



Designing contemporary music courses for the 21st century musician: virtual worlds as a live music performance space

Ms Lisa Jacka

School of Education
Southern Cross University

Dr Matthew Hill

School of Arts and Social Sciences
Southern Cross University

The landscape has already changed for the music industry in the way that music is created, performed and distributed. Higher education courses in music, including contemporary music, are abundant but in many cases are not preparing students for the 21st century music industry. Innovative technology is pushing the boundaries of what live performance in music actually entails. Technology such as virtual worlds is opening up avenues for greater control by the musician in relation to design of performance spaces and ability to attract global audiences. The potential for the exploration of virtual worlds by musicians to promote appropriate career development skills is discussed. Technical, organisational and motivational issues are also raised. Problems and possibilities associated with the initial running of performances in a virtual world reveal the capacity of higher education to implement live music performance in virtual worlds as part of their music courses.

Keywords: virtual worlds, music, education, performance

Introduction

Computer mediated environments that facilitate immersion of the user in a 3D space have been written about since the 1950s (Bradbury, 1951; Knight, 1952) and were rudimentarily pioneered in the 1960s with the design and development of Helig's *Sensorama* and Sutherland and Sproull's *The Sword of Damocles* head mounted display (Sutherland, 1965, 1968). In broad terms these experiences have been labeled virtual reality (VR). Development of VR continues with discoveries and developments informing much of the current popular entertainment experiences such as the Kinect, Wii and X-Box. The variety of VR experiences and environments can be categorized as immersive, desktop, projection and simulation (Jacobson, 1993). The type of human-computer interface largely determines these categories. Truly immersive environments require the user to wear equipment that facilitates the immersive experience by blocking out the real world and projecting image and audio through head mounted displays, gloves, position tracking devices and 3D sound systems. On the other hand, desktop VR experience only requires a computer with the specified level of hardware. With the rapid development of computer technology delivering high speed processing, high definition graphics and audio, and high speed Internet connectivity in low cost portable devices, access to VR technology is now possible at a consumer level. VR that can be interacted with using a desktop computer, mouse and keyboard are generally easy to access and as such have been the most likely to be explored in general higher education settings. The type of VR that the authors have explored is what is commonly referred to as a virtual world (VW). The VW is accessed via a desktop computer and interacted with through an avatar that is manipulated using a mouse and keyboard. The type of experience that the user can hope to encounter is what McLellan (1996) calls a window on the world in which the screen acts as a window into which the user is viewing.

Higher education institutions have been introducing the use of VWs as part of their courses in an attempt to meet the increasing demand for anywhere, anytime learning in a highly competitive marketplace (Albion, 2008; Dalgarno, Lee, Carlson, Gregory, & Tynan, 2010; Gregory et al., 2010; Kirriemuir, 2010; Warburton, 2009). Despite a downturn in recent years, the most popular VW used in higher education is Second Life (SL). Other VWs that universities are exploring include their own purpose built and other commercially available VWs and grids including JokaydiaGRID, Kitely, Jibe, World of Warcraft, Reaction Grid, Active Worlds and sim-on-a-stick. The university at which this study took place currently manages three spaces (VW sims often referred to as islands) in the VW SL as well as utilising sim-on-a-stick for single use VW building development. In 2013 a pilot project was undertaken within the Contemporary Music Program examining the experiences of performers and audience participants in live music performances in SL. Staff in the Contemporary Music Programme believe that incorporating SL into the music program will generate an authentic experience for students to develop their performance style and technique, to practice for a real event, to find new audiences and new performance outlets. Most important is the capacity for the VW to be utilised as another real performance space in which performers genuinely earn money and develop an audience.

Background

The project discussed in this paper is located in the Contemporary Music Programme at a regional university in NSW, Australia. The VW SL has already been examined by a number of disciplines within the university including business, management, nursing, tourism and education. Each of these sectors have recognised the potential for SL to enrich the current courses and assist students to develop skills for the 21st century. Unfortunately not all of the initial undertakings in SL have continued and the actual sustainability of VWs in higher education remains a contentious issue. Currently the university manages three islands; a main general purpose island, a nursing focus island and an education research island. On the education research island pre-service teachers are encouraged to consider the use of VWs in their future teaching practice. A small number of education staff and students have embraced the use of VWs for education. The development of a community through extra-curricular events has proved to be one way to encourage participation, as Broadribb et al (2009) describes in the development of a strong SL presence for the Open University, UK. Staff members in the Contemporary Music Programme and the School of Education have begun collaborating to develop music performances that can be attended by staff and students from all sectors of the university. The performances are being held on the education research island and aim to provide an educational experience for the music students and a social experience for the education students.

Literature Review

Music is an important feature of VWs such as SL with a high proportion of SL activities being concerts and night clubs, the streaming of music onto islands as background audio, and the development of social presence and stickiness (keeping people in there and getting people back) through the development of events. As in real life (RL), the aural element is pervasive in the VW, whether as foreground or background music, sound effects, audio cues or ambient sounds. A survey of music destinations catalogued on the SL website list 271 locations with at least one band, *Duran Duran*, having their own category that includes 16 different locations. SL has sub-categories of music that replicate generally accepted genres such as country and folk, live musician spots, pop music, hip-hop, R&B and reggae, rock and metal, electronic and dance, indie and alternative, jazz and blues, cafes and cabarets and live DJ spots. The SL destination listings do not provide a complete picture of music in SL as many spaces stream music to enhance the ambience of their environment or curate musical concerts. Examples of music utilised on SL locations include the Virtual Mine island where the music of the Appalachian mountains are included in the experience, Arkansas State University island has a recreation of Johnny Cash's diner, the Glastonbury Pop Festival SL event on the London island and Languedoc Couer community who hold lavish balls reminiscent of the Baroque period. Further to the utilisation of SL for live music performance by RL musicians is the 2006 concert by Suzanne Vega and the U2 tribute band that perform under the name of U2inSL.

Interestingly Ondrejika (2007), who was at the time the CTO of Linden Lab (the proprietors of SL) and one of the creators of SL, used music as a primary example of why SL was innovative. Importantly he suggested:

Simultaneous collaboration allows multiple participants to interact in ways not commonly seen on the web, such as musicians in different cities playing a duet to an audience from all over the world. This real-time exchange is at the core of how content is created within Second Life

(Ondrejika, 2007, p. 33).

Content creation is one of the main differences between a VW such as SL and other VWs such as the extremely popular Massively Multiplayer Online Role-Play Games (MMORPG). Antonello et al (2009, p. 45), who undertook a traffic analysis of SL, concluded that while SL and MMORPGs share many characteristics the ability for the user in SL to “build an assortment of objects with distinct network requirements” put added pressure on the requirements and the predictability of those requirements. Traditional MMORPGs have “fixed scenarios and objects that aren’t customisable” and as such only need to adapt to largely predictable player actions. They choose music streaming as the example of high bandwidth requirements to use for their tests. Their results help to illuminate some of the technical requirements for music performance in SL.

Despite the prevalence of music in the VW the inclusion of this mode of performance and distribution is not widely explored in higher education music courses. In 2007 Pence, in his role as the manager of the Pantheon Concert Hall in SL, created an internship program for music industry students from State University of New York – Oneonta. His project involved three staff and nine volunteer students in one semester. The staff played three different roles each as the music educator, the technician and the performance space manager. The students provided publicity and technical support to musicians who were already music performers in SL. Pence found that the concerts that these students organized were very successful and they “required fewer financial resources and entailed fewer risks” than performances in RL (Pence, 2007, p. 3). The project is discussed further in Greenberg, Nepkie and Pence (2008) and cited in Wongtangswad (2008) as one of three examples of the successful use of SL for education. Another example of the use of SL to promote and educate about music can be found in Schwartz (2009). He describes how in 2007 he realized that the immersive and interactive environment of SL had the potential to encourage and motivate others to appreciate Classical Music and he developed a presence for the Music Academy Online. Schwarz at first designed a tower block that had exhibits similar to a museum in RL. He discovered over the first year that people returned to the space when they knew others would be available to talk to or if a concert was programmed. In the second year they purchased a whole island and started to operate “just as a ‘real’ physical world campus” (p. 8). In 2009 Schwartz said that the Music Academy Online would “continue to develop and generate new and unique content with the goal of reaching beyond SL audiences” (Schwarz, 2009, p. 9). It is interesting to note that the examples of Pence and Schwarz discussed here have not continued in SL. Further studies into why educators are not still using SL are underway and necessary to assess why the potential of VWs is not being fully realized. While some have discontinued their use of SL and VWs for music Rogers (2012) demonstrates viability with her ongoing classical style concerts in play since 2007.

The literature is scant in regard to music education in VWs presumably due to the lack of use of VWs by higher education in the discipline of music. A significant reason for advocating for the use of VWs in a music course in higher education is to provide the students with experience in new technologies and new ways to negotiate their music career. As Bartleet et al (2012, p. 34) suggest, “(t)wenty-first-century influences on the Australian music industry such as digitization, globalization and deregulation mean that whichever part of the sector musicians work in, they must navigate new contexts and business models and possess new and diverse skill sets”. One particular aspect of these changes is highlighted by Luthy and Aucouturier (2013, p. 1) observations of the “transition away from the retailing and distribution of fixed objects (records, files) to the consumption of live, interactive events (concerts, happenings)”. Live performance in VWs represents one possible avenue for exploring these new contexts and business models requiring a range of new skills.

Methodology

An action research approach (Kemmis and McTaggart, 1988) has been utilised in the planning, reflecting and redesign of the utilisation of SL in music performance as part of a degree program in music at a regional university. The authors have brought their specific areas of expertise in music and VWs to design and implement opportunities for students to explore VWs. The intention in this pilot phase was to explore the possibilities of VWs as a new media for contemporary musicians and as such an action research methodology is an effective framework to help inform future practice. Three separate performances are discussed and represent three cycles of implementation, reflection and redesign. In semester one of 2013, live performances by staff and students were presented in SL to a variety of audiences and from a variety of RL spaces. The first performance was undertaken by one of the staff and projected to the whole Contemporary Music Programme at the beginning of the semester. The second performance involved ten students who comprised two student band ensembles. They performed in a practice room to an invited audience who were present in both RL and the VW. A third performance was by a band of four musicians, one of which was an honours student in the music program. After the performances the students were interviewed and asked to reflect on their experience and to envisage the

future potential of VWs for musicians. The participants offered their perceptions on how they may or may not use SL as a performance space. The feedback from the students was reflected upon by the staff who made changes to the way in which the activity was devised. For each of the performances the students were asked to create their own avatars and were also provided with premade avatars equipped with animation and musical instruments. The same SL space was used for all three performances. This paper describes the setup and technical requirements for each of the three performances. The integration of VWs into the music degree program is further discussed as an important part of the aim to develop the capacity for students to be responsive to changes in the music industry, particularly in relation to technological aspects of music creation and distribution. Much of this aligns with the University graduate attribute (transferable skill) of “lifelong learning – the ability to be responsive to change, to be inquiring and reflective in practice, through information literacy and autonomous, self-managed learning” (SCU, 2013).

Music Performances in Second Life

Solo staff performance

At the beginning of every year the staff in the Contemporary Music Programme give a performance to the whole cohort as a showcase for the staff and to start the weekly concert series. In 2013 one of the authors of this paper chose to use SL as a performance space. His intention was to use the performance as a launch pad to gauge interest from staff and students to SL. As the performance was undertaken during the regular concert time the performer had a high level of technical support from other staff. This was the first time that any of the staff had used SL for performance and the first time that many of the students had witnessed a performance in SL. In the design of the performance the authors had wanted the staff member to perform live from his home. Being able to demonstrate to the students that the RL performance location could be remote from the audience was an important driver for using SL. The concept of performing from home was also attractive to the staff member for a number of other reasons, including familiarity with instrument (an upright piano that could not be moved for the purpose of performing at commercial venues), ease of setup (no need to recreate existing home studio) and general level of comfort in relation to performing from a home studio. The technological requirements for streaming audio into SL were very much akin to home studio recording, with the addition of the live streaming and SL components. Figure 1 shows the desired set up for the solo performance from the staff member’s home. Without SL a listener can receive a live feed through the streaming servers URL. However the use of SL adds an extra dimension, that of the avatar. The avatar is the visual representation of the performer and as such requires animating and some attention paid to the avatar by either the performer or a person who may be playing the role of the performer. In the initial design the performer was to have a computer set up with him logged into SL with his avatar. The avatar would be animated as a piano player. The experience for the audience was designed so that they would either come to the performance in SL or view SL projected into the RL concert space at the university campus.

A number of factors caused this initial set up to be changed, helping to highlight a range of technical considerations when performing live in SL. The first problem was the lack of Internet connection at the performer’s home due to a recent house move and subsequent delay in phone lines being connected. Unable to perform from home, the contingency plan was for the performance to take place in a studio on the university campus. The authors were still trying to simulate the act of a performance from a remote location. In preparation for the performance occurring on campus a number of tests were done to check the connection to the audio server. In so doing a significant problem was found. The university have shaping tools on their server to restrict students from downloading large amounts of data from the Internet. This tool caused the audio stream to drop out continually. Fortunately an IT technician was willing to make changes to the shaping tool to allow the audio to proceed through to the server. On the day of the performance the studio based setup was working during sound check, however ten minutes prior to the scheduled performance time the computer delivering the live stream ceased working and some frantic troubleshooting proved unsuccessful. This led to the actual performance taking place on stage with a projection of the SL screen featuring the staff member’s avatar performing. The late switch in performance location made for a stressful performance due to the staff member not being prepared for the actual performance instrument (a piano with a much heavier action than the home studio or campus studio pianos) and also meant some elements of the performance were not included (e.g., samples triggered from a computer). The final performance in the first instance (during sound check) proved to the technicians and the staff that the set up for live performance in SL was viable. In the second instance (during the scheduled performance) the students were able to see what SL looked like but did not experience the true affordance of SL for live performance as the performer was in the same location as the audience.

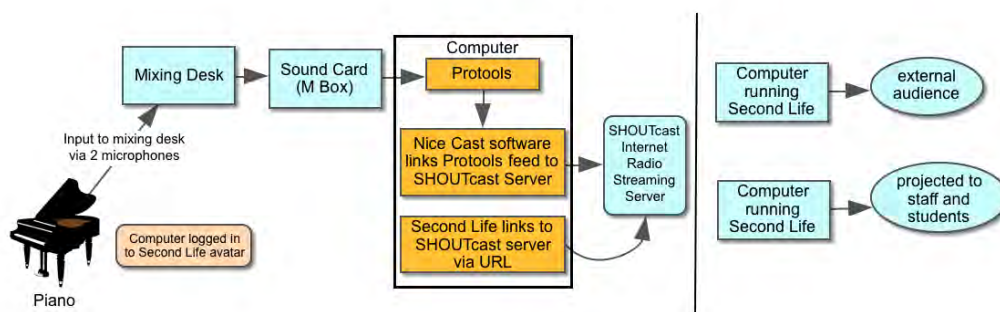


Figure 1: Initial set up for the first performance by a staff member. The vertical line indicates the physical separation of real world locations from the Second Life performance.

Undergraduate student band performances

Every semester students in the music program are put into bands that work together on a set repertoire each week culminating in a final performance. The students are assessed on their participation and performance. To provide students with an initial introduction to the use of SL as a performance medium a small part of an ensemble rehearsal schedule was dedicated to performing in SL. Using the ensemble rehearsal time to stream their performance into SL allowed two ensembles to perform for each other in RL and in SL. As with the staff performance the main audience were either in the RL space or in close proximity to the RL performance, at least two other audience members joined the performance from a remote location. Undertaking a SL performance with most of the audience in close RL proximity greatly diminishes the affordance of SL as a space to perform to a wider audience and/or from a remote location. In turn making it less obvious to the students as to why SL is a valuable space for performance. However the design was as an introduction to SL and the requirements to staging a performance with the hope that the students would experiment with this medium in the future. Prior to the ensemble groups performing in SL, a music student who uses SL as a performance space, doing regular performances and earning a small amount of money from them, made a presentation to the groups extolling the virtues of SL for her as a performer.

The set up for the student performance consisted of two groups of students who alternated being the performers and audience in SL. The performing groups comprised of one group of six (a rock/pop line up featuring drum kit, bass, electric guitars, keyboards and vocals) and one group of four (a rock/pop line up featuring drum kit, bass, electric guitar, and vocals). The initial plan for the performance was for the performing students to be in an ensemble rehearsal room (equipped with PA and instruments) with computer laptops in front of each performer so they could see and interact with their SL avatar. The audience would be in RL in an adjacent room seated at individual computers participating as audience members with their SL avatars. A stereo room microphone setup was put in place with a feed into a computer running the digital audio workstation (DAW), Pro Tools, with an output from the DAW to the Mac based audio streaming application Nicecast to the Internet radio server SHOUTcast. The URL generated by the SHOUTcast server would be added to the streaming audio on the SL performance space

As with the staff performance, a number of technical issues arose in the planning stages, just prior and during the performances. Finding an available bank of computers for students to utilise, both as performers and as audience members in SL, was a challenge. An ideal room for the SL audience, a video editing room equipped with large monitors and high quality speakers, was adjacent to the ensemble rehearsal space, however a different degree program had priority over this room and it was unavailable at the scheduled time for music students. As an alternative, laptop computers for each student were sourced from the university and staff members' personal computers. In pre-session testing it was discovered that the Ethernet ports in the room in which the performance was to take place were not active and an Ethernet cable needed to be fed to a different room to connect the computer streaming the audio at an adequate connection speed. The door to the performance space room door was designed for soundproofing purposes therefore it would not shut properly with an Ethernet cable running through. With the door slightly ajar, the spill from the band playing prior to the performance caused problems for the students working in the room next door further interrupting the preparations. Just prior to the performance the streaming server stopped working. This problem was due to the university shaping tool as discovered prior to the staff performance. While the problem was thought to have been fixed earlier it was discovered that other ports in the building were still affected by this tool. Due to the link to the server being

unreliable a decision was made to abandon the audio stream and utilise the ‘speak’ function within SL to provide the audio feed via a USB microphone. This fixed the sound spill problem, as the Ethernet cable was no longer required, but introduced the problem of much lower quality audio into SL. The final set up is outlined in Figure 2.

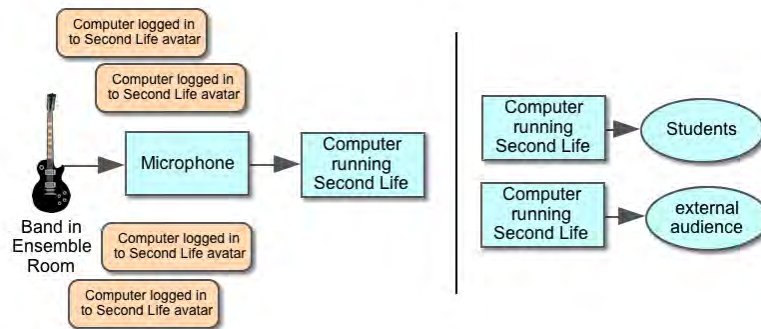


Figure 2: Set up used for the first performance by student ensembles. The vertical line indicates the physical separation of real world locations.

Honours student band performance

A second student performance was arranged with an Honours student who was interested in trialling VW technology after attending the student ensemble performances in SL. The student performed as part of his four-piece instrumental math-metal band in which he is the drummer. A different technical setup from the other performances was used as the band performed from one of the purpose built recording studios at the university utilising a multi-microphone setup and 48 channel mixing desk. A digital multitrack recording of the performance was undertaken using Pro Tools as part of the process. A live stereo mix was fed to a separate computer that was then streamed via the Mac based audio streaming application Nicecast to the Internet radio server SHOUTcast. The URL generated by the SHOUTcast server was added to the streaming audio on the SL performance space (see Figure 3). The band members were each provided with a laptop running SL and these were placed near each performer in the recording studio. Having trialled live performance in SL on the other two occasions the technical audio aspects of this performance came together relatively smoothly. The session proceeded in a similar way to a recording session with the bulk of the time spent setting up microphones, line checking signals and providing a suitable headphone mix for the performers. These tasks were fairly new to the band members but the staff member was experienced in this environment. The performance was scheduled for a Saturday afternoon so there were no distractions from other staff or students and no time pressures other than a self imposed performance time. The shaping tool issue which had interfered with the streaming of the previous student performances had been resolved with technical assistance from the university’s IT department. The audio stream into SL was tested 30 minutes prior to the scheduled performance time by means of one researcher in the studio contacting the other at her home by phone to get feedback on the audio quality. From an audio quality perspective the performance was a large step up from the previous student performance (where the ‘speak’ function had been used) with quality resulting from a multichannel studio recording.

Having mastered the technical requirements of the audio set up the focus turned to the issues of working in SL and what it means to perform in a synchronous visual online space. Only one member of the band (the Honours student) had his own avatar and prior to the performance he had made some effort towards adding set and stage design elements. The band logo had been rendered on a backdrop and the texture behind the stage had been redesigned. The other band members utilised the avatars that had been pre-made complete with musical animations for guitarists and vocalists.

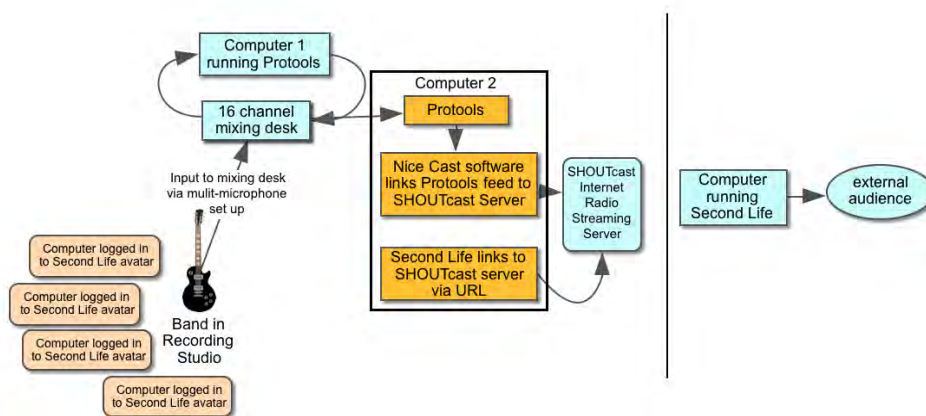


Figure 3: Set up used for the second performance by a student led band. The vertical line indicates the physical separation of real world locations.

Student response to performance in second life

As is often the case, many of the students appeared oblivious to the degree of technical facilitation that staff provided for the performances. For example, the students were asked to make their own avatars in SL before attending the session however of the 14 students who participated only one of them chose to do this. In anticipation of this, prior to the session the researchers had created generic avatars, equipped with animated instruments bought from the SL marketplace, to represent each of the instrumentalists. Before performing, students spent a brief time familiarising themselves with basic SL navigation techniques and exploring some of the avatar animations. There was a high level of engagement observed during the brief introduction with students visibly excited by the capabilities of the avatars and the look of the SL space. During the performances the performing students interacted with their avatars to different degrees. Some ignored their avatar and the computer screen altogether, instead focusing on their performance as they would for a RL performance. Others watched the computer screen as they performed and some changed the animation settings for their avatar in between songs. From an audience in SL perspective, the avatar's animations are an important part of the visual experience. This highlights one of the possible barriers for musicians using SL: the difficulty for the performer to make changes to an avatar's animations whilst they are performing.

The current way that users interact in SL is through their avatar. To manipulate the avatar the user needs to have the capacity to manipulate a device such as mouse, joystick or keyboard. The ability to do this is diminished for a user who is at the same time manipulating a musical instrument in RL. The performer is often engrossed in the act of performing as they interact with their instrument, for them to also interact with the screen via a mouse, joystick or keyboard is very difficult. It is possible for the performer to choose an animation for their avatar to perform while they are playing. This in many ways removes the performer from the immersive experience of the VW. For the audience in SL it is extremely important for them to be able to see an animated avatar to be provided with the right cues to understand that a performance is taking place and not just streaming pre-recorded audio into the SL environment. A device providing a VR immersive experience such that the musicians' RL actions can be tracked (for example, through a device such as the Kinect) may alleviate these barriers. At this time the authors are not aware of any such device and perceive that for a truly immersive live musical performance in a VW such a device will need to be made available. One of the musicians in the math-metal band remarked that if there were more synchronisation of movement between oneself and your avatar that "I'd be there all the time".

Furthermore the students who had previously played RL performances felt that the SL experience lacked the "energy" they associated with live performance. They felt that they were unable to "feed off the crowd" and respond immediately to audience reactions. This feeling reflects the limited time and lack of immersion that the students were engaged in with the SL experience. A seasoned SL performer, who spoke to the students before their performances, suggested that the acceptance of SL as a legitimate performance space that exudes energy and excitement similar to RL performance required time and familiarity with VWs from the performers. The students did agree that there would be value in the potential global audience, however they suggested that existing live video streaming technology was more engaging for such purposes. The students did agree that it would be relatively easy to do a SL gig in future, not having to book through regular channels, not having to cart

musical equipment and being able to play in the comfort of their home. One student saw the potential for a strong visual element to be added to the music and suggested that they might construct a dedicated band island in SL. Whilst acknowledging the potential to reach a wider audience, the students thought that most of their audience did not use SL and hence would need to be introduced to SL before being able to experience an SL performance.

Conclusion

The three instances of using SL for music performance primarily demonstrated a number of technical requirements but also lead us to further question how best we can assist students to fully engage with VWs. Our belief in the capacity for VWs to deliver outcomes that are currently unavailable to our students has not been diminished. Through the affordances of VWs a student musician can reach a global audience, perform with a high quality audio sound, practice their performance, can easily access an audience and other musicians with no need to travel and from a remote location. The musician can create a persona through their avatar and develop very specific types of spaces to perform in that all contribute to their musician image. They may choose to have multiple images and reach different audiences.

Presenting live performances in VWs may or may not be a common feature of the future music landscape. However as an exemplar of an emerging technology with a range of possibilities and an as yet to be codified set of practices, VWs offer a suitable context in which students are challenged to respond in creative and innovative ways. In a rapidly changing music industry environment the capacity to be responsive to and to accept and adopt new technologies is an important aspect of any future career in the industry. Such responsiveness is reflected in the notion of lifelong learning. As Smilde (2012, p. 289) suggests:

In order to meet the challenges of rapidly changing cultural life in the twenty-first century, professional musicians need to be lifelong learners, drawing on a wide range of knowledge and skills. To be successful in a variety of roles, they require a reflective and responsive attitude to change.

We continue to imagine that VWs will become ubiquitous encompassing education and entertainment. The current use of VWs by children provides some insight into the future as they engage with VWs such as *Moshi Monsters* and *Club Penguin*. These children are a musical audience today and tomorrow. In these VWs a music industry exists where children can visit the 'underground disco' and sing 'Moptop Tweenybop' with 'Zack Binspin' then purchase the music through iTunes. When the children of today reach university age they will be expecting VWs to be part of their education.

The small steps that appear to currently be happening in terms of VW adoption are slow indeed. In Australia we hope that an increase in connectivity will assist in making VWs more ubiquitous but expect that that alone will not be enough. Perhaps music will be one of the ways that VWs will be embraced as we have seen with the making of music portable from the walkman to the ipod and in turn the functionality that was designed for mobile devices driven by the desire for music anywhere, anytime. The common thread of music has created communities sharing through technology and that has begun to create a levelling of the music industry hierarchy with performers controlling when, where and for how much they play. In education we may see a music school that meets from all over the world in the VW to discuss, share and perform music and in which accomplished musicians and beginners can play together. These are some of the ways that we envision VWs playing a part in the music education landscape. Introducing our students to the current model and testing the process is a short verse in a longer song not yet written.

References

- Albion, P. (2008). *3D online spaces for teacher education: Mapping the territory*. Paper presented at the Society for Information Technology & Teacher Education International Conference 2008, Las Vegas, Nevada, USA. <http://www.editlib.org/p/27423>
- Antonello, R., Fernandes, S. n., Moreira, J., Cunha, P., Kamienski, C., & Sadok, D. (2009). Traffic analysis and synthetic models of second life. *Multimedia Systems*, 15(1), 33-47.
- Bartleet, B., Bennett, D., Bridgstock, R., Draper, P., Harrison, S., & Schippers, H. (2012). *Preparing for portfolio careers in Australian music: setting a research agenda*. *Australian Journal of Music Education*, 1, 32-41.

- Dalgarno, B., Lee, M. J. W., Carlson, L., Gregory, S., & Tynan, B. (2010). 3D immersive virtual worlds in higher education: An Australian and New Zealand scoping study. In C. H. Steel, M. J. Keppell, P. Gerbic, & S. Housego (Eds.), *Curriculum, technology & transformation for an unknown future. Proceedings ascilite Sydney 2010* (pp. 269-280). Brisbane, Qld.: The University of Queensland.
- Broadribb, S., Peachey, A., Carter, C., and Westrap, F. (2009). Using second life at the Open University: How the virtual world can facilitate learning for staff and students in Wankel, C. and Kingsley, J. (eds) *Higher education in virtual worlds: teaching and learning in second life*. (pp. 203-219) UK:Emerald.
- Bradbury, R. (1951) *The veldt*. In *Illustrated man*. New York: Doubleday.
- Greenberg, J., Nepkie, J., & Pence, H. E. (2008). The SUNY Oneonta Second Life Music Project. *Journal of Educational Technology Systems*, 37(3), 251-258. <https://doi.org/10.2190/ET.37.3.b>
- Gregory, S., Lee, M. J. W., Ellis, A., Gregory, B., Wood, D., Hillier, M., et al. (2010). Australian higher education institutions transforming the future of teaching and learning through 3D virtual worlds. In C. H. Steel, M. J. Keppell, P. Gerbic, & S. Housego (Eds.), *Curriculum, technology & transformation for an unknown future. Proceedings ascilite Sydney 2010* (pp. 399-415). Sydney:University of Queensland.
- Jacobson, L. (1993). Welcome to the virtual world. In Richard Swadley, ed. *On the cutting edge of technology* 69—79. Carmel, IN:Sams.
- Kemmis, S., & McTaggart, R. (1988). *The action research planner*. Deakin University:Deakin University Press.
- Kirriemuir, J. (2010). UK university and college technical support for "Second Life" developers and users. *Educational Research*, 52(2), 215 - 227.
- Knight, D (1952). The analogues. In *The magazine of fantasy and science fiction*. New York:Mystery House cited on http://www.blastr.com/2009/06/a_comprehensive_timeline.php
- Luthy, M., & Aucouturier, J.J. (2013). Content Management for the Live Music Industry in Virtual Worlds: Challenges and Opportunities. *Journal For Virtual Worlds Research*, 6(2).
- McLellan, H. (1996). Virtual realities. *Handbook of research for educational communications and technology*, 457-487.
- Ondrejka, C. (2007). Collapsing geography (Second Life, innovation, and the future of national power). *Innovations: Technology, Governance, Globalization*, 2(3), 27-54.
- Pence, H. E. (2007). The Homeless Professor in Second Life. *Journal of Educational Technology Systems*, 36(2), 171-177. <https://doi.org/10.2190/ET.36.2.e>
- Rogers, L. (2012). Invited essay - future of work: musical performance in virtual reality. *H+*. <http://hplusmagazine.com/2012/09/19/invited-essay-future-of-work-musical-performance-in-virtual-reality-music-island-five-years-of-virtual-concerts-in-the-park/>
- Schwartz, D. T. (2009). Second Life and Classical Music Education: Developing Iconography That Encourages Human Interaction. *Journal of Virtual Worlds Research*, 2(1). <https://doi.org/10.4101/jvwr.v2i1.392>
- SCU (2013). Graduate attributes policy. <http://policies.scu.edu.au/view.current.php?id=00091#maj1>
- Smilde, R. (2012). Lifelong learning for professional musicians. In McPherson, G., Welch, G. F., & Welch, G. (eds) *The Oxford Handbook of Music Education*. New York:OUP.
- Sutherland, I.E. (1965) The ultimate display. *Proceedings of the IFIPS 2*, 506-08.
- Sutherland, I.E. (1968) A head mounted three dimensional display. *Proceedings of the Fall Joint Computer Conference 33*, 757-64. <https://doi.org/10.1145/1476589.1476686>
- Wongtangswad, J. (2008). *Uses of Second Life in Higher Education: Three Successful Cases*. Paper presented at the World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2008, Las Vegas, Nevada, USA. <http://www.editlib.org/p/29825>
- Warburton, S. (2009). Second Life in higher education: Assessing the potential for and the barriers to deploying virtual worlds in learning and teaching. *British Journal of Educational Technology*, 40(3), 414-426. <https://doi.org/10.1111/j.1467-8535.2009.00952.x>

Author contact details:

Lisa Jacka, lisa.jacka@scu.edu.au

Dr Matthew Hill, matt.hill@scu.edu.au

Please cite as: Jacka, L. & Hill, M. (2013). Designing contemporary music courses for the 21st century musician: virtual worlds as a live music performance space. In H. Carter, M. Gosper and J. Hedberg (Eds.), *Electric Dreams. Proceedings ascilite 2013 Sydney*. (pp.412-421). <https://doi.org/10.14742/apubs.2013.1489>

Copyright © 2013 Lisa Jacka and Matthew Hill.

The author(s) assign to ascilite and educational non-profit institutions, a non-exclusive licence to use this

document for personal use and in courses of instruction, provided that the article is used in full and this copyright statement is reproduced. The author(s) also grant a non-exclusive licence to ascilite to publish this document on the ascilite web site and in other formats for the *Proceedings ascilite Sydney 2013*. Any other use is prohibited without the express permission of the author(s).