

Classifying Learning Objectives in Commercial Video Games

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Table of Contents

Abstract
Introduction
Teaching, Learning, Education, and Aims
Digital Games for Teaching and Learning
Locating and Identifying Learning 'Objectives' in Commercial Games
Next Steps
References

Abstract

An important step towards gaining an understanding of how a particular medium can be used most effectively in education is to study its outstanding examples, regardless of their original purpose. It is assumed that "good" games already embody sound pedagogy in their designs even if that incorporation was not deliberate (Becker, 2006). The work described here will examine commercially and critically successful video games as though they had been designed as learning objects. Through this perspective, it is possible to identify and classify built-in learning objectives and from there to associate the mechanisms and strategies employed to teach them. A significant outcome of this work will be to describe how the existing strategies used to promote "learning objectives" in commercial video games can be used in the design of educational games. An additional outcome will be a synthesis of the core requirements for instructional design of digital games for learning.

Introduction

The Current Generation is Different

Modern education continues to be condemned for not meeting the needs of our young people. Things keep getting worse, we say. At the same time, we complain about the shortcomings of the kids themselves. Kids today don't know how to pay attention (so we give them drugs like Ritalin). Kids have an apparent incessant need for "instant gratification". Kids don't know how to talk or write anymore. The complaints go on.

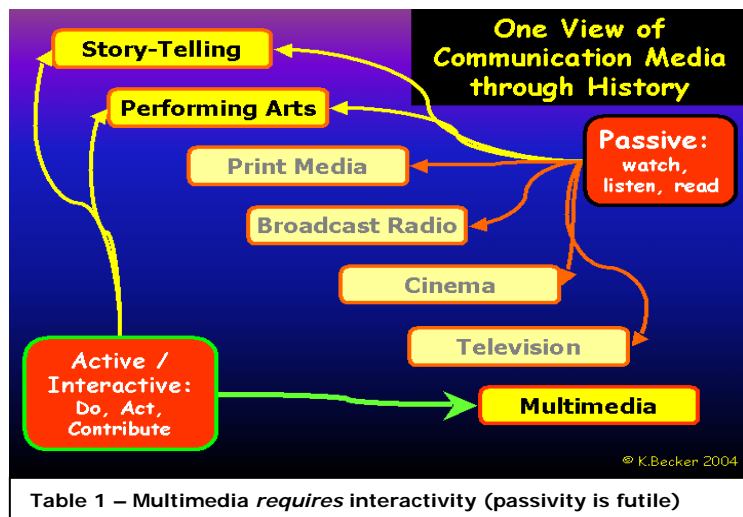
How much of this is true remains to be determined, but apart from the age-old complaints¹ that the younger generation does not appreciate the ways of the older one, there do seem to be some measurable and significant differences in the way today's young people work and learn. Even though we have learned a great deal about how people learn and effective ways to teach them, we still seem to be

loosing ground, at least with respect to formal instruction. There seems to be a mismatch between the educational system and the people it seeks to educate.

One possible explanation for this apparent disconnect between formal education and the target of our attention is that kids really *are* different from previous generations, although perhaps not quite in the ways we complain about (Beck & Wade, 2004; Prensky, 2001b, 2001c). If true, a failure to acknowledge and understand these differences could result in a greater and greater divergence between how we teach and how the learners learn (Norman, 2001, 2002; Papert, 1998). Perhaps more than at any time since the development of the factory model for learning, a gulf is developing between the institutions of learning and the learners themselves. It's not surprising that more and more kids complain that school is a waste of time. For many of them, much of it actually *is*. The world that the kids have been born into and must eventually inherit is a very different one requiring very different skills for success than the world their parents were born into, or their grandparents before them. Some aspects remain relatively unchanged – it seems kids have *always* complained that school was boring or irrelevant. In and of themselves, knowing how to cope with boredom and do things one doesn't like are useful things to know, and it doesn't look like the world is changing enough to eliminate the need for these skills. Other aspects have changed significantly, and the ramifications of these changes have by and large not been accounted for in formal education. Perhaps three of the most significant differences are:

- 1) These kids have grown up with access to what seems like the entire world's knowledge through the internet²;
- 2) They have the ability to communicate with anyone and everyone³ with access to that internet regardless of age, station, or economic status;
- 3) The primary leisure time activity for young people in the developed world has become video game playing. In fact, the video game industry has now surpassed the movie industry in some measures, and some television executives are now admitting that video games are also affecting television viewership. (Pethokoukis, 2002; Reynolds, 2004; Yi, 2004) While parallels can

and should be made between video games and other forms of media, including web-based applications, literature, film, and theatre, it must be recognized that *Video games are different*. Multimedia and games are interactive in a way not seen since before books became the dominant (learning and) communication medium (see Figure 1), and in a way that sets them apart from all other forms of media.



According to a recent study (Beck & Wade, 2004), these 'kids', who now comprise a cohort larger in number than the entire baby boomer population, are indeed different in some very promising ways. This new cohort, called 'Gamers' by Beck and Wade, include those born after 1969. One of the things they share is that all grew up with computer and video games as an integral part of their culture – even if they didn't play. The presence of these gamers is beginning to be felt in the corporate world, and although they also form a significant force in education, their influence has thus far been small there. It is not yet known why that is.

Play and Learning

You must train the children to their studies in a playful manner, and without any air of constraint, with the further object of discerning more readily the natural bent of their respective characters.

- Plato

As a society, we willingly acknowledge the value of games and play elsewhere among our social interactions: very young children play and it's often acknowledged as learning. Sports of all kinds have long enjoyed a special status, so much so that top athletes are viewed as role models in many western societies. Young animals of almost every mammalian species ⁴ play as well. It is thought that this is one way that animals have of practicing and perfecting the behaviours they will need as adults. A measure of intelligence in animals is how long and how much they continue to play as they mature: more play = more intelligence. Throughout history, play has been an integral part of our entire culture (Huizinga, 1950).

So where does one draw the line? At some point it seems, we are expected to stop all this nonsense and get down to work. Caillois (1961) claims that a game one is made to play stops being a game, Huizinga suggests that play and seriousness are opposites, and yet the qualities described by gamers to be the most desirable are what Csikszentmihalyi (1991) calls "optimal experience", or flow. In most of western civilization, play is to be kept apart from work – somewhere between the elementary school and high school, learning and play become disassociated. Learning becomes serious work, and play comes to be seen as frivolous. Much of the current generation (those 'in charge' – the baby boomers) has espoused this philosophy. In fact we have segregated play and work so well that we now require expensive retreats & corporate gurus to teach adults how to play because we seem to have forgotten. When did we forget how to play? When did we relegate play to a place apart from 'real life'? It seems to me people once kept time for play as an integral part of day to day life – that's part of the reason for all the celebrations (Sutton-Smith, 1997). Play is dismissed as frivolous, and yet, play seems to be an essential element in problem solving.

Overall, play or paratelic thinking creates a means for adapting to one's environment by providing self-confidence, new ideas, and relief from stress, and by reinforcing social relationships.

- *play provides both adults and children with experiences on which to build later learning;*

- *play promotes flexibility and possibly creativity in problem solving, which may or may not lead to more successful problem solving; and*
- *play can relieve factors that inhibit learning, such as stress. (Diamond)*

Lest it be thought that the 'kids' we are talking about are young children unable to influence our culture or economy, note that in 2006, the average age of a gamer is 33, while the industry expects approximately seven billion dollars in sales. Gamers are no longer children, and the games industry is a significant one. Seven of the top ten (by units sold) video games of the year were rated 'E' for everyone (five of those were sports titles), while the other three were rated 'T' for teen. In computer game sales, nine of the top ten were rated 'teen', and the tenth was rated 'E', but four of those were from the SIMs franchise. It would seem that there is something about these games that people find engaging besides the lure of violence claimed by some to be the main purpose of video games (Minton, 2006). In much the same way that mass-produced books, film, and television made their way into our culture as mass media, digital games have too. Just as the other forms of media have been used for education to greater and lesser effect, digital games are once again entering the area of educational technology (Harris, 2006).

In the 1980's, with the rise of computer aided instruction, "edutainment" became fashionable, but it has never achieved the recognition or respect of other forms or uses of digital media (such as "e-learning"), with good reason. Very little that was produced evolved beyond a drill-and-practice approach, and most of it amounted to little more than *e-workbooks*. The situation eventually became extreme enough that to this day, even hinting that a game might be educational causes game publishers to run the other way. One of the few games that has managed to survive in spite of being labeled as educational is coincidentally the best selling computer game franchise of all time, namely, Will Wright's [The SIMs](#)⁵ (Wright, 2000).

In recent years, there has been a renewed interest in the use of computer games to teach, in part because the runaway popularity of the video game industry is causing people to want to understand what makes this medium so popular. As a result, researchers are beginning to recognize the substantial learning that *already happens* in computer games (Aldrich, 2004; Beck & Wade, 2004; Gee, 2003; Prensky, 2001a). Games *already teach*, but in order to realize the potential of games as a learning device, we need guidelines and more information about *how* games teach, *what* they teach, how people learn through games, and how to design games as learning tools. Up until about 2003, professional educators, and especially academics from Education have played a very small role in this research. I don't think we, as educators and instructional designers should just let the application of this new medium to education evolve unattended. The creation of games for learning is gaining momentum, and it's going to happen with us or without us. Games developers, many military organizations⁶, and the corporate sector are already developing games for learning. We, as educators, could help it along. This author's goal is to find a way to bridge the diverse design approaches of games and instruction so we can do just that.

Teaching, Learning, Education, and Aims

"We cannot define anything precisely! If we attempt to, we get into that paralysis of thought that comes to philosophers, who sit opposite each other, one saying to the other, 'You don't know what you are talking about!' The second one says 'What do you mean by know? What do you mean by talking? What do you mean by you?', and so on."

Richard Feynman (Feynman *et al.*, 1963)

Although it is not the intent of this paper to provide the definitive treatise on aspects of educational theory, it is nonetheless necessary to define the domains of various terms that tend to be used in different ways at various times. For example, though many distinguish quite clearly between *education* and *instruction*, the field of Instructional Technology is somewhat unclear – at one point implying that the terms Instructional Technology and Educational Technology are interchangeable, and at another point claiming that *instruction* is a subset of *education*, and so Instructional Technology is also a subset of Educational Technology (Seels & Richey, 1994).

There exist many definitions of *education*, from William James' "Education is the organization of acquired habits of conduct and tendencies to behavior." (1915, p15, Dover Edition 2001) through the current Wikipedia definition that "Education formally is a [social science](#) that [encompasses teaching](#) and [learning](#) specific [knowledge](#), [beliefs](#), and [skills](#)." (Wikipedia, 2006) with many more variations besides. There is no single, all encompassing definition for education. This leaves us with an obligation to describe our context each time we wish to use the term. For the purposes of the following discussion 'Education' is being used in a fairly narrow and formal sense, involving the deliberate facilitation of learning. Further, R.S. Peters, in *Criteria of Education* (1966, p 25) states that it is impossible to consider education without implying some worthwhile and desirable change in the person being educated. Education is value-laden. This distinction will come into play later in this paper.

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, but need not result in any change, although in order to be deemed successful, it usually does. Education implies deliberate facilitation of valued learning which occurs over and above what is natural, and implies some persuasion (possibly even coercion) that is enacted on the recipient of this education. Now this is not meant to imply any negative connotations necessarily, as many individuals willingly accept and embrace many forms of education. This description is meant to distinguish between *learning* as a

naturally occurring phenomenon and can be done to oneself, and *education*, which is deliberate, and usually done to others.

Thus, learning may be a desirable result of education, but education is not necessary for learning to occur. Where do *instruction* and *teaching* fit in? At universities, where instructors are routinely referred to as teachers as well, teaching and instruction are terms that are often used interchangeably, yet there are some that would claim they are in fact mutually exclusive (Fernández-Armesto, 2006). The implication is that instruction is more structured, teacher-centered and directed, and more closely related to training than is teaching. Teaching includes facilitation of learning through constructivism, inquiry-based methods, and so on. Both imply some attempt to bestow something deemed to be of value to society onto another.

If the intent is to educate some individual, group, or many groups, then it seems fairly clear that one would also have some ultimate goal in mind – some deliberate aim. In other words, there must be some main objective, some way in which the learners are expected or intended to be changed after the education is complete. At the highest level, this is what educational objectives are about, when defined broadly. However, as with the terminology introduced in the previous section, some further delineation is in order here too. The terms: aim, goal, objective, and outcome are often used interchangeably. However, aims, goals and objectives are external and have to do with intent. They sometimes differ only in scope with aims being broadly defined; goals are more singular and objectives emphasizing specific characteristics or features. They are typically framed in terms of what the educator is trying to achieve, while outcomes are described with respect to the educatee, or learner.

Games for Teaching and Learning

Anyone who makes a distinction between games and learning doesn't know the first thing about either.

- Marshall McLuhan

That people learn from games is no longer in dispute (Egenfeldt-Nielsen, 2005; Prensky, 2006; Squire, 2003) even if what the players learn is not currently valued by society. However, though people do in fact learn from games, according to the preceding definitions, entertainment games are generally not educational. Yet there is increasing interest in the use of this medium as an educational technology and it would seem that the fundamental structure of at least some kinds of games are believed to lend themselves to use in this fashion. It has even been suggested that 'good' games already embody sound pedagogy in their designs despite the knowledge that that incorporation was not deliberate (Becker, 2005a, 2005b, 2006; Gee, 2003; Prensky, 2006). In order to take advantage of those aspects of "good" games that are conducive to both high engagement and effective learning, these games must be studied.

Games are distinct from all other digital and mass media. They share qualities with many other forms, but also have other qualities that set them apart

(Egenfeldt-Nielsen, 2004). While most, if not all of the qualities that make a computer game “good” (i.e. popular, engaging, entertaining, etc.) can also be found in other media, there have been few, *if any*, other entities that have captured the attention, time, and money of an entire generation the way games have. Given their popularity, it would seem reasonable to conclude that there is some *thing* or combination of things that make this medium distinct. In his seminal work on “intrinsic motivation”, Thomas Malone names four essential characteristics of good games: control, challenge, fantasy, and curiosity. (Malone, 1980a, 1980b, 1981)

If games are distinct from other forms of media, then instructional design (ID) for games is also distinct from ID for other media. The central thesis of this work is that ID for games must come **out of** games design, rather than being imposed on top of it. And the synthesis of such an approach must come from a combination of understandings of how to design games as well as how to design instruction. This was not the case with “edutainment”, and some feel this is part of the reason why, in the words of the kids who have it inflicted upon them, most edutainment “blows”. People designing the games often just don't get that the learning must be integral to the game itself, not an add-on or plug-in. That means that the instructional objectives must be woven into the game *design*, not just the game application. Without a thorough understanding of programming and software design, it is not possible to see the possibilities and limitations of gaming, and without an understanding of learning theories, their application, and instructional design theories, it is not possible to design a game that will deliver on its instructional objectives while retaining that which makes it a good game. There need to be people on an instructional games development team that know both, and if these are different people, they must be able to communicate effectively with one another.

The challenge of integrating learning objectives with the delivery medium is far from new. In some instances, this is easier than others. For example, when designing worksheets for drill and practice, it is common to create a visually pleasing background connected with the current theme. In the work the author does with the “Ducks in the Classroom⁷” project, vocabulary and word games are created on a pleasing background – possibly a nest, words enclosed in images of eggs, duck footprints, etc. This idea of ‘decorating’ a worksheet works well for a great many themes, and can be applied quite effectively and generically. Need a worksheet related to Louis XIV? Add some pictures, maybe a few quotes, and if skillfully done, we have added value, fun, even connections for the learners to capitalize upon. The same principle often works reasonably well for instruction delivered via a website – so long as the website is primarily organized as ‘print transferred online’. Taking online delivery a step further, the principle *still* largely holds, even when there are various interactive elements on the website or CD. The [Hatching Project Candling Tutorial](#)⁸ is a case in point. It includes many images, video, and self-tests, and it has received many positive reviews from all over the world, but aside from the non-linear interconnections, it is still many orders of magnitude less complex than a computer game.

Unfortunately, when applied to fully interactive media (specifically games), what the author the 'decorative media principle' does not translate well. The result is often a game that is little more than a wrapper for the instructional materials. Rather than incur the wrath of well-meaning, but misguided edutainment developers by giving specific examples, a purely hypothetical description will be offered here⁹. The game starts off as many typical commercial games do, with cool images and some sort of backstory - you are the world's last hope, and must use your superhuman powers to save mankind, and some sort of quest or challenge that must be overcome - defeat the enemy, or recover the lost treasure. But then, when the gameplay reaches a crucial moment, a new screen pops up showing what any child over 6 can identify as an "exercise", and the world-saving task to be accomplished turns out to be solving a quadratic equation. The answer to this equation, for some thinly justified reason, is the key. Even though the resultant number has no connection to the rest of the story, it is some kind of magic number that defeats the enemy. Even worse, this 'embedded worksheet' looks nothing like the rest of the game – in fact, it looks very much like the paper worksheet that was used in the same class the year before. This is what has become synonymous with 'edutainment'.

To be fair, there are some wonderful examples of fun games that employ this principle effectively – to remain with the hatching theme, examine the kewlbox.com game called "[Fowl Words](#)"¹⁰. This game is little more than an interactive worksheet, but the artwork, sounds, and design make it a great deal of fun. Part of what makes this particular game work is that it does not pretend to be more than the simple puzzle it is.



Figure 2 Fowl Words Game

There are other multimedia applications that are also highly complex, such as the software support for Computer Supported Cooperative Learning, and the design of such systems are also challenging. The design of one such installation is described by Carl Bereiter (2002). It is an example of a highly complex set of interactive tools, that are, nevertheless still tools. The role of the technology in this case is to *support* learning activities, whereas the role of the technology in the case of games is to *be* the learning activity. If games for learning are to be taken seriously, they must be design to work *both* as games *and* as learning 'objects'. The synergy must be complete.

Locating and Identifying Learning 'Objectives' in Commercial Games

I have learned throughout my life as a composer chiefly through my mistakes and pursuits of false assumptions, not by my exposure to founts of wisdom and knowledge.

Igor Stravinsky

An important step towards gaining an understanding of how a particular medium can be used most effectively in education is to study its outstanding examples, regardless of their original purpose. The work described here will examine commercially and critically successful video games as though they had been intentionally designed for learning. Through this perspective, it is possible to identify and classify inherent learning elements and from there to associate the mechanisms and strategies that are employed to facilitate that learning. The ultimate outcome of this work will be to describe how the existing strategies used to promote learning in commercial video games can also be used in the design of digital games for education.

The question of whether and what kind of education is embodied in games is one that will not be addressed here. Analyzing the entertainment game *as though it were* an educational one requires a dissociation of what is learned in the game from how society values that which is learned. Doing so creates a common plane on which games and other educational media can be assessed and analyzed. This is where the distinctions presented in the early part of this paper become crucial. It is recognized that education implies some societally desirable change, and that evidence of achievement of the associated goals and objectives are necessary for something to be properly called education. However, the viewpoints made available to us through this perspective afford opportunities in analysis not open to us if we simply view entertainment games as frivolous and without merit.

The effectiveness of digital games as a medium for learning is an important issue, but one that will also not be addressed directly in this study. However, the mere fact that the chosen games are considered 'good' according to the criteria laid out would imply that they must be successful as entertainment. A game would not receive both critical acclaim and commercial success if it did not provide the right amounts of challenge, curiosity, control, and fantasy to satisfy a substantial demographic. While many gamers will claim that winning the game is not as important as the experience of playing through, it is still necessary for players to feel they are making progress in order to remain engaged. That progress must be recognizable and supported within the game by elements inherent to that game, so in this way, it is possible to make the case that *good* games are effective in supporting players so they can meet the *game* objectives, even if those objectives are not recognized as educational or even learning objectives. They are, at the very least achievement objectives.

The core of the work involves a detailed examination of five to ten commercial digital games deemed to be 'good' according to various criteria. Games will be chosen based on a combination of points assigned through ratings by game reviewers, game designers, and commercial sales. Some kinds of games are excluded. No "M" rated games (M = Mature), such as *Grand Theft Auto* or *Halo* will appear among the possible candidates, for several reasons. Games are typically rated "M" because of violence or sexual content, and since these topics rarely enter into the curricula of either K-12 or higher education, they will be avoided. An additional reason is that there are enough other games to choose from without these. Sports games such as *EA's NFL Football* are also excluded from the list as it

is too hard to separate the popularity of any given title is attributed to the game elements vs. its popularity due to the fact that the sport portrayed is itself very popular. Games are to be chosen from among those that deal with things most people have not encountered in their regular lives. Further, no multi-player / MMO (massively multiplayer online) games like *World of Warcraft* or *Lineage* will be considered either, as it increases the level of complexity dramatically when dealing with things like player versus player (PvP) modes. In PvP modes of play, it is difficult to separate learning elements afforded by the game from those facilitated by other players, and combinations thereof.

Finally, also excluded are those games that are "played" primarily in what is called 'sandbox' mode such as the *SIMs* franchise. In other words, games whose primary mode of interaction is exploratory and who lack clear objectives for winning will not be considered in this study. Since it is assumed that games designed expressly for learning or educational purposes are almost certainly going to have some dominant aims or primary objectives, only games with clearly identifiable end states or winning conditions will be accepted as candidates.

Because of some of the difficulties with the definitions mentioned at the start, the term "learning objectives" will be avoided initially. Ultimately though, learning objective might actually be an appropriate term. The chosen games will be examined, and learning elements will be identified and classified along with the procedures employed to support this learning. The main methodology is one that is grounded more in engineering and computer science than educational research, as it involves no human subjects and does not seek to study an instructional intervention or its effects.

The approach to be taken for the study is a kind of reverse engineering which will look at the finished product, to try and identify how it is put together. Reverse engineering examines a finished product in order to recapture the original specifications. In this case however, rather than trying to recapture the actual original design specifications and implementation details, the goal is to 'pretend' that the game is an educational one, and to identify and classify the learning objectives that emerge along with the mechanisms used in the game that facilitate achievement of those objectives.

It is expected that numerous patterns will emerge from this classification that will be useful in the design of games for learning. The kinds of questions to be answered in such a study include, "What do people need to learn in the game in order to get to the end?" and "How are people helped to learn what they need in order to win?" A reverse engineering approach is useful in this context as the original designers of these games would not have framed their designs for an educational domain. The game designers almost certainly have different terminology for this (quests, tasks, missions, etc.) than an instructional designer would so asking the game creators directly won't generate the information in the form needed. For that, it must be viewed through the lens of instructional design, and from that perspective the things that need to be learned in order to win the game could be referred to as the learning objectives. Seen in this way, the game

will appear to implement various strategies to help people achieve these objectives, as well as providing various forms of assessment to determine if the player has succeeded.

Next Steps

The outcome of any serious research can only be to make two questions grow where only one grew before.

Thorstein Veblen (1857-1947) US Social Scientist

The study described in the preceding paragraphs is still in the preliminary stages, but there are several potential outcomes. One possible but unlikely outcome is that no elements will be found in these games that can be described in terms relevant to education. The reason this is unlikely is that games are currently being used for education and training with considerable success. Military educators around the globe as well as corporate trainers and educators have been using games, first traditional and now digital for some time and are convinced of their value (Dill & Doppelt, 1963; Ham IV, 2004).

A more likely, and the expected outcome is that several identifiable categories or levels of learning will come to be identified through this examination. Some possible examples include:

- functional skills needed to work the game controls;
- facts (content), like characters' names;
- main game goal and sub-goals: for each level in the game, for the entire game, and for game genres
- some games will have affective objectives (like: flicking villagers over the cliff is bad because it makes your creature turn evil)

This study will not only identify game elements in the framework of learning objectives, but will hopefully provide further tools for the design and development of games for learning that do not lose their attraction as games, while still delivering on educational objectives. Effective education may involve more than sound instructional design, but it is not less than that. (Crawford, 2004, with apologies to Kurt Guntheroth)

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Notes

¹ "The children now love luxury; they have bad manners, contempt for authority; they show disrespect for elders and love chatter in place of exercise. Children are now tyrants, not the servants of their households. They no longer rise when elders enter the room. They contradict their parents, chatter

before company, gobble up dainties at the table, cross their legs, and tyrannize their teachers.”
ATTRIBUTION: Attributed to SOCRATES by Plato, according to William L. Patty and Louise S. Johnson, Personality and Adjustment, p. 277 (1953).

² No generation before has had to cope with such an abundance of information. While this will not play a major role in my proposed work, it does figure into the picture. The gamers, perhaps more than any generation that came before it, need to develop critical analysis skills in order to sift through the information available to them. The processes that have so far worked reasonably well for establishing credentials and building reputations are no longer adequate, and new approaches must be developed. Part of this process can be observed as it evolves on weblogs and wikis. There are unprecedented opportunities for people to comment on the writings of others – organizations like the New York Times provide forums where readers can discuss articles, while others, such as SlashDot, provide more direct means to add your own comments.

³ Witness the evolution of Wikipedia: <http://en.wikipedia.org/wiki/Wikimedia> and such developments as weblogs (blogs): <http://en.wikipedia.org/wiki/Blog>, and now video blogs like Peter Jackson's: <http://www.kongisking.net/kong2005/proddiary/>

⁴ As well as some birds.

⁵ <http://thesims.ea.com/us/index.html>

⁶ Witness some of the games in production and already in use at the US Department of Defense: <http://www.dodgamecommunity.com/modules.php?op=modload&name=News&file=index&catid=2&to pic=&allstories=1>

⁷ <http://pages.cpsc.ucalgary.ca/~becker/HatchingProgram/index.html>

⁸ <http://pages.cpsc.ucalgary.ca/~becker/HatchingProgram/Candling/Fresh/index.html>

⁹ Any relationship to people, *living or dead*, or to software, *ditto*, is purely coincidental.

¹⁰ <http://www.miniclip.com/fowlwords.htm>