

How Can We Build Successful 3D Games For Learning?

John N. Sutherland

Department of Computing
University of Paisley, Scotland, United Kingdom.
j.n.sutherland@paisley.ac.uk

Thomas Connolly

Department of Computing
University of Paisley, Scotland, United Kingdom.

Daniel J. Livingstone

Department of Computing
University of Paisley, Scotland, United Kingdom.

Abstract

There has been much talk, some funding and considerable action since James Paul Gee [1] and others postulated that we can learn in virtual gameworlds. The paper's authors have been and are involved in various game-based learning environments (GBLE) initiatives, academic and commercial-related, over the past few years. They have also been variously involved with others in their development and use. This paper presents some conclusions from their experiences in developing and using a variety of GBLEs and postulates that, as the technical problems are increasingly being overcome, there is still much to be learned before conclusions can be drawn on if, where and when GBLEs will become a wider reality.

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1. Defining Education

On a straw poll of games development students at the University, when asked, 'What can you learn from using Computer games?', answers included: fast reaction speeds, endorphin rush, faster speed of thought, better problem solving, greater imagination, better reflexes, more abstract thought, aggression, flying airplanes, and dangerous driving. Some of these are clearly educative, others less so, and not a few are ethically questionable.

To White[2] education consists in the creation of excellence, selection of the best, imbuing basic personal goods, enhancing intrinsic goods, economic development, personal development, social moral cohesion and citizenship. In short, the creation of the educated person in the community via educational institutions. To Bryce and Hume [3] it is a product of government policy, created by government-appointed bodies, that exists in a socio-historic, national and global context, for various pre-defined age-groups, with pass-fail criteria, and is effected by professional teachers. To Gibbons *et al* [4] it is about the ever-changing world of theoretical and applied knowledge that is in content and in nature deeply subject- and field-specific. To Lave and Wenger [5] education is what happens in real-life as the young learn from older experts situated in the field of practice.

A GBLE exists as part of this milieu of thought and must be measured against currently agreed pedagogic values and intentions.

2. Defining Video Games

Mencher [6] is one of many who define games into *genres*: action, strategy, role playing, adventure, puzzles, sports, simulations, kids/family/edutainment and hybrids of the above. Video games run on open

platforms (e.g. PC and Mac), closed platforms (e.g. Nintendo Wii), stand-alone, networked, pay-as-you-play, pay-once, for public use, for private use, with seconds of play-time, or up to years of play-time.

To some, such as Meadows [7] video gaming is fundamentally about narrative and storytelling through a virtual/interactive proxy. However, Dave Jones [8], the designer of the Grand Theft Auto and Lemmings games, said video gaming is all about, 'the three rules of gameplay: fun, fun and fun.' This split between *ludology* and *narrative* is a moving and living thing, yet to be resolved, not least for reasons of market immaturity, as Kerr [9] discusses. To Jackson [10] video gaming was and is life-changing, a seemingly cultural phenomenon; this is also attested by the other contributors to the same book as they reflect upon games that profoundly affected some part of their lives.

The inner life of the fantasy of game-playing, unreal though it is undoubtedly in physical terms, is nonetheless as real an experience for the player as are other forms of fantastic mental play [11] making, as Fiske [12] states, it difficult to divide and separately define fantasy and reality in human experience.

Video games are also commercial products which compete in a cultural space where the dread words are, 'I'm bored!'. As Sayre *et al* [13] state, 'Consumers are drawn to entertainment offerings that are novel and different but, unfortunately, when the novelty wears off, attention may be lost.'

3. Successful GBLEs

Given the above definitions, a GBLE could be defined as a video game that intends to, and to a significant extent succeeds in, teaching specific learning outcomes to a target section of the population, in a way that they recognise as being culturally relevant, and with intentions which are defined as being worth teaching by an official, government-sponsored body. If this is so, then there are few GBLEs alive and flourishing in the real world outside acadæmia.

Dr Kawashimas Brain Training: How Old is Your Brain [14] (figure 1) could be the first GBLE aimed at adults. On the other hand, there are no success criteria for this apparent GBLE, except it sells well.

The major areas of success are in children's video gaming. The BBC's *Bitesize* [15] (figure 2) website is strongly supported by schools across the UK, providing

an internationally popular GBLE [16], interestingly entirely funded by United Kingdom taxpayers.

There are many other examples (figure 3) of such small Flash and Java games that teach generally academic-related skills.

On the other hand Bebo [17], as well as providing games for such as English and Arithmetic skills in similar small-scale, short and simple games, also covers virtual and real social skills - in the divide discussed by the cultural commentators McRobbie and Fiske (see above) - by providing a safe, virtual, web-based wrap for the games allowing kids to play safe in a world where nobody is, ultimately, real.

There is also the possibility of stealth learning through such as Sim City (urban planning) or Theme Hospital (health organisation and purpose.) This is more difficult to classify as *learning* as the learning outcomes can only be reverse engineered from the gameplay and facts are mixed with non-facts, which must be separated post-gameplay.

4. A Failure in 3D GBLE development

In academic year 2004-5 and again in 2005-6 the University of Paisley and another academic partner attempted to build a multi-user role-play game using student projects on a taught postgraduate degree in games programming. In each case a small team, 4-6 programmers, spent one academic year designing, developing and testing the video game. The students came from Europe, Asia and Africa; all had a good bachelors degree in Computing and strong programming skills.

The aim of the game was to teach database management and design skills by means of a virtual yacht marina. The learners would enter the virtual environment with the aim of finding out as much as possible about the marina, in a pseudo-lifelike, scripted conversational scenario. NPC avatars would be coded with enough AI to answer predefined questions, with various degrees of completeness and accuracy. The aim was to build an environment that emulated what real-world Systems Analysts do, but one that cannot be realistically emulated and controlled in a traditional university environment.

In each of the two development cases around one to two person years of work were put in at a possible virtual cost of around £50,000 - £100,000. In neither case did the student group complete the task successfully. Indeed, the work each team produced, despite being

totally separated from each other in time, was remarkably similar. In both cases their work also fell below the usual standard expected of such student development teams.

What went wrong? It was difficult to motivate the students to develop the learning game. When compared to other offered student projects, such as space-wars or fighting mech games, it also proved impossible to persuade digital artists to get involved. For both programmers and artists the 'boring' word kept reappearing, despite their need to create a significant game piece as part of their future employment portfolio.

This echoes Sayre's (above) comments on the danger of losing attentiveness in video gaming. A significant problem remains, as Lesley Keen, former CEO of the failed all-female games company, said, that video games is an industry which is dominated by an adolescent male culture [18]. This, in the experience of the authors over many years of teaching hundreds of budding new games developers, is as true for programmers as for players, who are often one and the same.

In both years a game engine was used to develop the game. Torque in the first year and Ogre in the second year. Both engines provide the basic 3D virtual environment code upon which the game is built. In both cases the student group managed to build a basic gamespace with very little gameplay.

There are technical problems that appeared to relate to two major aspects of the GBLE. Firstly, the difficulties in building the large and complex play-space, populated by a lot of NPCs, in a complex game level and with a large amount of AI scripting. Second, even with relatively open game engines (as opposed to the much more rigid moddable offerings such as Half-Life) the very different nature of the gameplay in the required GBLE involved a lot of additional coding and amendment of existing code. For example, the addition of logging and replay for later tutor/student reflection.

It was estimated that perhaps double this time, at an estimated cost of closer to £250,000, would be required to produce a working prototype of the GBLE required, and a figure of closer to £1m for a fully working game. This is remarkably similar to the cost of development of a commercial 3D video game today.

Who would play it? Again the culture of video gaming issue kicks in. The general public's impression of video games reached a new low when Sony's game, *Rule of Rose*, prompted Franco Frattini, the European Justice Commissioner who was reported to have written to EU

governments to tighten up controls on violence in video games [19] branding the game obscene, dreadful, violence provoking, profoundly shocking, sadistic, brutal and extremely violent (figure 4.)

Violent imagery produces a strong emotional response [20], leaving a stronger effect – hence the front page newspaper coverage – than something as educational and bland as a potential learning game (figure 5.) On the other hand, this helps produce a *worthiness* label that the student developers of the GBLEs almost instantly recognize and find repellent.

5. Creating Success in 3D GBLE

The University of Paisley has been active and present in the virtual world of Second Life for the past year. This is an example of a massively multiplayer online role play game (MMORPG) like Everquest or World of Warcraft. The game itself is a blank canvas of a 3D virtual world, to which many thousands of 'residents' have added their own content, using the easy to learn development tools and C-derived scripting language. Recently there has been something of a media-storm around Second Life as many leading IT companies and universities become actively involved in exploring its potential as a platform for communication, learning and knowledge transfer [21,22].

What makes Second Life special is that it is a complete online, 3D, multi-user environment just waiting for educational content to be plugged in. In constructivist fashion, some educators get their students to develop the educational experiences – including youth outreach projects using the 'Teen' version of Second Life.

What makes it potentially *extra* special is its *cumulativity* – the ability to reuse and build on previous work rather than endlessly re-writing code and recreating data to build the basic frameworks for GBLE. This cumulativeness is also being leveraged to try and solve another issue – GBLEs exist independently of web-based learning management systems that have been developed over the past decade.

The Sloodle project (see figure 6) involves the development of tools which enable communication between the University's web-based learning management system and Second Life, enabling teachers and students to access and update content held in the University's e-learning system while carrying out activities in the immersive environment of Second Life.

Another approach the University is taking is to partner with commercial GBLE companies. We are working closely in a development with one company and are in discussions with others in the UK and North America as possible future GBLE development partners.

This opens up more sources of funding for everyone involved, creating the potential for more ambitious products. The University brings an approach to rigorous design, wide technical know-how, and a natural test-bed for checking GBLEs. The commercial partners bring a product-driven approach, their technical knowledge, artistic skills, and sales and marketing knowledge. Both parties bring a range of pre-written technical artefacts that can be used in GBLE development.

On the potential down-side there is the different approach to software development of business and the academy: software engineering *versus* computing science, and 'do' *versus* 'talk'. The common flakiness of funding in the two sectors is also a problem, as can be the geographic separation of the partners, although the latter can be helped by government funding for tech parks in or near universities, and/or universities freeing-up space for a commercial presence on the campus.

Paisley University has the advantage that many of its GBLE academic staff are ex-commerce and most games developers are graduates, providing commonalities of understanding.

6. Discussion

There are emergent areas where GBLEs look like becoming technically workable 3D worlds where learning can take place. Some of these are potentially off-the-shelf (like Second Life) whilst others will have to be developed with commercial and academic partnerships.

If the devil is in the detail, then it is in the uses of 3D GBLEs as educational tools: the ability to gain measurable and agreed inputs and outputs for and from their development and use. The inputs - time, money and effort - are significant and can be difficult to source as GBLEs are not found to be attractive to most games developers and funders/publishers. How the educational outputs are measured are often set by those outside the development and academic team: inclusivity (underpinned by the socio-politics of the *soi disant* 'new left' which currently drives the educato-

political agendas in Europe), examination content (driven by the the opposing 'new right' forces and such as the parts of the press noted for their hatred for video gaming) and financial (to ensure the ongoing assessment and development of the GBLE.)

As we begin to overcome the technical difficulties of developing GBLEs, it is these unresolved paradigms [23] which academics and developers must also engage with.

7. Acknowledgements

All trademarks used in this paper are acknowledged.

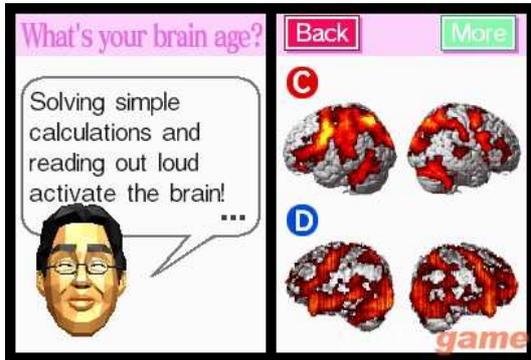


figure 1 – a screenshot from *Dr Kawashima's Brain Training* [nintendo.com]



figure 2 – a screenshot from a BBC BiteSize *Hangman* game [bbc.co.uk]



figure 3 – a Flash game to teach football tactics



figure 4 – screenshot from *Rule of Rose* [www.scee.com]



figure 5 – screenshot of *Lemonade Tycoon*



Figure 6 – the Sloodle e-Learning group meets in *Second Life* (www.sloodle.com)

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