the impact of the application of serious games in geovisualization, due in particular to the use of flight simulators and associated technologies.

“Serious Gaming Supporting Competence Development in Sustainable Manufacturing” introduces a new learning environment which is built around a gaming engine supporting the development of competences in Sustainable Global Manufacturing.

Cyber defense competitions provide active student learning, mimic real-world situations and provide engagement with computer and network security topics; chapter four, “Cyber Defense Competitions as Learning Tools: Serious Applications for Information Warfare Games” provides a brief history of cyber defense competitions, as well as describes how they are run.

The chapter “Design and Evaluation of Tamhattan: A Multimodal Game Promoting Awareness of Health in a Social and Positive Way” presents an interactive game called Tamhattan that was designed to promote health awareness of adolescents; it supports socially networked gaming and learning and enables input with game controls, positioning (GPS), and gestures, as well as multimodal feedback through visual and auditive modalities.

Chapter six, “Game4Manager: More than Virtual Managers” introduces a serious game in a 3D online environment where the learner’s role is to implement an Integrated Management System in a
virtual company, analyzing, managing, and improving all the significant aspects related to the company’s sustainable development.

Chapter seven, “Using Serious Games for Collecting and Modeling Human Procurement Decisions in a Supply Chain Context,” presents a serious game called DecisionTack that was specifically developed to capture the human decision-making process in operations management (the procurement process).

In “Authoring Tools for Edutainment Environments to Design Active Learning Activities,” an authoring tool architecture named Archaud is proposed and an RPG game is presented for an undergraduate Physics course created using Archaud.

Chapter nine, “An Overview on the Use of Serious Games in the Military Industry and Health” presents the use of serious games in the military industry and health and discusses what serious games are and in which areas they can be applied, which steps a serious game development involves, as well as which platforms and technologies can be used in its development.

“PLAYER: A European Challenge Game to Discover Young Entrepreneurs” consists of the presentation of a project in which an educational game was implemented in Facebook with the aim of promoting entrepreneurship by guiding young people in the definition of a business proposal.

The eleventh chapter, “Playing with Design: The Universality of Design in Game Development” stresses the need and universality of design in the development of digital games, at the level of amusement games and, mainly, in serious games.

Chapter twelve, “eRiskGame: A Persistent Browser-Based Game for Supporting Project-Based Learning in the Risk Management Context,” proposes the use of a Persistent Browser-Based Game as a support in the qualifying process for new professionals of Project Management.

The last chapter of this section, “Virtual Worlds Innovation with Open Wonderland,” presents the Open Wonderland, robust enough in terms of security, scalability, and functionality environment, where organizations can rely to conduct real business or education.

**Section 2: Technological Aspects of Serious Games**

Section 2: Technological Aspects of Serious Games—includes five chapters that deal with the technological aspects of serious games.

Chapter 14, “Serious Lessons from the Commercial Games Industry,” seeks to find the common ground between the business oriented design practices of the commercial video game industry and the scholarship based design practices of the serious games segment of the video game industry.

The chapter “Crossing the Chasm: Hurdles to Acceptance and Success of Serious Games” examines the chasm serious games must traverse by examining the issues and posing approaches to minimize their effect on the adoption of the technology.

Chapter 16, “Security Issues in Massively Multiplayer Online Games,” presents and discusses security issues in MMOG environments, the security approaches that are applicable to MMOGs, exposing the implications of security breaches and the need for better protection mechanisms and security trends that can be relevant in the future.

“Serious Games and Virtual Reality for Education, Training, and Health” presents details of the development of five serious games in which were incorporated intelligent methodologies and/or virtual reality techniques.
“Serious Game Framework for Design of Medical Applications” proposes a Serious Game Framework (SGF) that provides a conceptual architecture that considers the design alternatives, support for multiple game types on the same architecture, and the ability to assess, research, and improve the learning process.

Section 3: Psychological and Social Effects

In its four chapters, Section 3: Psychological and Social Effects, addresses the psychological and social dimension of computer games.

In the nineteenth chapter, “Articulating the Paradigm Shift: Serious Games for Psychological Healing of the Collective Persona,” the authors discuss that that neural processes are correlated with archetypal states of the cognitive unconscious.

In “Norms, Practices, and Rules of Virtual Community of Online Gamers: Applying the Institutional Theoretical Lens,” the authors address a key question rooted in an institutional perspective: What norms, practices, and rules are evident in online gaming that facilitates the development of a virtual community of online gamers?

The chapter “Online Playability: The Social Dimension to the Virtual World” discusses how the social mechanism present in MMOGs takes precedent over the range of pre-defined player objectives and plays a key role in this type of game.

Chapter 22, “Serious Games in Speech Therapy,” analyses the way in which serious games can be used in education and how they can become useful tools in speech therapy.

Section 4: Applications in Business

The nine chapters of Section 4 describe relevant applications in business, management, and strategy.

Chapter 23, “The Business of Collaborating: Designing and Implementing a Group Decision-Making Scenario Using the TeamMATE Collaborative Computer Game,” explores how humans and their business partners can come together and engage collaboratively to solve a resource-scheduling problem for a large multinational organization consisting of multiple regions.

“Capturing Tacit Knowledge within Business Simulation Games” presents a conceptual model for embedding knowledge management capabilities, including Web 2.0 applications, within simulation games environments for the purpose of improving the learning outcomes with regard to capturing tacit knowledge as well as to developing on-line communication skills.

The chapter “The Quartic Process Model To Support Serious Games Development For Contextualized Competence-Based Learning and Assessment” presents the QUARTIC process model for developing contextualized, competence-based educational games.

The 26th chapter, “Play or Vote: Matching games as New Approach for Design Evaluation in Innovation Contests,” announces IT-based innovation contests as new means to enrich a company’s “design-ideas” by the creativity of a multiplicity of external designers and enthused users all over the world.

“Serious Games in Business” gives an overview about Serious Games from a scientific as well as from a business related point of view and demonstrates the possibilities of Serious Games for training and learning purposes.

Chapter 28, “Serious Games: Issues and Challenges for Teaching and Training,” discusses challenges and impacts of serious games for teaching and training, and outlines some of the fundamental issues and considerations for the effective use of serious games and strategy of game-based learning.
In “Wargaming for Business, Non-Profit, and Government Strategy Development,” the authors explain why wargaming is valuable, when it can be used most fruitfully, and describe how to run a wargame, spanning from the relatively simple to the more complex.

“Serious Games for Serious Business: Improving Management Processes” discusses the use of serious games in improving management processes in organizations and shows the advantages of using video games for this purpose (games-based learning) in relation to traditional methods.

Chapter 31, “Exploring Serious Games from Service Science Perspective” discusses serious games from the service science perspective, which explores the model of value-creation in complex and technology-enabled services.

Section 5: Applications in Education

Section 5: Applications in Education- is composed by 21 chapters of innovative applications of serious games in education.

The 32nd chapter, “Game-Based Learning: A Review on the Effectiveness of Educational Games,” presents a systematic literature review on the effectiveness of educational Games in three databases.

The chapter “geo@NET in the Context of the Platform of Assisted Learning from Aveiro University, Portugal,” describes geo@NET, a computer game, played online, the main purpose of which is to motivate students to the study of Geosciences.

“Serious Games Applied to Project Management Teaching” report studies that explain how to develop serious games and use them in teaching and learning, relating experiences related to the topic of Project Management.

Chapter 35, “The Use of a Business Simulation Game in a Management Course,” reflects on the concept of educational simulations and games applied to business and describes how a Web-based competitive management game has helped to achieve that.

“Serious Games for Exhibition Contexts: Limitations and Design Decisions” argues about the limitations and requirements associated to the development of games for museums and exhibitions and refer experiences made in two case studies performed by Digital Media Master students.

The chapter “Brazilian Occupational Therapy Perspective about Digital Games as an Inclusive Resource to Disabled People in Schools” discusses serious games studies taking into consideration two aspects: “as a tool of social change” and as “applications of serious games in healthcare and e-health, education, and other fields.”

Chapter 38, “The Three Dimensions of Flexibility in the GameTel Project,” presents the GameTel project, carried out (among other partners) by the University of Vigo, which aims to develop a software system that enables the composition of lesson plans that include serious games.

The chapter “Using Games for Primary School: Assessing its Use with Flow Experience” presents a study based on the Flow Experience applied to several games and concludes about its effect on learning experiences.

“21st Century Learning: The Role of Serious Games” describes the 21st century skills and provides information on generative gaming based on the generative learning theory, which requires students to generate their own learning based on their experiences in a individualized environment.

Chapter 41, “Virtual Reality Simulations: Teaching Interpersonal and Clinical Judgments Skills to Healthcare Practitioners” reviews the literature around simulation techniques and outline a development process that can used to develop virtual simulations to meet a variety of learning objectives.
In “Beyond the Technological Dimension of Edutainment: An Evaluation Framework with a Curricular Perspective,” the authors propose a framework for carrying out an analysis of edutainment products from a curricular perspective.

Chapter 43, “Social Studies Education Game Development as an Undergraduate Immersive Learning Experience,” describes a model for involving multidisciplinary teams of students in history education game development, focusing on the process as a learning experience.

The chapter “BIG: Business Interactive Game: An Innovative Game to Support Enterprise Management Training” describes the characteristics of Business Interactive Game (BIG), an innovative business game that includes a number of “Wellness” parameters, developed mainly to support enterprise management training.

In chapter 45, “Criteria of Development of Adaptive Didactic Games for People with Intellectual Disability,” the authors propose criteria to develop games for people with intellectual disability.

In “Motivational and Cognitive Aspects of Applying Educational Games as a Learning Tool,” authors present a study conducted among university students with the purpose of acquiring empirical evidence to support the claim that game design can be used as an effective form of learning.

“The In-Depth Science of the Tic-Tac-Toe Game” explains a robotic application bringing together games, informatics, robotics, artificial intelligence, and artificial vision, and presents a demonstrator that has proved to be good at catching attention, curiosity, and publicity.

The chapter “Exploring the Educational Power of Serious Games: A Review of Literature” presents a review of the state of the art of research carried out over the last few years aimed at a deeper analysis of the educational uses of serious games.

Chapter 49, “Challenges of Serious Games for Improving Students’ Management Skills on Decision Making,” presents an approach for reducing the barriers of the adoption of Serious Games to improve management skills.

“Stalin’s Dilemma: Design, Development, and Employment of a College Level Historical Computer Game” describes the game and discusses its design, development, and use in various educational settings and structures.

* As editor, I must mention that this chapter was subject of acceptance objections by reviewers concerning ethical issues; however I decided to include it to promote an open discussion of the ethical issues that can be raised by “serious games,” especially war games and historical simulations.

The chapter “Immersion, Narrative, and Replayability as the Motivational and Attractiveness Factors in Serious Games” presents a proposal for the use of immersion, narrative and replayability as devices to make serious games more attractive to the student in general.

Chapter 52, “Using Serious Games and Building Models: Two Complementary Steps in the Learning Process,” presents a general review of the value added by the serious games use in the case of management training and particularly visits the experience of using games based on systems dynamics simulation models.

Section 6: Applications in Research and Development

Section 6 is made up of four chapters concerning applications of special games for research and development.
In “Human Computation: A New Aspect of Serious Games,” the chapter analyzes the differences between game design for human computation and traditional digital game design. An in-depth consideration of these differences shows that it is a viable approach to build human computation games with a wide range of designs.

Chapter 54, “Employing Co-Design in the Video Game Design Process,” discuss co-design and the use of co-design techniques in the design of a serious video game to explore history, to help children be more environmentally minded, and a virtual world that reinforces positive social behavior.

To consider that the concept of game could be a basilar element of definition to give a systematic order to the numerous typologies of Serious Game, is the justification for chapter “A Taxonomy and a Proposal for a Classification of Serious Games.”

“Using an Agent-Based Behavior Modeling for Finding Humanitarian Relief Center Location in an Earthquake Zone” draws a model for humanitarian relief center facility location problem, considering characteristics such as earthquake risk index, population density index, and transportation index.

**Section 7: Applications to Defense**

Section 7 includes the description of three applications of serious games to the defense domain.

Chapter 57, “Quantification of Game AI Performance for Junior Leadership Training in the Defence Domain,” describes an academic and rigorous evaluation of the utility and current short-comings of state-of-the-art game AI to support junior leadership training outcomes in the defense domain.

The chapter “The Use of Computer Games in Military Training by the British Army” gives an overview of how serious computer games are being used for training, education and decision support within the British Army and give an in-depth example of the use of JCOVE training system used to train soldiers in convoy driving.

“The Use of Digital Games to Stimulate Behaviors” presents an online game in which the user is invited to experience the life of a soldier of the regular army: The America’s Army game, which is considered the first combat serious game, and analyses the extent to which the use of the game influences the behavior of its users.

**Section 8: Applications to e-Health and Healthcare**

The four chapters of section 8 present applications of serious games with people with disability and in therapy.

“Games Improving Disorders of Attention Deficit and Hyperactivity” presents two games that intend to help children to improve their capacity to speed information processing, enhance executive functions, and use of working memory by performing a set of exercises presented in the form of educational games.

Chapter 61, “An Overview on the Use of Serious Games in Physical Therapy and Rehabilitation,” discusses the different potentialities of several serious games, when used in physical therapy and rehabilitation of patients with problems in motor skills.

The chapter “New Forms of Interaction in Serious Games for Rehabilitation” addresses up-to-date research development regarding to the adoption of more natural forms of interaction in the Serious Games for rehabilitation domain of application.

Finally, the chapter “Interactive Games with Robotic and Augmented Reality Technology in Cognitive and Motor Rehabilitation” aims to contribute a new overview of treatment therapies with elderly
and pediatric patients that present cognitive and motor impairments, and it presents the methodology of evaluation to determine the effect of games and social robots as a means to carry out a therapy.

**EXPECTATIONS**

Along these 63 chapters, the reader is faced with the discussions and confirmation of the relevance and impact of this hot topic, providing professionals, researchers and scholars, with some of the most advanced research developments, solutions, state-of-the-art enabling technologies, discussions and applications. The handbook is expected to support a professional audience of IT professionals, software developers, technology providers, business managers, as well as teachers, health professionals, professionals from strategic and military fields, and an academic audience (teachers, researchers, and students, mainly of post-graduate studies). As an academic tool, it can be a support to disciplines of post-graduate studies on IT/IS.

We hope you find it useful. Enjoy your reading and study!

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