

Design Paradox: Instructional Games

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ABSTRACT

Current approaches to the design of games for learning can be roughly divided into two main camps: one claiming that commercial games already employ many strategies that are valuable in the design of instructional games and that formal instructional design methodologies are not needed, while the other argues that the design of instructional games must apply traditional practices in formal ways and that games designers must yield to the better-informed professional instructional designer. The main focus of this paper is to explore the tension between these two viewpoints. A comparison of game design and instructional design uncovers several paradoxes which must be reconciled before they can be properly combined to be of use in the development of instructional games.

Topics: Cross disciplinary issues in game development; Serious games; Games and learning (educational games); Bridging the academia-industry gap; Experiences and lessons learned from game development in academia and industry

1. INTRODUCTION

Support for the viability of serious games has been growing steadily for several years now, and the use of digital games in education is again being examined by the education community, as it was during the ‘edutainment’ era of the late 80s and early 90s. Some even go so far as to claim we are “witnessing a mad rush to pour educational content into games in an ad hoc manner in the hopes that players are motivated to learn simply because the content is housed inside a game”. [1] If true, that sounds like the same sort of bandwagon jumping that contributed to the downfall of games for education the last time around. Fortunately, for the most part the literature does not support this claim. [2-5]

Although the ultimate solution(s) will undoubtedly lie somewhere in-between, the current approaches to the design of games for learning can be roughly divided into two main camps. One claims that commercial games already employ many strategies that are valuable in the design of instructional games [5-8] which we need only understand in order to utilize, while

the other argues that the design of instructional games must apply traditional practices in formal ways [1, 9] and that games designers must yield to the better-informed professional instructional designer. The main focus of this paper is to explore the tension between these two viewpoints.

2. THEN AND NOW

The last time the education community witnessed a rush to adopt digital games as learning technologies the effort failed to fulfill expectations [10, 11], and one of the side-effects was that the term ‘edutainment’ became pejorative in the software industry and game producers shied away from having their games labelled “educational”. [12] Another effect was that many educators came to view all software employing game technology with suspicion. [13] The current movement has a new name and a much broader scope [14]. Rather than focusing primarily on school-like education, the serious games movement includes the use of digital games and game technology for purposes other than pure entertainment, such as applications in the military,

healthcare, policy and politics, and others as well as education. Such a broad interdisciplinary base will hopefully ensure that the errors of the edutainment era are not repeated.

When one examines the culture and technology of digital games, the landscape today looks radically different from what it did in the late 80s and early 90s. For one thing, the internet was not really a viable option for mass information exchange, or even general communication. As recently as 1999, serious research necessitated one's physical presence in a library; now with access to the digital resources of an academic library, one can conduct most forms of research without ever leaving home. General knowledge of video games was scant back then and the body of research in Games Studies was in its infancy. When educators began to study the use of games for learning, they proceeded largely in isolation from other disciplinary groups [15], and although there are still some who continue to favour 'pure' educational sources over a more interdisciplinary approach [1, 9, 16], others are now taking a broader view [4, 6, 7, 17]. Aside from the overall approach to disciplinary studies, there are some other significant differences as well. The percentage of people who play games either casually or regularly has gone up significantly in the last ten years. Not only are there more gamers, they are considerably older – the average age of a gamer is now 33 and the prime demographics for games is in the 18-35 year old range [18]. Finally, along with the advances in internet accessibility, Google© has become a verb, and personal computer power and capacity is orders of magnitude greater than it was a decade ago. In fact, almost all of the hardware advances made in that time have been motivated by games and thus owe their very existence to the medium.

Digital games are not just for kids any more (if indeed they ever really were), and PC prices, capabilities and popularity are largely the result of the unmitigated success of the games industry. All of these differences imply that the situation for the educational use of games is, or at least *should be* quite different from what it was during the edutainment era, and a fresh approach is in order. However, there remain several significant obstacles to be overcome before games can

achieve the respect and recognition as educational technologies that they deserve.

3. PARADOX 1: VEXED BY FUN (OR, THE IMPORTANCE OF BEING EARNEST)

Any games designer can tell you that the first rule of digital games is: the game must be fun. If the game isn't fun, then nothing else matters. But is that all there is to games? It seems unlikely that mere 'fun' could support the multi-billion dollar industry that it has become. If "fun" is the sole reason for the popularity of games, how does one explain a first day sales record of \$125 million for a single game, *Halo 2* [19]. Can "fun" explain how one massively multiplayer online role-playing game (MMORPG) like Everquest can acquire a global ranking equivalent to Namibia when measured in terms of Gross Domestic Product? [20]. Clearly, there's more to games than "fun".

While "fun" can't possibly be the only requirement - not even in games designed purely for entertainment, it is certainly essential - meaning that if the game is not fun, then the rest: the quality of the graphics, storyline, etc. is irrelevant. Unfortunately, fun is contextual, and not simply defined. Someone feeling the effects of zero gravity in a roller coaster may be having fun, while someone experiencing the same effect because they have fallen off a cliff would be unlikely to attribute fun to the sensation. Just the same, the potential power embodied in "having fun" should not be underestimated. For our purposes however, the implications behind the term 'fun' are significant obstacles – among other things, they interfere with progress in understanding the symbiosis necessary between the game design and instructional design.

Too often 'fun' is associated with ridicule and frivolity. These perceptions tend to be antithetical to notions of significant learning, and thereby denigrated by those who prefer to emphasize the more solemn and earnest aspects of teaching and learning. As a result, elevating the importance of "fun" in the context of an instructional intervention may be problematic. However, an examination of what actually constitutes "fun" in this context might yield a perspective, or alternate terminology which might

prove more useful. For example, “fun” is not really possible without “engagement”, and engagement is a state we *do* strive for in all our teaching. If we view fun as excitement and as a vehicle for engagement, it might help make it more palatable. Another possible perspective comes from the well-known games designer, Chris Crawford: "True fun is the emotional response to learning."

Although they are becoming known as Serious Games, games designed for purposes other than pure entertainment, including games for learning, still retain “fun” as an essential ingredient. Fun is an essential element in digital games generally [21], and so must remain an essential element of Serious Games as well. Furthermore, fun must be acknowledged as highly subjective. The ‘fun’ in a game, even a serious game, must be carefully tailored to the intended audience if it is to be an asset rather than a liability. If past successes and failures in “edutainment” are any indication, then fun is an aspect often underestimated by many ISD (Instructional Systems Design) people – and when it is included, its subjective nature seems generally to have been overlooked.

Learning happens all the time: it is a natural condition of being human. It always involves some sort of change: change in what we remember, our skills, attitudes, or behaviours. Learning is neither positive nor negative. We can learn things that are useful or useless, life-saving, or dangerous, helpful or hurtful. In short, learning has no associated implications of moral, ethical or other value. Education, on the other hand does imply value [22], but need not result in any change (although in order to be deemed successful, it usually does). Education implies deliberate facilitation of societally valued learning which occurs over and above what is natural, and implies some persuasion (possibly even coercion) that is enacted upon the recipient of this education.

Caillois claims that a game one is made to play stops being a game [23]. If education is deliberate, and being *made* to play a game causes that object to cease being a game, then the whole notion of educational games would constitute a paradox. Huizinga suggests that play and seriousness are opposites [24], and it seems that a

similar sentiment is prevalent in the educational community: the more playful and game like something becomes, the less serious it appears to be, and since education is considered to be serious and valued learning, games have no place. The notion that games cannot embody serious or *significant* learning must be overcome for games to gain broad acceptance.

4. PARADOX 2: GAME DESIGN VS INSTRUCTIONAL DESIGN

If we are to consider the use of games for learning, then we must also examine how instructional design (ID) and games design (GD) can be made to fit together. There are many accepted and well-tested process models for Instructional Design [25]. In most of these models, the details of how the medium fits in to the design are left till near the end of the process. Typically, the needs assessment and the design of the instructional goals and strategies are to be completed before the design and development of the instructional materials themselves. Unfortunately, none of the models are directly applicable if the intervention we are designing is to be delivered as a digital game so long as the game is viewed as instructional ‘material’.

The educational perspective typically views games as receptacles for content rather than teaching methods, and this only works in a subset of applications. Unfortunately, when applied to fully interactive media (specifically games), this perspective, which the author has referred to as the ‘decorative media principle’ [26] does not translate well. When creating digital games for learning, the design of the instruction and the design of the medium for delivery, i.e. the game must be completely intertwined in order for it to be worthwhile.

Let me explain: the game must still be a game. A typical commercial game has a production cycle of 2-3 years, employs teams of 10 – 50 people, and costs \$1 - \$10 million to produce. Games contain, among other things: input systems, networking systems, real-time systems, rendering engines, display systems, sound systems, artificial intelligence engines, asset managers, physics engines, and a front end (which is the only part the user gets to see). Game design is arguably as complex as instructional

design – and when the two are combined, the complexities together become multiplicative rather than additive. It is naïve to assume that an instructional design process can be devised by simply inserting “game” in the right places in the existing literature and go from there.

As a discipline Games Design (G.D.) has been evolving for several decades. There are plenty of books and resources available should someone wish to learn how to design a digital game, which does not in any way imply that it is easy. There are a growing number of universities and colleges that are offering specializations in degrees and even entire degrees devoted to games design, and yet as with any other truly creative effort, while most can be taught the principles of game design, designing a *good* game takes something more. If there were a formula for making *good* games that could be taught, there would be many more good games out there (however we choose to define the term ‘good’).

Much the same can be said of I.D. (Instructional Design). It too is a complex task supported by several decades of disciplinary development. Most can be taught the principles of sound instructional design, yet designing *good* instruction takes something more. However, in contrast to G.D. which has developed largely in the field by practitioners with little scholarly input (at least until recently), I.D. has proceeded in the more structured manner of an academic discipline and the result is a substantial body of both theory and practice upon which academic and other researchers and professionals in the field can draw.

If we compare I.D. and G.D. we discover that the primary vantage point of instructional design has largely been that of formal education, while the vantage point of games design is more closely aligned with the entertainment industry. Games designers approach their task from the perspective of the player experience [27], whereas instructional designers approach their task from the perspective of the content that needs to be delivered [28]. Even though both G.D. and I.D. are highly complex tasks, the design of instructional games requires both. Instructional game design requires a synergy between two seemingly opposed approaches with radically different histories.

To summarize, the second paradox can actually be described as several closely related paradoxes: I.D. tends to view games as content receptacles rather than teaching methods, *exogenous* rather than *endogenous* [29] and their perspective is that of delivering content rather than experiences [7]. In terms of disciplinary development, I.D. is supported and advanced through academic research, while G.D. is supported and advanced through professional development from an entertainment industry perspective. In some sense this too relates back to the original paradox: games = entertainment = NOT serious, while instruction = scholarship = serious.

5. LITERACY'S

I started learning to write computer programs in 1977. I taught my first computer science lab in 1978, and have been teaching freshman Computer Science (CS) students how to program for about 27 years, with varying degrees of success. One of the things I have learned after all that time is that we *still* don't really know how to teach programming. Granted, we can teach people who are interested and already inclined, but this is not the same as, say, basic literacy (i.e. reading and writing), which we manage to teach to almost everyone.

There are those who hold that programming skills ought to be counted as a basic literacy in the 21st century, like reading and writing [30]. There is a belief that learning to program helps people learn to think. It is hard to deny that experience in programming helps develop logical thinking. However, if we endeavour to make programming into a basic literacy, we still have a long way to go in order to learn how to help (all) people learn it, including those people who do *not* dream of becoming Computer Scientists.

An understanding of programming, including some computing theory and hardware fundamentals has an undeniable effect on one's approach to problem solving, especially when the problem is to be solved using a computer. For example, I am a better programmer because I understand something about languages and formal grammars. I am also a better programmer because I understand how data are represented at various levels of abstraction, and because I understand

something about compilers and how they translate programs into executable code. All of these things contribute to my being able to design the programs that are digital games. How can one hope to design good *educational* games if one doesn't first know how to design games?

The question could also be asked, how can one hope to design good educational games, if one doesn't understand how to design good instruction? At the risk of betraying a bias, it should be noted that most of the critically acclaimed game titles currently being used in educational contexts were *not* designed by instructional designers, but rather by game designers. Whether this is true generally remains to be seen, but it is certainly true specifically. Ultimately, being able to demonstrate that a game intended to be used in educational contexts was developed with the incorporation of sound instructional design principles will be necessary for widespread acceptance within the educational community.

6. INSTRUCTIONAL DESIGN FOR EDUCATIONAL GAMES

One way of looking at the problem of how to design instructional games is to try and answer the question: what do we need to know in order to TEACH others to design good games for learning? Unfortunately this paper can not provide a clean answer, but will instead explain why a simple answer to this question may not be forthcoming soon.

A significant and irrefutable aspect of designing and creating educational digital games is the design and creation of the *program* that is the game. This author remains unconvinced that we will be able to teach people how to design educational games without also having them understand how to design digital games. Since we don't really know how to do that either, our challenge is a large one.

People need to understand their tools, and we tend to undervalue the importance of technical acumen when creating artifacts. Understanding one's tools is another form of literacy and as necessary as the video game literacy defined by Gee in his seminal work on the subject [31]. Some things are just more complex and demand a

greater level of awareness in order to understand them and use them as tools. Movies and film are more complex than print, as is the web. Games are more complex still. Knowing how to use Dreamweaver or FrontPage to make web pages (or even being able to write your own html) is not the same as understanding how pages are transmitted, stored, or displayed. Designing something using a technology or medium you don't really understand - be it instruction or anything else - often results something that is somehow shallow. It's a misuse of the resources, like driving a tank to go grocery shopping. Now that's not to say that posting a paper on the web is wrong, it's just that it should be seen for what it is - a convenient way to make that paper accessible - it doesn't make the paper into web technology.

As another example, clothing designers need to understand fashion, but they also need to understand colour, textures, patterns, the fibres and fabrics they work with, and the bodies that wear their clothes - right down to the structure and movement of the muscles and bones. Instructional designers need to understand their delivery medium too - whether it be the web, or film, or print, music, or digital games. What is not yet clear is which specific parts they really need to understand, and which parts they don't. What *is* clear is that a knowledge of a medium's potentials and limitations is essential if one is to take full advantage of it, and when it comes to games, if one is not prepared to take full advantage of the medium then it is probably easier, cheaper, and faster to use a different medium.

How grand to be able to devise a clean, structured ID methodology for designing good educational games. Unfortunately (or fortunately, depending upon your POV) there are lessons to be learned from the field of Software Engineering (SENG) that apply here. This is a discipline that has devoted itself to the pursuit of finding what could be deemed 'recipes' for software design that do not depend on skilled or talented personnel for their success. Put another way, SENG has been trying to formally specify "good" software design for 30 years - the dream seems to be that if we can only specify everything (requirements, metrics, interfaces, documentation, etc.) well enough, we will be able to hire **anyone** to produce sound software, and the specifications and tools will compensate for human lack of skill and talent. Put

another way., SENG has as its prime directive to validate Edsger Dijkstra's definition: "Software Engineering is programming for those who cannot." Sadly, after 30+ years of trying, we still have no real evidence that our efforts are actually producing better software. Although software design in general is key to the development of games, the field of software engineering may not be the best place to turn to inform educational games design.

Similarly, while much can be learned from past developments and experience in instructional design, games are distinct as a medium, and no existing ID theory or model is likely to help developers consistently produce good educational games in spite of the fact that we might wish otherwise. Just because a model like Gagne's Nine Events of Instruction was thought by some to be a perfect fit when multimedia was in its infancy [1] does not imply that it will also be a good fit for serious games. The evolution from HyperCard to modern computer games is not a linear one.

7. CONCLUSIONS

The fact remains: digital games are software. To design good games we need to be able to design and produce good software. True, digital games are more than software - but they are not less than software. We also need to be able to design and produce good instruction. So, our goal is to design good instructional games, when we still don't have a nice recipe for how to design good software, or good instruction, or good games. Tall order.

There are people now who are designing and building instructional games that look like they will be pretty cool. Right now, most of the promising educational games are being designed by people with considerable experience, in software and/or games design, in education or some combination. We can't always require that we have developers with decades of experience upon which to draw. We can't teach new people how to build instructional games by telling them to go away and acquire 20+ years of experience - that seems a little rude. SO, we have to figure out how to teach people how to do this.

Not only do we need to teach people how to do these things, we ultimately also need to figure out how to teach people to teach people how to do these things.

The design of educational or instructional games requires knowledge of both instructional design, and games design. There is a need to understand the technology well enough to know not only its limitations and possibilities, but also the ramifications of various choices.

8. REFERENCES

1. Gunter, G., R. Kenny, and E. Vick. *A Case for Formal Design Paradigm for Serious Games*. in *CODE - Human Systems; Digital Bodies*. 2006. Miami University, Oxford, Ohio: The International Digital Media and Arts Association and the Miami University Center for Interactive Media Studies
2. Prensky, M., *Don't Bother Me Mom I'm Learning!* 2006: Continuum 350 pages.
3. Carolipio, R., *Playing with purpose: Video games are tackling serious issues like never before*, in *San Bernardino County Sun* 2006: San Bernardino CA
4. Shaffer, D.W., et al., *Video games and the future of learning*. 2004, University of Wisconsin-Madison, Academic Advanced Distributed Learning Co-Laboratory.
5. Gee, J.P., *Learning by Design: Good Video Games as Learning Machines*. E-Learning, 2005. 2(1).
6. Dickey, M.D., *Development - Engaging By Design: How Engagement Strategies in Popular Computer and Video Games Can Inform Instructional Design*. Educational technology research and development : ETR & D, 2005. 53(2): p. 67 (17 pages).
7. Crosbie, W. *Instructional Design does not equal Game Design - Lessons learned in delivering a course in game design and education*. in *World Conference on Educational Multimedia, Hypermedia and Telecommunications 2005*. 2005. Chesapeake, VA: AACE.
8. Papert, S., *Does Easy Do It? Children, Games, and Learning*. Game Developers Magazine, 1998(Game Developer magazine, "" section, page 88.): p. 88.
9. Alessi, S.M. and S.R. Trollip, *Multimedia for learning : methods and development*. 3rd ed. 2001, Boston: Allyn and Bacon. xi, 580.
10. Ito, M.A.U.o.S.C.U.S.A., *Engineering Play: Children's software and the cultural politics of edutainment*. Discourse 27, no. 2, 2006.
11. Grundy, S., *A Computer Adventure as a Worthwhile Educational Experience*. Interchange, 1991. 22(4): p. 41-55.
12. Egenfeldt-Nielsen, S., *Beyond Edutainment: Exploring the Educational Potentia of Computer*

- Games. 2005, IT University Copenhagen: Copenhagen. p. 280.
13. Okan, Z., *Edutainment: Is Learning at Risk?* British Journal of Educational Technology, 2003. **34**(3): p. 255-64.
 14. Sawyer, B., *Serious Games: Improving Public Policy through Game-based Learning and Simulation*, in *Foresight and Governance Project*. 2002, Woodrow Wilson International Center for Scholars.
 15. Randel, J.M., et al., *The Effectiveness of Games for Educational Purposes: A Review of Recent Research*. Simulation & Gaming, 1992. **23**(3): p. 261-76.
 16. Gredler, M.E., *Games and Simulations and Their Relationships to Learning*, in *Handbook of research on educational communications and technology*, D.H. Jonassen, Editor. 2004, Association for Educational Communications and Technology., Lawrence Erlbaum: Mahwah, N.J.
 17. Becker, K., *Pedagogy in Commercial Video Games*, in *Games and Simulations in Online Learning: Research and Development Frameworks*, D. Gibson, C. Aldrich, and M. Prensky, Editors. 2006, dea Group Inc.
 18. ESA. *Essential Facts About the Computer and Video Game Industry: 2006 Sales, Demographics, and Usage*. [pdf file] 2006 [cited 2005 Jun 25 2006]; latest data on Video game industry]. Available from: <http://www.theesa.com/archives/files/Essential%20Facts%202006.pdf>.
 19. Yi, M., *THEY GOT GAME Stacks of new releases for hungry video game enthusiasts mean it's boom time for an industry now even bigger than Hollywood*, in *San Francisco Chronicle*. 2004: San Francisco.
 20. Castronova, E., et al. *Virtual World Economy: It's Namibia, Basically*. 2004 [cited Jan 20 2005]; Available from: http://terranova.blogs.com/terra_nova/2004/08/virtual_world_e.html.
 21. Koster, R., *Theory of Fun for Game Design*. 2004, Scottsdale, AZ: Paraglyph Press. 250.
 22. Peters, R.S., *Criteria of Education*, in *Ethics and Education*. 1966, Allen and Unwin.
 23. Caillois, R., *Man, play, and games*. 1961, [New York]: Free Press of Glencoe. 208 p.
 24. Huizinga, J., *Homo Ludens: a study of the play element in culture*. 1950, New York: Roy Publishers. 220 p.
 25. Reigeluth, C.M., *Instructional-design theories and models : vol. 2, a new paradigm of instructional theory*. 1999, Mahwah, N.J.: Lawrence Erlbaum Associates. x, 715.
 26. Becker, K., *Classifying Learning Objectives in Commercial Video Games*, in *Summer 2006 Institute - Linking Research to Professional Practice*. 2006: University of Calgary, Calgary, Alberta.
 27. Crawford, C., *Chris Crawford on game design*. 2003, Indianapolis, Ind.: New Riders. xi, 476.
 28. Gagné, R.M., L.J. Briggs, and W.W. Wager, *Principles of instructional design*. 4th ed. 1992, Fort Worth, Tex.: Harcourt Brace Jovanovich College Publishers. xiii, 365.
 29. Malone, T.W. and M.R. Lepper, *Making learning fun: A taxonomy of intrinsic motivations for learning*, in *Aptitude, learning and instruction. Volume 3: Cognitive and affective process analysis.*, R.E. Snow and M.J. Farr, Editors. 1987, Lawrence Erlbaum Associates, Inc.: Hillsdale, NJ. p. 223-253.
 30. Evans, D., *Smash the Windows: To be truly free in the 21st century, we have to ignore the flashy graphics and really get inside our computers*, in *The Guardian Unlimited*. 2003: UK.
 31. Gee, J.P., *What video games have to teach us about learning and literacy*. 1st ed. 2003, New York: Palgrave Macmillan. 225 p.