CONCLUSION

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Although virtual worlds, and 3D virtual environments more broadly, have been used in educational contexts for more than 20 years, there remains a great deal that we still do not know about how best to design and use them to maximize learning effectiveness and outcomes. The contributors to this volume have explored a range of research topics related to the use of virtual worlds in education. Topics spanned human–computer interaction issues related to navigation, communication, identity formation, and authentic learning; leading-edge technologies that have the potential to take learning in virtual worlds forward in new directions, with a specific focus on conversational agents and computer-controlled avatars; and considerations and frameworks for designing and implementing learning in virtual worlds. The contributions made by these chapters within the broad areas of human–computer interaction, advanced technologies, and learning design and implementation are discussed in turn in the following parts before concluding with a summary of the main contributions of the book as a whole and the opportunities that exist for future research.

Part 1: Human–Computer Interaction

Chapter 1 by Shailey Minocha and Christopher Hardy, “Navigation and Wayfinding in Learning Spaces in 3D Virtual Worlds,” described their studies examining various interface issues that affect navigation and wayfinding in a virtual world, leading to guidelines for virtual world educators and learning designers. The studies involved interviews with students, educators and designers, observations of students undertaking virtual world-based learning activities, and heuristic interface evaluations. As a result, Minocha and Hardy pinpointed a
number of navigation and wayfinding problems, including the inability to identify the interaction possibilities of objects, difficulty locating and using navigational aids, and becoming disoriented and needing to return to the entry point. The design guidelines they proposed include the provision of maps, the use of notecards for ease of teleporting, the inclusion of objects replicating real-world objects to aid familiarity, and provision of a range of navigation mechanisms to cater to different user preferences and needs. Their key recommendation is that the design of virtual world learning spaces should be undertaken in an iterative fashion drawing on user evaluations.

Chapter 2 by Stephany Wilkes, “Communication Modality, Learning, and Second Life,” described a study that investigated how the choice of communication modality within a virtual world-based learning environment—voice only, text only, or a combination of both—influenced learners’ cognitive load, their perceptions of presence and co-presence, and their achievement of learning outcomes related to short-term retention. Wilkes found that communication modality had an effect on cognitive load and retention, but not on sense of presence. Surprisingly, cognitive load was highest for the voice-only participants and lowest for the text-only participants. One possible explanation for this is that the ability to retain and re-read text chat logs may have allowed participants to relax in the knowledge that they did not have to commit everything to memory. Retention was also highest for text-only participants, but only for those with experience in Second Life. Wilkes expected that voice communication would contribute to sense of presence, but this was not the case—there was no significant effect of communication modality on sense of presence. It is worth noting, however, that the lesson did not require peer discussion and the levels of communication were relatively low. This study is important because it illustrates that the ways in which communication modality affects learning experiences are complex and may be dependent on both the prior experience of the participants and the nature of the learning task. More studies are needed to confirm the findings and also to explore the way different learning designs, especially those which involve substantial peer discussion, affect the results. At this stage, educators should be cautious about making assumptions about the relationship between communication modality and learning experiences.

In Chapter 3, “Virtual Body: Implications for Identity, Interaction, and Didactics,” Laura Fedeli studied the relationships between avatar appearance, sense of embodiment, social relationships, and identity in a virtual world. By analyzing the data from various qualitative sources, she scrutinized the rich
experiences of the teacher participants in depth. Her key finding was that experiences gained in a virtual world should not be interpreted purely as representational experiences, but are perceived by participants as “real” experiences, even if separated to an extent from “real-world” experiences.

Chapter 4, “(In)Accessible Learning in Virtual Worlds” by Robert Todd, Jessica Pater, and Paul Baker, explored the degree to which virtual worlds are accessible to people with disabilities, and examined various proposed solutions for improving virtual world accessibility. The authors identified accessibility problems likely to affect people with visual or hearing impairments and those with limited hand-eye control or dexterity. They found that technologies such as screen readers, which are commonly used to support visually impaired users, were limited in their application in virtual worlds due to the lack of a standard for the inclusion of non-visual metadata. The use of text chat catered well to hearing impaired users, but the increased use of audio for communication has introduced new problems for this group. The authors considered alternatives such as sound amplifiers, word-to-text software, and environmental sound-to-text software to be promising. Traditional mechanisms to support low-dexterity users such as track-and-ball mice, head-pointer mice, and voice activation were also considered to be valuable in virtual worlds. On the positive side, Todd, Pater, and Baker suggested that the use of virtual worlds could be particularly valuable to people suffering from Asperger’s Syndrome and those with limited physical (real-world) mobility.

In Chapter 5, “Benefits of Second Life in the Ageing Population” Ann Smith discussed pilot studies of the use of virtual worlds by elderly people, highlighting the potential value to these users but also underscoring the need for specialized training and ongoing support. Aside from the navigation and usability obstacles already reported in the literature, problems encountered by elderly users included difficulty involving their use of Second Life to accommodate to interface changes, emotional discomfort when flying, and difficulty in communicating through avatars. Interestingly, the users showed a greater interest in using the virtual world for self-enrichment and lifelong learning purposes than for socialization and community engagement. The experiences of the elderly users Smith documented highlight the need for further studies in this area to allow designers of virtual world activities to develop a better understanding of the unique usability issues encountered by this important group of potential students.

In Chapter 6, “The Reality of Authentic Learning in Virtual Worlds,” Helen Farley questioned some of the claims made explicitly or implicitly by many
authors about the authentic experiences that are possible using current virtual world platforms. In particular, Farley argued that in many knowledge domains authentic tasks cannot as yet be feasibly carried out in virtual worlds, and that the limitations in the physical representation of the environment and the types of interactions and tasks that can be carried out result in an absence of many of the cultural and social aspects of real-world experiences. Further, Farley argued that the necessary reductions in complexity of the environment result in constrained rather than open-ended and well-structured rather than ill-structured problems, which restrict the degree of authenticity of the learning tasks. According to Farley, the additional cognitive load imposed by the virtual world software interface and the unnatural interaction mechanisms can interrupt flow and interfere with the apparent potential for increased sensory immersion or sense of presence. The claims and ideas Farley put forward in this chapter are important because the limitations do not just apply to particular virtual world implementations but to any applications of virtual worlds using current technology, thus suggesting that virtual world educators and designers need to be more cautious in their expectations.

Part 2: Advanced Technology

Chapter 7, “Conversational Agents in Second Life” by Robert Heller, Mike Procter, and Corbin Rose, explored the use of conversational agents in virtual worlds and, in particular, their impact on the social presence experienced by learners. Contrary to expectations, their study found that there was no difference between conversations held with the Freudbot agent in Second Life and those held with a similar agent in a text-only environment in terms of the social presence and engagement arising from the conversations. A possible explanation the authors posited for these findings was the possibility that virtual world participants may have been distracted at times by the contents of the environment (modelled on Freud’s office) and this may have prevented them from getting to the depth in their conversations with the agent that text-based participants achieved. Another possibility Heller, Procter and Rose raised was that the absence of “paralinguistic” communication channels in both the virtual world and the text-only communication environment (e.g., body language, gesture, facial expression, etc.) may limit the degree of immediacy in the conversation and consequently the social presence experienced. A limitation of this study, which needs to be addressed in future studies, is that participants
were drawn from different samples, conversing with the agent for different purposes within different learning contexts.

Chapter 8, “Virtual Bots” by Torsten Reiners, Sue Gregory, and Vicki Knox, considered the value of non-player character (NPC) or “bot”-based avatars in virtual worlds where a minimum number of avatars are needed to create a realistic experience for users. The authors drew a distinction between virtual worlds based on what they termed “hard” technologies, in which user action is constrained by the environment, and “soft” technologies, in which user action is less constrained or more open-ended, arguing that allowing bots to operate in an unconstrained, soft-technology environment is challenging. They discussed how bots were designed for use in VirtualPREX, a project aimed at providing inworld professional learning experiences for pre-service teachers, and described different frameworks for enhancing and enriching virtual world-based learning experiences through the use of bots.

Part 3: Learning Design and Implementation

Chapter 9 by Steven Warburton and Margarita Pérez García, “Analyzing Teaching Practices in Second Life,” presented a learning design taxonomy for virtual world-based workshops. The taxonomy is grounded in an analysis of data gathered from a large number of workshops conducted by the authors and other educators, and was systematically validated through its application in further workshops conducted by participants of a large, pan-European program. Evaluation of the taxonomy led to the finding that certain aspects of the design and delivery of the workshops had a major impact on their success, including the technical design of the virtual teaching spaces, the establishment of clear and understandable interaction/communication protocols, the overall instructional design (including strategies for individualization of the learning experience), the setting aside of adequate time for designing the workshop and for further improvements, and refinements following delivery and evaluation. A taxonomy of this type is an important contribution to the field, since despite the acknowledged potential of virtual worlds for addressing a range of learning design challenges, their uptake has been relatively modest, due in part to the difficulties faced by teachers in adapting their face-to-face teaching strategies to a virtual world context. The chapter is the first thorough analysis of the design issues in the use of virtual worlds as a synchronous teaching space, and it is important for educators considering the use of virtual worlds in their teaching.
as well as more experienced virtual worlds educators wanting to evaluate and refine their approaches.

Francesca Bertacchini and Assunta Tavernise illustrate the design of three virtual worlds devoted to cultural heritage in Chapter 10, “NetConnect Virtual Worlds.” They looked at three historical settlements from Poland, Germany, and Italy. Students aged from 15 to 18 were able to explore the sites to discover new knowledge and motivation for their experiences. Archaeological sites were made available to learners through virtual worlds so they could explore cities, buildings and squares, houses and huts, and objects that were found in the buildings. These virtual worlds enabled students to explore lost locations and manipulate 3D objects that are too fragile or rare to handle in real life. There are three paths in the NetConnect virtual world that students can take: they can follow points of interest, engage in personal exploration, or learn/view/read about different contents. Students in this study undertook a 12-hour laboratory course in the virtual world. This type of learning enabled secondary students to look back into time to witness history and provided them with a hands-on approach for a deeper understanding of cultural and artistic heritage in all of its components and relations.

In Chapter 11, “Scaffolding Learning Through the Use of Virtual Worlds,” Chris Campbell and Leanne Cameron explored the way in which learning in virtual worlds can be supported through “scaffolded” tasks drawing on resources outside of the virtual world. They contrasted the proposed approaches with the alternative of providing scaffolding through the structuring of tasks within the environment, as illustrated by virtual worlds such as Quest Atlantis (Barab et al., 2007), River City (Ketelhut, Nelson, Clarke, & Dede, 2010), and Virtual Singapura (Jacobson, Kim, Lee, Lim, & Low, 2008). The evaluations of the activities in the two projects (one involving teacher education students using Second Life, and the other involving secondary students using OpenSim) led to Campbell and Cameron’s recommendations, including the need for timely feedback for students as they undertake virtual world activities, the importance of student–student and student–teacher collaboration, and the value of scaffolding of tasks to ensure that students stay on track with the overall task goals.

Chapter 12, “Challenges and Strategies in Designing Cross-National Learning” by Paul Resta and Miri Shonfeld, discussed the learning design issues and challenges involved in using virtual worlds to house collaborative learning activities for geographically dispersed teams of students. Findings from surveys and interviews conducted with graduate education students from Israel and the US who participated in cross-national team projects, indicated that social
presence and engagement correlated with satisfaction and group cohesion, and course satisfaction correlated with engagement. Some of the challenges that arose included scheduling difficulties due to time zone differences and technical difficulties relating to audio communication, which are not “new” problems as such, but are commonly encountered when using synchronous technologies for learning across the boundaries of time and space. Resta and Shonfeld recommended providing advance orientation and training, allocating ample time for the activity, mentoring students during the activity, and exercising care when assigning students to groups.

The final chapter, Chapter 13, “Introduction to Laws Relevant to Virtual Worlds in Higher Education” by Layla Tabatabaie, explored the legal issues involved in the use of virtual worlds, with a particular focus on the contrasting of laws and legal frameworks within the US, the UK, and China. The specific legal issues Tabatabaie addressed in the chapter were intellectual property issues associated with student and teacher creation of virtual world spaces and artifacts, the protection of student avatar images and speech, and distribution of records of student actions in a virtual environment. Tabatabaie’s key recommendation, applicable across legal domains, is the advance documentation of terms and conditions of use because many of the legal problems identified can be avoided if there is a written agreement between students and the educational institution prior to use of the virtual world. It is important, however, that such agreements are written with awareness of the legal framework in operation, because they can be rendered null and void by courts in some jurisdictions if they are considered unfair. Some of the challenges Tabatabaie identified in anticipating the way in which a court would view a case involving virtual world activities or artifacts relate to the fact that the real-world equivalents of situations occurring in virtual worlds are not always obvious. In the UK, for instance, recording activities undertaken by students in a virtual world would be considered educational records, for which there are strict laws relating to distribution, whereas the absence of such laws in China means that privacy laws would have to be applied instead. The author also highlights the challenges in constructing terms and conditions that are applicable in multiple jurisdictions. For example, in some jurisdictions, virtual world artifacts are treated as art (e.g., China), while in others they are considered to be literary works (e.g., England).

Emerging Themes and Future Directions

A number of key issues and directions for future research have emerged across the chapters in this book. Here, we attempt to draw together some of the
common issues and highlight some research opportunities that could be taken up by other researchers.

The chapters in the “Human–Computer Interaction” part report on research into some of the most important aspects of the learner experience in virtual worlds. Ease of navigation is an important prerequisite for almost any virtual world activity, and there are a number of virtual worlds design issues which if not considered could result in confusion, disorientation, or disengagement from the learning task. Even minor navigation usability problems have the potential to increase the learner’s cognitive load, reducing the attentional resources available to focus on the key aspects of the learning task. Given this, the design guidelines derived by Minocha and Hardy should be a key inclusion in the design “kitbag” for all virtual world educators and developers. The range of studies undertaken by the authors, the thoroughness of their evaluations, and the grounding in the wider human–computer interaction literature allow designers to be very confident about the validity and applicability of these guidelines. Although further studies are needed in other learning contexts using other virtual world platforms to provide additional validation of these guidelines, it is even more important for efforts to be made to ensure that guidelines such as these are made available in clearly understandable forms to virtual world developers and learning designers. Work to package guidelines such as these, along with those developed by other researchers, in ways that ensure they can be easily applied, is essential to ensure that we avoid repeating the mistakes of the past and genuinely move forward in the design of usable virtual worlds for learning.

Ease of use is particularly important but sometimes hard to ensure for elderly and disabled users of virtual worlds, as discussed in the chapters by Todd, Pater, and Baker and by Smith. The virtual world accessibility issues they highlighted, and the somewhat limited range of solutions available, suggest that if virtual world use is to become more common in educational institutions, substantial additional research is needed to devise design standards and assistive technologies to enable both people with disabilities and older users to participate on an equal footing. This said, the authors highlighted a number of promising projects which aim to increase accessibility of virtual worlds for people with a disability, including work at the IBM AbilityLab focusing on users with vision impairments, the development of Radegast, a non-graphical virtual worlds viewer including text-to-speech and speech-to-text capabilities, and Virtual Guidedog, which assists visually impaired users in virtual worlds by listing nearby objects and avatars in a way so that screen readers can pick them up. Smith argues that similar research is needed which explores the customization
to virtual world interfaces to make such environments comfortable places for elderly users. Given the rapid increase in the use of communication technologies such as Skype by older people (see, for example, Loeb, 2012), there is a real need for this research if we are to see virtual worlds become a mainstream alternative social space accessible to all.

The choice between the use of voice, text, or a combination of voice and text for communication by learners is one of the key decisions made by designers of virtual world-based learning experiences as explored in detail by Fedeli. Wilkes’ research also illustrates the complexity of the situation, and the fact that some of the prevailing assumptions about the effect of communication modality on sense of presence, retention, and cognitive load may not in fact be valid. In particular, it would appear that, at least for experienced Second Life users, text communication may result in just as great a sense of presence, increase retention, and not increase cognitive load when compared to either voice communication or a combination of the two. Given the problem of ensuring that all learners have access to voice communication without technical difficulties, this finding, if confirmed by other studies, will be important. Confirmation of such a finding would also be good news for users suffering from a hearing impairment, who were able to participate freely in virtual world activities through the use of text chat prior to the more widespread adoption of voice communication by virtual world communities.

Even though the wider application of user-interface design guidelines, along with ongoing improvements to the user interfaces provided by virtual world viewers has enormous potential, Farley highlights the need for a reality check before we assume that such enhancement will remove all barriers to authentic learning. She suggests that even if we get all of the design elements right there are still some fundamental limitations of virtual worlds that will continue to reduce the authenticity of the learner’s experience. We need to be careful not to adopt inflated expectations with regard to virtual world designs but rather to design tasks with a view to complementing rather than replacing real-world tasks.

The chapters in the “Advanced Technology” part raised some interesting points about conversational agents and computer-controlled characters (or bots) more broadly. The lack of a difference in the social presence experienced in communicating with a Freudbot historical-figure agent with a realistic appearance in a virtual environment versus communicating with a similar agent in a text-only environment is surprising as discussed by Heller, Procter, and Rose. Further studies are needed to explore whether the same findings emerge when undertaken with participants randomly assigned to the virtual world and text-based
conditions. An additional promising avenue for future research could be combining conversational capabilities such as those exhibited by Freudbot with physical interactivity such as that exhibited by the VirtualPREX student bots, as outlined by Reiners, Gregory, and Knox. It is possible, for example, that an enhanced Freudbot with both conversational and physically interactive capabilities would be more realistic to interact with and would result in increased social presence for users.

The chapters in the “Learning Design and Implementation” part collectively proposed a number of key principles to be taken up by the designers of learning activities in virtual worlds. Warburton and Pérez García highlighted the challenges of designing for effective learning in Second Life, and in particular the importance of providing a well-structured learning environment, of tutors being skilled in the use of the environment so that they can adequately support learners, and of pedagogies that focus on learner reflection rather than directive learning. Bertacchini and Tavernise discussed a different pedagogical strategy: one that enabled students to witness and experience history firsthand through a hands-on approach, thereby encouraging them to develop a deeper understanding of cultural and artistic heritage in all of its complexity. Campbell and Cameron made a compelling argument for the value of various types of scaffolding to support learners in undertaking virtual world tasks, both inworld and in the physical classroom. Warburton and Pérez García echo this argument, with the monitoring of student progress, provision of guidance, and support and feedback key aspects of their model. Future studies could further explore the feasibility of translating the face-to-face support advocated by Campbell and Cameron into online support (which could be delivered in and out of world), which is necessary for the use of virtual worlds for students studying at a distance. These recommendations are also in accord with those of Resta and Shonfeld, who focused on collaborative activities undertaken by users in disparate locations in Second Life, in that they also recommended mentoring and scaffolding as well as monitoring of meetings during the activities. Other recommendations emerging from their study include advance training for students so that a lack of familiarity with the virtual environment does not impinge on the ability of students to participate in group activities, and careful allocation of students to teams, including balancing their language capabilities within groups.

The final chapter by Tabatabaie delivered some key messages for educational designers and institutions more broadly about the legal issues to consider when using virtual worlds in a learning context. Most important is the conclusion that across all three legal jurisdictions studied (US, UK, and China)
contract law provides the most consistent and predictable framework. As a consequence, universities and colleges are advised to focus their attention on clear documentation of their internal policies and procedures and, in particular, the provision of clear and simply phrased Terms of Service (TOS) and End-User License Agreement (EULA) documents. Such documents, assuming that they are clear, unambiguous, and free of unreasonable conditions and clauses, will provide a robust foundation for any legal disputes or disagreements that might emerge.

Closing Remarks

The thirteen chapters in this anthology bring together some of the leading contemporary virtual worlds research from around the globe, with findings synthesized for the benefit of both educational practitioners and scholars. The book in its entirety is a recommended resource for teachers in an online or distance context who are considering adopting the use of virtual worlds into their practice and who want to avoid repeating the mistakes of others, as well as for researchers or research students wanting to get a sense of the researchable issues and key unanswered questions within the virtual-worlds-for-education landscape. Equipped with the knowledge of theories, strategies, and frameworks gained from reading the chapters in this book, readers will be well placed to look to other scholarly and professional sources for more examples and case studies of innovative and exemplary use of virtual worlds for learning and teaching, and to approach those examples and case studies with a critical and analytical eye. They are urged to consider the discipline-based applications in the literature, as well as other applications they encounter in their own work, in light of the issues and findings reported in this book, carefully weighing up the implications of the evidence presented for their own practice and/or research pursuits.

REFERENCES


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