INTRODUCTION: DIGITAL GAMES AND LEARNING

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1.0: BACKGROUND TO THE BOOK

The rapid emergence of game-based learning over the last ten years has been stimulated at least in part by the emergence and pervasiveness of entertainment gaming. Since the earliest digital entertainment games, such as *Pong* and *Space Invaders*, many children and adults have been captivated by gaming genres from puzzle games to driving and flying games to first person shooters. More recently, the pervasiveness of broadband and the modern PC have led to multiplayer games, such as *World of Warcraft,* attracting 11.5 million players globally to date (November 2009), and where players inhabit complex and engaging immersive worlds. The opportunities for social games through *Facebook* and casual games, such as the *Wii Fit* have opened up gaming to new markets, and today women and girls as well as older gamers pervade the online games forums and contribute to the substantial revenues of entertainment gaming.

This phenomenon has more recently sparked interest in harnessing the power of gaming for non-entertainment purposes, such as training and business support. The emergence of the serious games movement in the US and later in the UK has capitalized on this interest in leisure gaming and helped to spread applications from the home into schools, colleges, universities and out into professional training and continuing professional development. Many questions arise from this use of gaming technologies in new learning contexts, such as how can gaming technologies be used to engage learners? How can games be used to motivate and accelerate learning? What are the main strengths of games for learning?

A number of these questions are similar to those that drove the use of simulations in training over the last thirty to forty years, and unsurprisingly many of the questions around how to use games have been already considered in that context. However, simulations and games, whilst having much in common, developed using divergent technologies. An additional divergent issue was the requirement for simulations to have some referent to reality. By contrast, games can be entirely fantasy, or they can be grounded in real-world performance. The two forms have evolved separately, and as such have different design parameters and pedagogic purposes. It is not surprising therefore that games present educators and learners with a different set of constraints and opportunities. Games have certain strengths: they have been associated with increased motivation, engagement, accelerated learning, targeting of specific groups and in particular the targeting of otherwise hard-to-reach social groupings. But games are also more inherently rule-based and structured, where by contrast simulations can be much more free-form and exploratory. For example, feedback in games tends to be instant, while in simulations feedback can be deliberately delayed or dealt with in debrief.

However the comparison of games vs. simulations can never be neat and clear and with the emergence of virtual worlds the re-convergence of games and simulations is possible, and in many ways desirable if more effective learning results. Immersive environments and worlds,

such as *Second Life* and *Active Worlds*, can be more open-ended than games traditionally are, although developed using the same underlying technologies, e.g. games engines.

Definitions of digital games therefore already present the avid researcher and couch-bound game players with quite a few headaches. However, the research domain of the newly emerging field has greater challenges when we take into account the actual digital games for learning that have emerged already in nearly every sector and almost every disciplinal area. Reflecting this, the research literature is spread across all sectors, including business, military, medical and education sectors. Many disciplines, including, health, psychology, educational research, computer science and art & design have explored the use of educational games as solutions to their particular training problems and challenges.

To address these challenges, conferences dedicated to games and learning have emerged, communities have developed over the last five years in the US and Europe, as well as research institutes, all dedicated to exploring the use of the games technologies in different areas of activity. Companies developing serious games content have been started and publishers and e-learning content producers have developed innovative new content. Although uncertain of markets and routes to markets, these content producers are generally experiencing more demand than they can supply.

In addition, the social impact of gaming and in particular the putative benefits of serious and educational games pose interesting questions for society, policy-makers, further and higher education, and parents and teachers. How can these forms be harnessed for educational purposes? Will game-based learning replace traditional learning? How can we better design educational games? Will games for learning become as pervasive as games for entertainment?

While we do not aim to answer all of these questions in one volume, this book does attempt to bring together some of the range of leading edge knowledge currently available in the US and Europe, in terms of selected theories, practice and applications of game-based learning. No single volume can be completely comprehensive in the field, due to its wide inter- and cross- disciplinary engagement, so we have brought together some of the leading researchers in the field to address some of the many unresolved research and practice-based questions as a starting point for future investigations. The volume therefore provides a state-of-the-art contribution, in terms of leading-edge thinking in the field, and is a step towards bringing together some of the diverse voices reflecting different sectors, disciplines and approaches to the concepts and applications of games for learning.

2.0: STRUCTURE AND OUTLINE OF THE BOOK

The structuring of the book centres upon a key claim that games and simulations have the potential to have a significant impact upon learning in our societies. In considering this claim, and with view to bringing together the diverse voices in the field, the book is divided into three main sections: theoretical positions upon games (*theoria*), cultural perspectives upon games (*cultura*) and theory into practice approaches (*praxis*). Reflecting some of the key challenges of designing, implementing and analyzing effective game-based learning approaches, theoretical positions will provide a bedrock for the analysis and evaluation of games, inform the design parameters of games design and highlight the critical challenges for game-based and simulation- based approaches. In this way, the book begins by first presenting some of the theoretical bases for the efficacy of game-based learning approaches, also borrowing from existing theory that supports simulations. Cultural perspectives upon

games will provide scope for considering individual case studies in relation to cultural shifts and changes in the wider context of the institutions and places of learning. The second section then explores the cultural perspectives upon games with case studies exemplifying how games are being used in schools and to support informal learning. Practice-centred approaches include case studies in relation to the implications for the practices of learning and teaching that exhibit greater sensitivity to the impact of game-based learning upon learning communities and teaching practitioners more directly. The third section then provides examples from practice to illustrate how all areas of formal and informal learning can utilize elements of game-based and simulation approaches.

The three-section division is an integral part of our argument in this volume. Games and simulations, when taken seriously by educators, nearly always involve a re-appraisal of the elements of theory, culture and practice; and we would argue that successful implementations nearly always involve re-considerations of the three domains. The extent of this re-appraisal depends, of course, on a number of pre-existing factors – teachers' and students' openness to change, the extent of the game implementation, the extent to which the contextual curriculum and its physical environment can be altered, and so forth. It also depends on the extent of the implementation. Small-scale games and simulations (ie small in terms of time, effort to construct and play) can be easily accommodated within other more conventional pedagogic approaches. But like other forms of pedagogic innovation such as problem-based learning, when games and simulations are implemented on a significant scale they often challenge accepted theories of learning, institutional cultures of learning, teaching and assessment, and even the physical practices of teaching and learning in classrooms, lecture-halls, labs, seminar rooms, examination halls and libraries. In this regard they can be termed 'disruptive' learning technologies.

2.1: THEORIA

In the theoretical section, the authors explore varied considerations upon the central claim that games and simulations have the potential to substantially alter learning. The first chapter by Sara de Freitas and Paul Maharg outlines a vision of the use of games for learning as an opportunity to revisit core thinking around 'learning as experience'. Learning in this reading is no longer considered as knowledge acquisition-centred but rather as centred upon social interactions, active engagement and knowledge construction. Building upon this notion, the chapter considers learning as transactions and tutoring as being centred rather upon 'choreography' or orchestration of immersive experiences, providing greater scope for *social interactive learning*. The chapter outlines a vision and an approach to achieving the vision via combining different theoretical work, including 'play as *diegesis*', learning as transaction and signature pedagogies. Bringing these notions together, the chapter provides an interplay of some of the core aspects in need of integration: play, immersive experiences, pedagogy and social interactions.

Building upon these concepts, the second chapter by Ian Dunwell, Sara de Freitas and Steve Jarvis explores one of the core strengths of game-based learning according to new research that outlines the importance and centrality of feedback. Based upon the four dimensional framework, the authors posit a new approach for understanding facilitative feedback in relation to specified game design parameters and game principles. Research arising from recent studies indicates how central feedback is for the efficacy of game-based learning approaches, and as such how important it is to the educational game design process. The chapter indicates how feedback can be integrated and designed into the learning game,

and sets out a new approach to considering how feedback can be designed and evaluated.

In chapter three, the theoretical ground for simulations is considered through the development of a complex systems model. Here, David Gibson explores the extent to which classroom teaching can be taught using simulations underpinned by the generics of a complex systems model sensitive to the complexities inherent in learning and teaching. *simSchool*, a network-based training and assessment application for teachers, offers a game-like computational framework that represents the actions and dynamics of classroom teaching and learning. The online simulator offers teachers transferable practice in key instructional planning, diagnostic and interpersonal communication activities involved in teaching in a classroom environment. Gibson generalizes the *simSchool* framework into concepts needed for a complex systems model of teaching and learning, providing initial answers to key questions about simulating the complex process of teaching and learning.

These first three chapters provide a theoretical context for exploring the deeper considerations of how learning pedagogies and learning design can be most readily integrated with games and simulation-based metaphors and approaches. The conceptual work provides a basis for building a more inter- and cross- disciplinary approach to game-based learning within which learning design with games can be considered, building also upon insights from simulation design and opening up new scope for improved learning design with games and games metaphors.

2.2: CULTURA

Cultural perspectives upon digital games and learning are well represented in the book, with four chapters that provide an overview of how games and simulations can affect the culture of learning across a range of situations and applications.

Russell Francis' study, undertaken whilst he was based at MIT's Comparative Media Studies Lab, documents the power of role-play and social interactive learning, providing a unique opportunity to assess the real strengths of game-play in the context of formal and home schooled learning. This work, in chapter four, outlines an experiment of using games with school children in the United States using a 'mod' or modified version of another game, *Neverwinter Nights*. For the study, researchers created a multiplayer history game called *Revolution*, and used it to explore the children's identification with 'real-life' figures from late eighteenth century Williamsburg just prior to the outbreak of the American War of Independence. The main cultural perspectives from the study highlighted lessons for tutors using games, emphasizing how important the role of storytelling is in terms of identification and learning. Through the shared storytelling exercises, young people gained valuable and personalized insights into the experiences of others. The player here is positioned as an actor and a spectator in an interactive cyber-drama, providing new scope and opportunities for supporting collaborative learning and teaching in the Humanities classroom.

The social interactions of learning are also highlighted in chapter five, where Esther MacCallum-Stewart documents sets of interactions through an analysis of multiplayer learning, in three separate case studies. The chapter makes the case for the concept of 'stealth learning' in entertainment rather than specific educational games, arguing that we need to understand better how these approaches may and can be fit into game-design for serious games. The chapter provides an interesting cultural approach to research, for the concept opens up perspectives on how some aspects of social learning take place in such games. MacCallum-Stewart's work here takes forward prior research in the forms that learning can

take in online communities, for instance Bandura's concept of vicarious learning, as adapted by Lee et al (1999) and others. She concludes that entertainment games can improve learning capabilities and suggests utilizing these defined benefits and strengths for creating more engaging learning in formal and curriculum-based contexts.

Focusing again on the design of games, Michele Dickey suggests in chapter six, a more structured approach to serious games design through her case study on *Murder on Grimm Isle*. The game-based learning environment allows Dickey to trace how research from game design, literature, behavioural psychology and animation studies can be brought together to better inform this design. Building in inter- and cross-disciplinary approaches within the design approach, sets a different agenda perhaps for future development, and begins an interesting debate perhaps upon how design strategies themselves could provide a touch point for greater cross-disciplinarity in learning. Building upon a significant body of previous work in this field, Dickey argues that a design culture composed of narrative, environmental design and interactive design strategies can facilitate learning, in this case supporting the development of better argumentation skills for grades 9-14 in language. Targeted learning in a game-based environment, as chapters four and five also attest, is a successful strategy for learning, enriching the learning process and creating opportunities for new approaches to be developed.

The final chapter of this section, written by Scot Osterweil and Eric Klopfer from MIT, explores how games can engage players in learning that is specifically applicable to formal curriculum-based learning. It also considers how teachers can use game-based learning in such a way that formal learning and informal play outside of school are not affected adversely. In some ways, Osterweil and Klopfer are arguing powerfully for using games in schools but do not think that this will necessarily create a paradigmatic shift of learning culture in schools. They argue for the role of play in learning and explain this power, embedded in four main freedoms, as the freedom to fail, the freedom to experiment, the freedom to fashion identities and the freedom of effort. Together, these freedoms connect to empower the learner. According to the authors the freedoms cross the cultural boundaries of formal and informal learning, free play and formalized learning. Their discussion of games, in particular how at first glance games seem at odds with the freedom of play vis-à-vis their rule-based constraints, is a subtle argument, highlighting as it does the paradox that within the structured game, players 'regularly exhibit all of the freedoms of unstructured play.'

2.3: PRAXIS

The third section contains more experiments and examples of practice than the other two; but what is intriguing about this section is the extent to which the examples themselves generate research. Nor is this research 'action research' alone, deriving from the practice of games. The relationship between action and theory is much more subtle. Squire and Shaffer have investigated this relation with regard to the work of Louis Pasteur, adducing Latour and actor-network-theory, and describing Pasteur's own practice as

> a series of levers by which problems and contexts were more deeply understood, tools and techniques were developed, and systems of practices were reorganized in light of the resulting process of inquiry (Shaffer & Squire, 2006: 49).

From the editors' experiences of working with games and simulations and their practitioners, the concept of high theory handing down lessons to praxis to enact in the world is simply not what happens in actuality. Educational praxis itself is full of theory and to deny this is to shrink ever further the possible meanings of education. However, we aim to explore the more

practical applications of games and its impact upon learning communities and practitioners in this section, and explore case studies and examples that allow the learners' voices to emerge from the research and design experiments.

Richard Sandford, Keri Facer and Ben Williamson present two recent survey studies that focus upon the educational praxis around using games in schools. Their chapter explores the ways in which teachers work to re-construct their professional identities in the light of a model; where tutors are largely 'invisible' in relation to usual gaming practices which often take place in informal settings, and where 'adult/teacher identity' is absent from the dominant accounts. In these informal gaming settings, there is no traditional 'pedagogue' and no formal curriculum that a teacher is responsible for delivering. Researchers, designers, and enthusiastic teachers interested in bringing games into school are therefore, to some degree, attempting to bring into a teacher-centred setting a set of practices developed outside education in which the teacher has no role. This has real challenges for improving game-based learning and teaching practices, and to address this, the authors propose the adoption of a new set of professional identities for constructing more effective game-based approaches to be transferred into formal settings. They propose the 'teacher-as-designer' as one new identity used for recognizing the importance of the teacher in creating the environments in which students learn, thereby affirming their new visibilities in the complex exchanges of formal educational practices.

The voices of the learners are filtered in the chapter by Kurt Squire and Nathan Patterson where they consider the efficacy of game-based approaches, this time in the context of informal science education. Squire and Patterson outline a brief introduction of simulations and games in informal science education, which attempts to connect the research, theory and practical wisdom from education and entertainment games across a variety of contexts. Helpfully, the book chapter seeks to clarify some of the ambiguities between games and simulations; and with reference to games, including *Resilient Planet,* the chapter examines the research and theory on learning in structured informal learning environments, such as workshops and after school programs. The chapter also provides a framework for contrasting these structured informal learning environments with more formalized learning environments, such as school. As part of a comprehensive overview on learning with games, the chapter also reviews research on relatively unstructured learning environments, such as learning in the home or online, highlighting the opportunities and challenges for informal science education with games.

The chapter by Karen Barton and Patricia McKellar looks forward to a moment described by Gee where the 'line between education and entertainment is truly erased.' While the authors argue that this vision of the future has yet to be realized, in their chapter, the authors consider what promise this prospect might hold for students, teachers and educational developers. Building upon ten years of experience with designing and using computer-based simulations to help law students learn how to practice law in authentic situations, the team in Scotland have been able to extend the simulation duration and complexity, improve the interface and integrate the simulation within a blended learning environment. Some design principles and technologies that were initially applied have been adapted or abandoned while others have been reconstructed. The chapter provides evidence from this long experience and the chapter also presents a context of theoretical models from a range of fields, such as situated learning and constructivism that enabled them to create games and simulations as effective learning tools. As such, the simulations they describe are good examples of what Shaffer and colleagues have called 'epistemic games' (2005). The chapter also explores the culture of implementation of the simulation-based approaches, discussing the changed academic and training practices needed to support these new models and forms of learning

and the use of these models in the teaching and learning of professionalism.

Finally, the chapter from Francesco Bellotti and colleagues based at Genoa University in Italy focuses upon the widespread use of online virtual environments and related technologies for supporting game-based cultural heritage learning experiences. In particular, they survey the area of serious games arguing that the related technologies and applications are likely to open important new opportunities to enhance modalities of knowledge and interaction with virtual representations of cultural heritage. In particular they argue, given the possibility of creating compelling virtual adventures set in the context of artistic and natural places of interest, that the player and learner can now explore faithfully reconstructed places and live information-rich, contextualized experiences.

Bellotti and colleagues envisage a future where serious games represent a significant opportunity for learning, allowing for embedding high-quality contextualized information so that the players/learners can explore the virtual environment. The research team is developing new methodologies and tools for effective production, including developing a conceptual framework based upon task-based learning theory and authoring tools that allow users to interface with the virtual world and task-based content. The tools have so far been applied in cultural heritage contexts for supporting and enriching museum visits and trips to places of interest, and their game-based activities include a treasure hunt around art objects in some European cities.

3.0: TRANSFORMATIONAL POSSIBILITY

The book's three sections therefore present a series of apparent paradoxes – theory-based chapters that draw on practice, practice-based chapters that create theory, culture-based chapters that explore theory and practice. How do they cohere as a whole? As we state above, our general argument is that games and simulations have the potential to improve not just learning but society also. For this to happen, successful implementations need to re-consider the three domains of theory, culture and praxis. But the three can rarely be treated in isolation: we need to examine how they interplay, one with the other. This problem is not new. Dewey and many others after him have advocated this approach. In 1970, the educationalist Joseph Schwab, for instance, warned against seeking foundational theories of education, instead advocating a 'polyfocal conspectus' that is a sophisticated convergence of theories and experience (Schwab, 1970, p. 4).

This has been the approach of the editors in this book. As a result, readers will find touch points, issues and controversies that are threaded through chapters in the different sections and upon which different chapters have different insights. One example is the transfer of learning from one domain to the next and which, in one form or another, is touched on by almost every chapter. Another is the role of teachers in classes and teaching moments where games and sims are used. What do they do? How do games and sims change that role? Gibson tackles this issue with the analysis of classroom dynamics embedded in *simSchool*; de Freitas & Maharg take a brief case-study of a mentoring moment in a simulation; Barton & McKellar discuss how a simulation can change the conventional role of a tutor, and the consequences that has for the rest of the curriculum, and Sandford, Facer and Williamson discuss two studies of teachers within the context of teachers' sense of identity and professional role.

Yet another issue common to most chapters is the concept of immersion – the extent to which game- and simulation- players are engaged in their play. Salen & Zimmerman

(2004) describe this as an 'immersive fallacy' – 'the idea that the pleasure of a media experience lies in its ability to sensually transport the participant into an illusory, simulated reality' (2004, 450) – and as an extreme example of it they cite the Star Trek 'holodeck', an immersive reality experience involving matter and energy that is indistinguishable from reality. They critique the idea, following Bateson's concept of metacommunication (Bateson, 2000). They elaborate on Bolter & Grusin's fusion of immediacy (the representation of an alternate reality) and hypermediacy (the constructed technical environment of that representation) as *remediation*, where a form of immersive experience can occur, but where it is a much more complex and multi-layered experience than the directly immersive concept would imply.

The nature of that experience, the effect of context upon it, the way that the frame of game or simulation can powerfully mediate the experience of players – all these are issues that are explored in a number of chapters – MacCallum-Stewart for instance discusses how it affects 'stealth learning' in multiplayer online games; Francis describes the relations between player and adopted character in *Revolution*, and Barton & McKellar describe how the experience can be used in the play of professional identities and professionalism in SIMPLE simulations. The discussions raise intriguing questions about immersion that go beyond the simplistic idea of the holodeck. None in this book describe games or sims merely as simulacra, nor do they hold immersion as such a total experience that the frame of the game or simulation vanishes. For many, it is the tension between game/sim frame and experience that provides the real ground of learning.

Together the three sections highlight many themes, opportunities and challenges. For the editors the core arguments centre upon the efficacy of game-based learning, the authors' positions as advocates and early adopters of the new technologies, and the position of learners in the new domain. Design of serious games and learning has been a central theme throughout the book, and approaches to design in Dickey's chapter, in Dunwell and colleagues' work, and indeed most chapters, provide a useful spine to the debate about game-based learning efficacy. Interestingly the agenda for games in schools has not suppressed the learners' own voices from emerging throughout the text. In particular in section two the design approaches seem to centre much more upon the needs of learners than we have perhaps seen in other areas of e-learning development. What those needs are, and how the introduction of games can serve them in schools, colleges and universities is a hotly debated issue in the education sector as a whole. While the use of simulations in professional development contexts is well established and to some extent (in some professions more than others) it is embedded in practice, there are nonetheless many lessons to be learned in education. However, the imperative of engaging new learners and their use of new technologies is driving the implementation of games into every day teaching practices.

This book has provided a chance to reflect upon the key challenges and opportunities of game-based learning, and has provided a great opportunity for assessing how effective game-based learning can be in the future. The authors collectively have spent many years assessing the impact of this approach to learning and it seems that at least from their perspectives that the benefits significantly outweigh the disadvantages. Game- and simulation- based learning will, we believe, shape and re-shape the education landscape over the next five to ten years, and it is hoped that some of the lessons and observations in this book will help to stimulate others to join the authors in their exploration not just of the scholarship of conventional teaching and learning, but in the scholarship of transformational possibility that is represented by games and simulations.

4.0: HOW TO USE THE BOOK?

The book is divided into three sections, which are designed to have interest for the three main groups of readers. Researchers, policy makers and managers may have more interest in the first section, which provides a theoretical basis for game-based learning. The second section may have more appeal for tutors who are looking to find case studies and examples where games have been designed and used with specific users, such as school children. The third section, containing more discussion of practical examples, may be useful for practitioners eager to use games in their disciplinary areas.

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