Educators around the world acknowledge the fact that we live in the knowledge society and ability to think systematically is one of the necessary skills in order to function effectively in the 21st century. In the past two decades, popular culture introduced digital games as part of leisure activities for children and adults. Today playing computer games is routine activity for children of all ages. Many have agreed that interactive computer games enhance concentration, promote thinking, increase motivation and encourage socialisation. Educators found their way in introducing game-based learning in science education to entice the students in teaching difficult concepts. Simulation games provide authentic learning experience and virtual world excites the students to learn new phenomena and enlighten their inquisitive mind. This book presents recent studies in game-based learning and reports continuing attempts to use games as new tool in the classroom.
Playful Teaching, Learning Games
CONTEMPORARY APPROACHES TO RESEARCH
IN LEARNING INNOVATIONS

Volume 5

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Rationale:
Learning today is no longer confined to schools and classrooms. Modern information and communication technologies make the learning possible any where, any time. The emerging and evolving technologies are creating a knowledge era, changing the educational landscape, and facilitating the learning innovations. In recent years educators find ways to cultivate curiosity, nurture creativity and engage the mind of the learners by using innovative approaches.

Contemporary Approaches to Research in Learning Innovations explores approaches to research in learning innovations from the learning sciences view. Learning sciences is an interdisciplinary field that draws on multiple theoretical perspectives and research with the goal of advancing knowledge about how people learn. The field includes cognitive science, educational psychology, anthropology, computer and information science and explore pedagogical, technological, sociological and psychological aspects of human learning. Research in this approaches examine the social, organizational and cultural dynamics of learning environments, construct scientific models of cognitive development, and conduct design-based experiments.

Contemporary Approaches to Research in Learning Innovations covers research in developed and developing countries and scalable projects which will benefit everyday learning and universal education. Recent research includes improving social presence and interaction in collaborative learning, using epistemic games to foster new learning, and pedagogy and praxis of ICT integration in school curricula.
Playful Teaching, Learning Games

New Tool for Digital Classrooms

Edited by

Myint Swe Khine
University of Bahrain, Kingdom of Bahrain
DEDICATION

To my parents who gave me life and education
and Elizabeth and Emily who gave me happiness
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This book draws together the research and development work of games in education and training. I would like to extend my gratitude to all contributors to this volume for their hard work and sharing their experience to the readers.

Finally, special thanks go to Michel Lokhorst who oversee the production of this book. To all my good friends, my deepest gratitude.

Myint Swe Khine
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1. THE IMPACT OF VISUAL DESIGN QUALITY ON GAME-BASED LEARNING

INTRODUCTION

Computer games have the potential to provide an engaging and pedagogically-sound alternative to traditional teaching (e.g. Connolly et al, 2007; Ebner & Holzinger, 2007; Akkerman et al, 2009). They can support exploration, interaction and provide an immersive experience in which learners can collaborate with others to solve problems and learn from their mistakes. However, a major limitation on their use is the ability for educators to obtain or create games that meet the desired learning outcomes for a particular context and are appropriate for their learners. Commercial-off-the-shelf (COTS) games have the advantage of being professionally produced but are designed primarily for entertainment – so even if an appropriate game can be found there are still the challenges of steep learning curves, time-consuming play, and expense to overcome before they could be deployed in an educational context. Designing games from scratch requires expertise in game design, graphics and programming and, while games produced in this way may meet their educational objectives, the limited time, know-how and budgets available mean that the look-and-feel of the game is less likely to be professionally executed than a commercial game.

An understanding of the importance of this visual design quality, on the acceptability of computer games for educational use and the learning that takes place during play, can help to determine game development priorities and the feasibility of different production options. This chapter explores the ways in which visual design influences or limits the use of games for learning and provides an overview of the ways in which visual design quality can affect the use of different types of games. Factors that may contribute to a player’s perception of visual design quality are also considered in relation to both entertainment and educational games.

There is a general lack of academic research into the visual design of games and how this influences player perceptions, therefore some of the arguments presented in this chapter cite material from other sources such as articles for online game-developer journals and market research material. Drawing on less formal research has a number of advantages. First, much of this material is up-to-date and refers to current tools and techniques used in commercial game development, which is important in such a quickly moving industry. Secondly, many of the articles were written by those actively involved in developing games for the commercial entertainment market and can offer unique insights – which are perhaps missing in more academic work.
The term ‘visual design’ does not have a universally-agreed meaning, but is used in a wide variety of ways, often dependent on the field or area of use. Designers working in the discipline of graphic design often use the term to describe the balance between textual information and visual elements, such as photographs, diagrams and illustrations, where each contributes to the overall ability of the finished work to communicate and inform in an efficient and visually engaging manner. Shedroff (2001) defines visual design as:

“… the field of developing visual materials to create an experience. Visual Design spans the fields of Graphic Design, Illustration, Typography, Layout, Color Theory, Iconography, Signage, Photography, etc. and any medium, including online, broadcast, print, outdoor, etc. Visual Design is concerned with the elements of visual expression and style”.

(Shedroff, 2001)

The all-encompassing nature of Shedroff’s definition, which spans the range of design disciplines, visual elements and presentation media, is suitably open for the purposes of this chapter and allows the authors to draw on relevant literature from a wide range of sources where applicable. An inclusive definition of visual design is used throughout this chapter that encompasses interface design, graphic design, and aesthetic design in relation to computer games.

Interface design is concerned with the way in which the gaming environment is structured and presented to the player and the ways in which the users interact with the game space. It focuses on the player’s experience and includes aspects such as the design of the graphical user interface, interaction methods, information flow and other issues that affect the overall usability of the game. Krieger (2001) suggests that “a tightly crafted game not only has to be fun, engaging, and aesthetically pleasing – but it also has to be supremely flexible and easy to learn”. He also reflects that poor interface design can lead to player frustration, affect whether a game is played or not and ultimately influence future purchases. Desurvire and colleagues (2004) note that, although similar in some respects, the goals of software interface designers may be at odds with design strategies used by game developers.

The term graphic design was coined in the early 20th century and was originally strongly linked to typography and static printed media, although it now includes many other forms of visual information. Graphic designers are routinely employed in all sectors of entertainment industry including film, television, web, multimedia and games development. Graphic design describes the ways in which the visual elements within the game are used to communicate messages, either consciously or sub-consciously. Graphics can be used to communicate in a variety of different ways, including being used purely for decoration, to represent a concept or image, as a mnemonic device, to show the organisation of information (e.g. an organisational diagram), to show relationships between concepts (e.g. a mind map), to depict transformations and show changes in state (e.g. a diagram depicting the nitrogen cycle), and to provide interpretations of information (Clark and Lyons, 2004).

The term aesthetic design is used to describe look-and-feel, and considers the stylistic choices made by the designer. Schell (2008) highlights the value of aesthetics
in game design, saying that good artwork can draw the player into a game, make it feel “solid, real and magnificent” (p. 347), create aesthetic pleasure and make players more likely to ignore imperfections in game design. While aesthetic design is, perhaps to a greater extent than graphic and interface design, subjective, the importance of aesthetics to game design cannot be underestimated. Commercial games companies invest significant time, resources and money – employing staff to manage the overall aesthetic of their games and who can create products with an appropriate visual appeal that are desirable to their target audience. These games are almost always team efforts with staff often specialising in technical or artistic aspects of the game. Large games development teams often employ a Lead Artist or Art Director who:

“…manages production of all the visual assets in the game: models, textures, sprites, animations, user interface elements and so on. The art director also plays a major role in creating and enforcing the visual style of the game”

(Adams, 2009, p. 53–54)

The substantial sums that large commercial games companies invest in employing creative staff suggests that the games aesthetics are seen as an integral part of the design and marketing process. Aesthetic design can often play a significant role in a product’s commercial success (Bloch, 1995) and it can be assumed that the aesthetics of computer games, like those of many other products, are intended appeal to players’ emotions, enhancing the desirability of a particular game and thereby influencing whether it is purchased or played.

It can be speculated that commercial game manufacturers use high quality visuals to differentiate titles in the crowded games marketplace and to meet perceived market expectations. While this may be true, it is debatable how much of this is strive for visual quality is consumer driven rather than market-led. Hayward (2005) argues the industry has a key part to play in the demand for greater game realism stifling the development of other possible game aesthetics.

“The industry and the market are bewitched by the idea of more pixels and polys. Higher visual quality is fair enough, but why is it equated with better stabs at photo-realism? What’s the point of aesthetics at all?”

(Hayward, 2005.)

Although Hayward (2005) bemoans the games industry’s fixation with realism he usefully maps out the range of game aesthetics available and gives examples of successful games that use different styles such as the abstract (e.g. Tetris), iconographic (e.g. Kingdom of Loathing) and those that attempt a degree of photo-realism (e.g. Project Offset).

Aesthetic design has long been a key part of the development of many mainstream commercial IT products, especially those aimed at entertainment, and may be important for meeting players expectations for leisure gaming but there is not enough evidence to know how important it is in terms of either the acceptability of educational games or its effect on learning.

There is considerable overlap between the constituents of visual design described in the preceding paragraphs, and each will inevitably influence the others, but large
amounts of time on semantic discussion will not be spent here. This chapter uses an open definition of visual design but it is explicitly not looking at subject areas such as the game design itself or the playability of the game mechanic (although it is acknowledged that, again, there may be some overlap). In this instance the emphasis is specifically on the ways in which the visual design of a game can influence the potential of computer games for learning.

Computer games can be an effective way of motivating and engaging learners (Virvou & Katsionis, 2008) but it is essential that the game design (or design of associated activities) is closely mapped onto the desired learning outcomes (Whitton, 2010). For educators, obtaining an appropriate game for a given situation, which not only matches the learning needs but is also pitched at the correct academic level, can be completed in an appropriate time slot, uses a suitable technology, an has an acceptable cost, and so on, can be difficult at best, but, more probably impossible. Where no commercial game exists, often the only choice available is to develop a new game. With the present levels of funding for educational games, and development models that exist, the amount of resource that can realistically be expended on educational games will never match that of commercial games, and therefore the visual design will never match commercial production values.

However, some learners, particularly those who have played certain types of computer games for many years in their leisure time, may have high expectations when it comes to the visual game experience. First-person shooters and racing games, for example, typically offer a state-of-the-art graphic experience with visuals (as well as sound) being important for creating realistic and immersive game play. Therefore, when exploring the value of commercially-available educational games, considering the implications of visual design – on both the acceptability of the game to learners and the learning from it – is essential. In addition to commercial games and interactive media designed purely for education (often called ‘edutainment’, and often limited in terms of the interactivity on offer (Buckingham & Scanlon, 2003)), there are a variety of other ways in which teachers and educators can create the types of game they require, including the use of developing games in virtual worlds (e.g. Second Life, Active Worlds), using commercial gaming engines (e.g. Unreal), adding game modifications (e.g. Neverwinter Nights), creating games from scratch using games creation or multimedia development software (e.g. Game Maker, Dark Basic, Flash), or adapting commercial off-the-shelf (COTS) games for educational use (e.g. Civilisation, Myst). Each of these options offers a different approach to the creation of graphics from the professional level graphics of the gaming engines to the less sophisticated bespoke games. An awareness of the implications of graphics choice for particular gaming genres is important for educational game designers. While gaming engines, mods or COTS games may be those that produce the highest quality end product, they may also be those that are least appropriate for learning.

The visual design of games can influence how usable, playable and acceptable to various audiences they are, and the visual design of learning materials can support or hinder the learning process (Kirsh, 2005). This does not mean that the visual design of a game is the be-all-and-end-all. There are other factors such as game mechanics and learning design that may be equally – if not more – important. In recent years
there has been a growth in a variety of gaming genres and platforms where sophisticated graphics are not so crucial. For example, the emergence of platforms such as the Nintendo Wii and DS, where the emphasis is on novel forms of interaction rather than visually stunning graphics, and they have been used successfully in educational contexts (Miller & Robertson, 2010). Genres such as alternate and mixed-reality games that take place both online and in the real world have also been used in a variety of contexts (Moseley et al, 2009), and casual games that focus on the ability to engage with play quickly and in chunks have grown steadily in popularity in recent years. Clearly it is possible for games with lower graphics quality to be engaging and appealing, for entertainment and learning, but there is limited research on the suitability of these types of games in an educational context.

This chapter first considers existing research on visual design and learning, and how it might relate to computer games, and then looks at the evidence for the impact of visual design quality on playability. The relevance of genre is next discussed, taking into account the types of game more suited to academic learning and those where visual design quality is most important. The chapter then consider the results of original research that compared learner engagement between two different games – one with a simple visual interface and one that allowed faux-3d exploration and object interaction. Finally, the chapter closes by drawing conclusions on the research evidence presented.

VISUAL DESIGN AND LEARNING

In order to understand the impact of visual design quality on the learning that takes place from computer games, first the literature on visual design and learning has been considered in this section. While much of the literature that is discussed relates to visual design of learning materials on paper, or more recently online, there is much that is still relevant to the design of computer games-based learning and so still considered worthy of discussion here.

Graphics can support learning in a variety of ways, such as drawing attention to key elements, providing links to existing mental models and supporting the creation of new models, simplifying presentation to minimise mental effort, supporting transfer of learning to real life through emulation, and act as a motivational factor (Clark & Lyons, 2004). Visual devices, such as metaphors, help people to transfer learning from one domain to another by taking the characteristics of one domain and applying it to another (Benyon et al, 2005). In terms of online learning, visual design quality can also affect the amount of cognitive effort required to manage the interface and the learning process itself (Kirsh, 2005).

The field of visual design is complex and encompasses many areas, and for many of these there is limited research evidence on their impact of changes in quality on learning. Vanderdonckt (2003) describes a detailed taxonomy for understanding visual design including physical techniques such as balance and symmetry, composition techniques such as simplicity or understatement, association and dissociation techniques such as unity or grouping, ordering techniques such as consistency and predictability, and photographic techniques such as sharpness or roundness. Each of
these elements could be considered in great detail in relation to learning, however, in practice, it is unlikely that changes in single elements alone would have a measurable affect on learning. Much of the research carried out on graphics in education – particularly in relation to computer-based learning – focuses on multimedia and looks at the way in which visual material interacts with other elements (audio, text, animation) and the subsequent combined impact on learning.

Mayer (2001) draws on extensive research on multimedia and learning to present seven principles of multimedia learning. These principles are summarised in Table 1 below.

The first three principles provide support for the idea that visuals enhance learning, which is perhaps unsurprising and, in the context of games, perhaps extraneous as this is already a highly visual medium. Provision of words as well as graphics may enhance learning (and accessibility) but could also affect the flow of a game. The coherence principle is more problematic in this context as, in games, aspects that are gratuitous to the learning outcomes may be essential to the game play and the overall look-and-feel of the game. The modality and redundancy principles support the use of sound in games and also that too much information presented in different formats may actually detract from learning – computer games are very good at providing appropriate information at the time when the player needs it. The individual differences principle highlights that multimedia or games-based learning may suit some learners better than others.

Ayres and Sweller (2005) present the split-attention principle of multimedia, saying that it is important to avoid situations where learners have to split their attentions between, and mentally integrate, disparate sources of information, so that cognitive load is reduced. Good computer games successfully present necessary

<table>
<thead>
<tr>
<th>Principle</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multimedia</td>
<td>Learning is better from words and pictures than from words alone.</td>
</tr>
<tr>
<td>Spatial contiguity</td>
<td>Learning is better when corresponding words and images are closer together.</td>
</tr>
<tr>
<td>Temporal contiguity</td>
<td>Learning is better when corresponding words and images are presented</td>
</tr>
<tr>
<td></td>
<td>simultaneously rather than one after the other.</td>
</tr>
<tr>
<td>Coherence</td>
<td>Learning is better when gratuitous images (and sounds) are removed.</td>
</tr>
<tr>
<td>Modality</td>
<td>Animation and narration is more effective for learning than animation</td>
</tr>
<tr>
<td></td>
<td>and on-screen text.</td>
</tr>
<tr>
<td>Redundancy</td>
<td>Animation and narration is more effective than animation,</td>
</tr>
<tr>
<td></td>
<td>narration and on-screen text.</td>
</tr>
<tr>
<td>Individual</td>
<td>Effects are stronger for low-knowledge and high-spatial learners.</td>
</tr>
<tr>
<td>differences</td>
<td></td>
</tr>
</tbody>
</table>
and sufficient information within the interface, but they may also involve assimilating
information over various screens. While the split-attention principle may have some
relevance in designing learning materials, the reality is that analysing and synthesising
information from a variety of sources is now a key real-world information literacy
skill.

Plass and colleagues (2009) draw on the existing literature as well as original
research to present additional design factors for educationally effective simulations
and animations. They present four additional principles, as summarised in Table 2.

The cueing and colour coding principles provide further evidence of the value
of graphics for highlighting important information – something that is almost taken
as read in games. The representation type principle shows the importance of graphic
icons, but icon design is non-trivial, requires specialist skills and poorly designed
icons can be worse than no icons – it is arguable whether the effort and expense
required to create and test an icon set would be worth the additional learning value.
The integration of multiple dynamic visual representations is an important considera-
tion for games that contain a variety of different elements.

In addition to the learning that takes place when a user is interacting with learning
materials, there is also the issue of perceived acceptability of the materials, and the
initial motivation to use them. Benyon and colleagues (2005) describe five factors
that can affect acceptability: political, convenience, cultural and social habits,
usefulness, and economic. When considering educational games and acceptability,
political factors may influence acceptance by institutions or individual teachers, and
cultural and social habits may influence acceptance of game-based learning by
students. What is acceptable for learning may also differ from what is acceptable
for fun.

This section has provided an overview of the types of research that have been
carried out on graphics and learning, however while there is strong evidence that
graphics do enhance learning, there is limited research as to whether the actual quality
of those graphics makes any difference. However, there is more evidence in terms
of the impact of visual design on the playability of computer games, and this is
examined in the section that follows.

Table 2. Four additional principles of multimedia learning (Plass et al, 2009)

<table>
<thead>
<tr>
<th>Principle</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cueing</td>
<td>Learning is better when graphics are used to highlight important information.</td>
</tr>
<tr>
<td>Representation type</td>
<td>Learning is enhanced when graphical icons are used rather than text to represent information.</td>
</tr>
<tr>
<td>Colour coding</td>
<td>Learning is better when colour is used to highlight key features.</td>
</tr>
<tr>
<td>Integration of multiple dynamic visual representing</td>
<td>Learning is better when visual representations used across multiple simulations are linked to one another.</td>
</tr>
</tbody>
</table>
VISUAL DESIGN AND COMPUTER GAMES

This section provides an overview of the aspects of visual design quality (taking into account interface design, aesthetic design and graphic design, as described in the introduction) that influence playability in entertainment games. An understanding of these factors in the entertainment field, where there is market evidence, helps to increase understanding in the educational games domain. Many of the references in this section come from work from the field of games design and development practice rather than research and so are less rigorously backed up with research evidence and may be biased towards the feelings and experience of individual game designers. However, despite lacking in rigour this type of evidence is often the most up-to-date and relevant to what is really happening in the commercial world.

Visual design quality is also a concept that is not easy to pin down. There are a variety of factors that might affect the perceived or actual quality of a game – for individual players, some factors that might determine quality are highly subjective (e.g. colour choice) while others are based around conventionally accepted aesthetic norms of beauty (e.g. the golden ratio, balance, harmony, order, and symmetry). This section considers the importance of visual design quality in relation two aspects of playability. First there are the factors that influence whether a game can be played (i.e. whether the design affords the types of interactions that will allow successful and enjoyable game play) and second, those elements that influence whether a game will be played (i.e. whether the game will be motivational to its players) and replayed (i.e. whether there is continued engagement with the game over a period of time), and possibly more importantly from the commercial game designers point of view, chosen in preference to other similar games.

The design factors that determine whether a game can be played or not are closely linked to the notion of ease of use and ideas of interface design and usability. Neilson (2003) suggests that usability has five key quality components: how easy the system is to learn (learnability), how quickly tasks can be performed (efficiency), how quickly the interface can be remembered after a period away (memorability), how are errors reduced and recovered from (errors), and how pleasant do people find the system to use (satisfaction). These factors are presented in relation to computer-based applications in general and may differ when applied to games. For example, in games learnability and efficiency may be less important because learning the game and playing the game may be part of the fun, likewise making errors and learning from them could be an integral part of the game playing process, whereas satisfaction may be much more important as an entertainment game is something that is played for its own sake, not to achieve some other task (this may not be true for a learning game). Even though these components were devised to illustrate general desirable usability qualities rather than those specific to games, they are however a useful framework for considering the importance of interface design. It is important, at this point, to differentiate between the usability of the game interface itself (for example legibility of information, affordances between game-control mechanisms and the game itself, ease of navigation) and how easy the game is to play. Game designers purposefully build challenges into game play that toy with the components described above and seem at odds with notions of usability (complex button presses and
sequences of moves that rely on manual dexterity, small margins of error and levels of accuracy required, memorisation of difficult patterns of play).

However, as Oxland (2004) says:

“the player must not, under any circumstances, struggle with the interface. If he does, the game is doomed. The player must feel like he is in control of the game world at all times and the moment your interface becomes unresponsive, he will be pulled out of that world and most likely stop playing. (p. 210)”.

Korhonen and Koivisto (2006) present a set of heuristics for the usability of games. They look specifically at mobile games, so one of their constructs, mobility, is of less value out of that context, but they also describe two other constructs: usability and gameplay. In relation to good practice in visual design, they suggest that it is important to ensure that audio-visual representation supports the game, screen layout is efficient and visually pleasing, status indicators are visible, and navigation is consistent, logical and minimalist. Sánchez and colleagues (2009) present a number of desirable attributes of playability in games that go beyond usability. These are: effectiveness, learnability, satisfaction, immersion, motivation, emotion and socialisation.

The second point under consideration is whether the game will be played and replayed voluntarily (and continue to engage the player) over a period of time, there are a variety of visual design factors that can influence this. There are a vast number of elements that might contribute to visual design quality, but Table 3 below shows some of the key ones.

This list is not intended to be exhaustive, but it is simply provided to show the range of factors that make up a game’s visual design quality. In some instances, the game designer may have little influence over some of these visual design considerations (for example there may not be much choice of dimensionality in a first-person shooter by definition) and others may be limited by cost or technical constraints. Many game genres and their audiences demand different levels of visual quality as an acceptable norm.

### Table 3. Elements of visual design quality

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Style</td>
<td>The overarching visual theme (e.g. photo-realistic, cartoon, abstract).</td>
</tr>
<tr>
<td>Realism</td>
<td>The degree to which the visual design looks like the real world.</td>
</tr>
<tr>
<td>Colour</td>
<td>The choice of palettes and individual colours.</td>
</tr>
<tr>
<td>Perspective</td>
<td>The player’s view on the game world (e.g. first person, third person).</td>
</tr>
<tr>
<td>Dimensionality</td>
<td>Whether the world is viewed in two or three dimensions.</td>
</tr>
<tr>
<td>Fidelity</td>
<td>The reproduction quality.</td>
</tr>
<tr>
<td>Professionalism</td>
<td>Aspects such as attention to detail, appropriateness and design skill.</td>
</tr>
</tbody>
</table>
Egenfeldt-Nielsen and colleagues (2008) argue that visual effects “add to the atmosphere, provide a sense of realism and generally make the world seem alive” (p. 105). Visual design quality can also affect confidence (Ruecker et al, 2007) and users may choose not to play a particular game simply because the look and feel does not appeal to them (Taylor & Baskett, 2009). In relation to educational games, it has been argued that they are perceived as boring because they do not use state-of-the-art visual effects (Bellotti et al, 2009) and that higher visual design quality in education generally is linked to higher perceived credibility (Robins & Holmes, 2008).

Dormans (2008) highlights the importance of realism (or iconic simulation as he calls it) in games and argues that it is not the function for games to be as realistic as real-life but suggests that there are two other forms of simulation that are useful to game designers: indexical and symbolic. Indexical simulation is where there is a relationship between the real world and the item represented but this may be simplified whereas with symbolic simulation the link between the real world and the game environment is “arbitrary and based on convention” (p. 54). Thompson and colleagues (2007) distinguish between different types of realism in games, such as those that model reality (for example in a flight simulator), visual realism including the use of cinematic techniques such as cut scenes, and simulated realism with an emphasis on the real-time game mechanics that aim to mimic reality rather than graphics. They highlight that the expectations of the player are very important. There is also evidence that greater realism will lead to greater immersion and greater sensory appeal will heighten emotion (Sánchez et al, 2009).

The use of colour is also an important consideration in terms of visual design quality. Certain colour palettes are more visually pleasing, appropriate, or evocative than others, there are also implications of designing for accessibility in respect to colour-blindness. Ringuette-Angrignon (2009) argues that because modern video game technologies are bad at lighting, the use of desaturated colours has increased to counter this and heighten a sense of realism.

This section has examined what can be learned from the games industry in terms of visual design and considered how it could be applied to educational games. It is clear that a lot of the importance of visual design in a game is dependent on the type of game it is. The following section examines those games where visual design is most important, and compares them to those most appropriate for learning.

VISUAL DESIGN AND GAME GENRE

The importance of the visual design quality of a computer game is, to some extent, dependent upon the genre into which the game falls. Certain types of game, for example adventure games, rely more on puzzles, narrative and game-play than on graphics, while for others, such as first-person shooters, racing games or sports games, the graphical quality and realism required to create an immersive experience is more important.

Table 4 below provides a rough guide to the relative importance of graphics quality in different game genres. In order to examine the importance of visual design
### Table 4. The relative importance of visual design quality in different game genres

<table>
<thead>
<tr>
<th>Genre</th>
<th>Importance</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adventure</td>
<td>Low/Medium</td>
<td>Adventure games were initially text-only and essentially rely on puzzles and narrative rather than visuals. Higher quality graphical environments allow more emphasis on visual puzzles and greater immersion in the story.</td>
</tr>
<tr>
<td>Platform</td>
<td>Medium/High</td>
<td>Platform games are essentially about manoeuvring a character through different levels. Although there is some emphasis on puzzle-solving, the game play is predominantly visual, although less graphically sophisticated platform games are still popular.</td>
</tr>
<tr>
<td>Role play</td>
<td>Medium/High</td>
<td>Role play games combine narrative and puzzle solving with character development and fighting or action. The use of high quality graphics helps immersion in fantasy worlds and interaction with fantasy characters.</td>
</tr>
<tr>
<td>Shooter</td>
<td>High</td>
<td>First-person shooter games involve the player immersing themselves within a fast-paced virtual environment. Realism and visual design quality is of greater importance.</td>
</tr>
<tr>
<td>Sports</td>
<td>High</td>
<td>Many sports games involve immersion with a real playing simulation so the graphic quality may need to be high in order to convey greater realism.</td>
</tr>
<tr>
<td>Strategy</td>
<td>Low/Medium</td>
<td>Strategy games typically provide a top-down 3D view of a playing environment. The emphasis here is on data quality rather than graphic quality.</td>
</tr>
</tbody>
</table>

Quality of different game types, six of the most common types of computer game are used in the following analysis: adventure, platform, role-play, shooter, sports, and strategy.

Adventure games, where players have to solve a series of puzzles to complete a quest, do not typically require motor skills (with some exceptions such as action-adventures) but focus on problem-solving and lateral thinking. They also provide a vehicle for presenting factual information within the context of the game play (for example, reading in a book). Platform games, where the player has to negotiate the way through an environment past various obstacles requires greater co-ordination and quick responses but can also develop strategic thinking, problem solving and lateral thinking (when getting past difficult obstacles for example). Role playing games involve the player taking on the role of a character with their background and attributes in order to complete various challenges and quests and are also commonly multi-player allowing for development of communication skills. They also provide scope for problem solving, but the narrative structure also lends itself to the embedding of facts in context. First person shooter games, while being commonly decried by the media as valueless, have the potential to support the development of a range of skills, such as physical coordination and rapid response, communication
and teamwork (when played collaboratively) and strategic thinking skills. Sports games, including racing games, typically aim to emulate the playing experience and are focused on physical coordination skills, although some do contain elements of strategy and organisation when it is a team rather than an individual being controlled. Strategy games, including ‘god’ games and simulations, present a world with problems that need to be investigated and solved, often through creative thinking as well as application of strategy. They also commonly present a narrative which allows the embedding of factual knowledge.

Game genres in which physical immersion is important, in particular first person games, also require greater levels of realism and therefore greater graphical quality. Games that rely more on the imagination of the player and less on actually being part of the environment are more likely to require less realism and visual design quality. However, there does not appear to be a difference between the emotional experience of playing in either first or third person perspective, but distance from the character often makes the difference in terms of immersion (Egenfeldt-Nielsen, 2008).

In the same way as visual design quality is relatively more or less important depending on game genre, certain types of game can be better suited for different types of learning, and the type of game selected for use in a given situation will impact upon both its educational value and its acceptability. Table 5 below provides summary of these genres and some of the types of learning that may commonly be undertaken in them.

It is worth noting that while these are generalisations based on genre, which may not hold true for specific games, this table does highlight the fact that certain genres of game may be more appropriate for formal learning than others, while others may be more appropriate for informal learning or skills acquisition. This quick analysis of what can be learned in various game genres it shows that there is no genre without some merit (although it could be argued that the negative aspects

<table>
<thead>
<tr>
<th></th>
<th>Adventure</th>
<th>Platform</th>
<th>Role play</th>
<th>Shooter</th>
<th>Sports</th>
<th>Strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem solving/investigation</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Lateral thinking/creativity</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Coordination/dexterity/response</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication/team work</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Strategic thinking/organisation</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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</tr>
<tr>
<td>Facts</td>
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of some games outweigh any learning value). Games viewed as more appropriate for academic learning may be those that include more higher level skills such as problem-solving, lateral thinking, communication and strategic thinking, of which adventure games, role playing games and strategies seem most appropriate (particularly those that involve or support collaborative play, either online or together in the real world).

The impact of the visual design of a game is more important depending on the genre of the game. For example, the early adventure games provided no visual element but were simply played with text (such as the first text adventure, Colossal Cave). As technology evolved, the game designers started to introduce crude still graphics (e.g. The Hobbit), then two-dimensional spaces that could be explored (e.g. The Secret of Monkey Island) and immersive three dimensional spaces (e.g. The Longest Journey). While the more visually rich environments may add more colour and tone, they do not essentially change the nature of the puzzles in the way that the shift from textual to graphical adventure games did (for example, puzzles based on spotting hidden objects or clues in the environment). However, the elements that are core to most adventure games – puzzles, narrative, exploration, dialogue – do not rely on a graphically sophisticated immersive environment. In fact, it can be argued that navigating complex environments in some cases can detract from the game play itself. For some genres, however, the visual environment is everything. The aesthetic value of platform games, the immersive qualities of first person shooters and the realism of sports and racing games are part of the fundamental appeal of these genres.

While graphics with high production values may not always be essential in terms of the game play experience for certain types of game, absence of a strong visual design and state-of-the-art rendering may be unacceptable to some players. Expectations depend very much on the user group, and younger players or those who play a lot of computer games at home may have much greater expectations than adults or those who do not play them. In addition, learners may have different expectations from a computer game for entertainment that may not translate to a computer game used for learning, so for example some learners may consider a graphically sophisticated game to be frivolous or inappropriate in a learning context. In the section that follows, a research study is described in which the impact on learning and engagement of two different game designs were compared.

COMPARING COMPLEXITY IN VISUAL DESIGN

The idea that computer games can be used to motivate students is a common one but not universal. In reality, not all learners are intrinsically motivated to play games, and games that do not match the learners expectations in terms of what is ‘fun’ and what is ‘appropriate for learning’ are less likely to be motivational for their own sake (Whitton, 2010). It is important therefore to ensure that the value of using a game to teach goes beyond its motivational or visual appeal but is rooted in sound pedagogy.

Realistically, options for educational game production are limited. Educators wishing to use computer games as part of their teaching could use commercial educational games that are produced on far lower budgets than entertainment titles,
or use games created by enthusiastic teachers or as part of small-scale research projects. Neither of these scenarios provides the scope for the use of games matching the visual sophistication of commercial entertainment titles.

Using a commercially produced entertainment game has the advantage of enabling students to use a professional product with high production values, which has been explicitly designed to be fun and engaging but they can also be expensive and it can be difficult to find a game that exactly matches the desired learning outcomes. Some gaming environments now come with an additional creation engine (e.g. Neverwinter Nights) that allows the development of bespoke extensions to the game, but these are limited and often require computer programming skills. Commercial games do exist that are specifically designed for learning (e.g. Marketplace, PeaceMaker) but can still be expensive, and are often difficult to customise if they do not meet the exact requirements of the learners or curriculum. Creating a bespoke game from scratch has the advantage allowing the design of a game where the learning outcomes are closely aligned with gaming outcomes for a specific curriculum and student group. This however can require a certain amount of development expertise (coding skills, visual design skills, game design skills) and can be time consuming.

There are a growing number of game development tools available for which allow bespoke games to be created by non-programmers, many of these specialise in specific game genres (for example, adventure games - Adrift, 3D Adventure Studio, role playing – Hephaestus, platform games – Platform Studio) and may only allow a limited amount of creative freedom.

Given that it is realistically impossible for educators to develop games for learning that are as visually sophisticated as high-end commercial games, it is important to understand which aspects of visual design matter in terms of learning and acceptability of the game in an educational context. There follows a description of some research that examined the differences in engagement between two different game versions that aimed to teach the same learning outcomes.

In order to determine whether visual design might make a difference to learning and engagement, two collaborative game-based activities were developed: the Time Capsule, a direct online translation of a face-to-face collaborative activity; and the Pharaoh’s Tomb, a graphical multi-player adventure game. While both of these applications were examples of game-based learning, the Pharaoh’s Tomb required the player to navigate around a three dimensional virtual space and interact with objects, whereas the Time Capsule was designed to have a much simpler interface and did not involve exploration of a virtual world.

Both games aimed to teach basic collaborative and team working skills. The Pharaoh’s Tomb is a three-dimensional collaborative graphical adventure game that offers a range of challenges based around group problem-solving. It provides a fantasy environment of an Egyptian Pharaoh’s tomb that can be navigated and explored; characters can interact with objects and gain feedback from the environment as well as from other players. The Time Capsule, in contrast, is an interactive group negotiation game that creates a fantasy scenario for the participants but it does not present an immersive world that can be explored as part of that scenario, although it does
provide interactivity and feedback to actions. Both games were designed to take the same time to complete and have the same set of learning outcomes and supporting materials. Each of the game-play sessions was designed to fit into a one-hour time slot, because this fitted with the timing of lessons at the institutions where the research was undertaken.

The majority of the students who took part in this research were undergraduate computing students, and it was speculated that this would be a group in which there was a relatively high level of computer literacy and, being predominantly male and under 30 years of age, might be likely to have more experience playing computer games. It was hypothesised that there would be a lower impact on learning engagement by factors such as learning to interact with the interface or use the games themselves so any effects could be attributed to the design of the game. The experiment was designed so that the students were split into two groups, each group undertaking only one of the two activities; the relative levels of self-reported learning and engagement could then be compared for students undertaking each of the activities.

Two small-scale pilots were run \((n=15\) and \(n=19\)) previously, with students in computing and marketing, to test the experimental design and the games themselves in a multi-user environment. For the main study \((n=78\) the games were embedded into a first year professional skills module so that they were part of the core curriculum. In each trial students were allocated to one of the two game-based learning activities – Pharaoh’s Tomb or the Time Capsule. In the case of the first two pilots, members of the group were randomly allocated to one condition or other, and in the case of the final trial the games were used in six separate tutorial classes, with three classes randomly allocated to each condition; the original allocation of students to tutorial groups was random. When a student logged in to the multi-user software engine he or she was automatically allocated to the next available game, which effectively meant that players were allocated to teams at random.

In order to evaluate the effectiveness for learning for each of the game conditions, it was decided to use a questionnaire that measured engagement, based around five different factors (that had been discerned from previous research). Engagement was used as a measure rather than learning because of the problems associated with a pre-test/post-test model and teaching collaborative skills (including the fact that the test itself could influence learning), the limited time available, and the limited value of self-assessment of learning. Levels of engagement have been linked to levels of learning (Malone and Lepper, 1987) so it was hypothesised that higher engagement could indicate higher learning. The questionnaire developed was designed to measure an overall engagement score, which could be broken down into component scores for each of these factors. These score could then be used to compare engagement between activities using comparative non-parametric statistical tests (for more details of the questionnaire design and tests used, see Whitton (2007)).

The results of this comparative experiment did not show any difference in overall engagement between the two activities. However, there was a significant difference in the amount of perceived control that the players felt, with a feeling of more control using the simpler interface. This provides evidence that, while the Pharaoh’s Tomb was designed to provide an environment with many options and objects that could
be manipulated, students actually felt a significantly higher level of control using the more basic Time Capsule application. This could be due to the greater complexity in the interface of the Pharaoh’s Tomb, or the fact that the Pharaoh’s Tomb required three-dimensional spatial navigation skills, which left a small number of students unable to move around in the environment, whereas the time Capsule did not require the players to master navigation or interact with objects in a virtual environment.

While there are clearly limitations to this research, in terms of the two games that are used as a basis for comparison and determining what factor might have caused this perceived difference in control, this experiment provides evidence that it is not necessarily the most complex and interactive game that is best for supporting engagement or learning. The issue of visual design is complex and further research is needed to gain a better understanding of the whole range of implications of design on learning.

CONCLUSIONS

This chapter has considered the different aspects of visual design, and their potential impact on learning. The visual design of games is an important issue because it has an impact on the cost and on the skills required for production. The market for educational games is limited, particularly in the area of Higher Education, where courses may be niche, so development by commercial games companies may never be feasible if the initial financial outlay spent developing a game with high production values cannot be recouped. Realistically, in order to achieve a good fit between learning outcomes and gaming outcomes, educators wishing to explore game-based learning may have to create or modify games for themselves rather than simply using commercial titles (either educational or entertainment) and an understanding of the importance of visual design will help to determine whether this desire is feasible.

Overall, the key question is how important is the visual design of games for learning, and this is clearly debatable. Should games for education attempt to emulate the production values of commercial entertainment titles, or should educators concentrate on creating game-like active learning environments using low tech methods?

The visual design of educational games has the potential to impact both on the acceptability of a game for the target learners and also on the learning itself, although there is more evidence for the former. Acceptability will depend a great deal on the genre of game being played and the expectations and prior experience of the learner. The learning outcomes of the game are crucial in determining the importance of aspects such as visual realism and fidelity, which are far more important in realistic simulations than they are in adventure games. If the learning outcomes are directly related to the visual design (for example in a surgical simulation) then the impact of that design will be critical for learning.

There is a big difference in the importance of visual design for games when they are used for education as opposed to purely for entertainment. In entertainment games the design is crucial for the feel of the game, to meet player expectations, to keep pace with other games in a competitive marketplace and is part of the gaming experience itself. In educational games the visual design may be important but it may also
detract from the intended learning outcomes. For example, in the Pharaoh’s Tomb game some players found the need to navigate around a virtual space a distraction from the collaborative learning intended. Entertainment games may also have extensive and complex user interfaces that need to be mastered and, in themselves, are part of the fun of playing the game. In the context of education, time may be limited and it is more important to focus on the intended learning than learning to operate the game itself.

In the Introduction to this chapter, visual design was defined as having three components: graphic design, aesthetic design, and interface design. Depending on the type of game, and its context of use, the relative importance of graphic design or aesthetic design may differ. However, the interface design, with its impact on usability and learnability, is likely to always be a crucial aspect in the design of educational games. It is not about making interfaces that are complex or offer a large amount of functionality but about creating interfaces that are straightforward and fit-for-purpose. Overall, the authors would argue that in general it is aspects such as the game mechanics and the playability that have a greater effect on player motivation, engagement and learning, than the visual design quality.

So, what does this mean for game designers, developers and educators? It is important to take acceptability into account and also to be aware that the importance of the visual design will very much depend on who the game is aimed at, the type of game and what it is being used to learn. There will always be a choice about whether to use and augment a commercial off-the-shelf game or to create a game from scratch, and this choice should be heavily influenced by the type of game and the importance of visual design in that context. There may be times when anything less than professional visual design will simply not engage the user group (for example, highly experienced gamers who are used to that level of graphical sophistication) but on other occasions it will be less important. The games that are designed from scratch should be those where the visual design is less important, as a lone educator or small team cannot hope to compete with the budgets expended by commercial games companies. The gulf between the resources expended on commercial entertainment games and games designed for educational purposes is likely to increase. The average development budget for a multi-platform game is now between $18–$28 million dollars (Crossly, 2010).

Another option is for educators and small-scale games designers to use development packages that take care of the design and do not require the end user to think about it. Although this limits the amount of customisation possible it also ensures that a certain standard of visual design quality is achieved. Customisation of commercial games using modding engines enables higher quality games to be produced, but may still require some level of programming skill and the genres of game that supply modding engines may not be appropriate for many types of learning outcome.

To conclude, this chapter has highlighted some of the aspects of the visual design of computer games that can impact on their appropriateness of use in education. Although there is little robust research evidence one way or the other as to the relative importance of visual design, compared with aspects such as the game design itself, it is clear that visual design is more or less important in different situations.
Consideration of the context in which any game is to be used is essential to understand the importance of design. In order to better understand the nature of visual design on games based learning, further research in this area is required to truly understand how aesthetic design, graphic design and interface design can impact on computer games-based learning.

REFERENCES


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2. AN ACTIVITY THEORETICAL MODEL FOR SOCIAL INTERACTION IN COMPUTER GAMES

INTRODUCTION

Computer games have for years been the focus of Human Computer Interaction (HCI)-oriented research. For example, researchers have looked at playability and have developed heuristics for evaluating fun as well as usability of computer games (Desurvire, et al. 2004; Fabricatore, et al. 2002; Federoff 2002). Although much of this research has revolved around enhancing engagement by improving player-game interaction, some (Ducheneaut, et al. 2004; Ducheneaut, et al. 2006; Kolo and Baur 2004) have begun to look into the social aspects of gaming as most computer game play is social. Surveys have shown that almost 60 percent of game players play with friends; 33 percent play with siblings and 25 percent play with spouses or parents (Jenkins 2006). Similarly, within the area of game-based learning, the focus is moving from treating games as a standalone tool that delivers knowledge to learners in an enjoyable way, to utilising games as a medium for social interaction and collaboration.

The emergence of massively multiplayer online games (MMOGs) has provided a further impetus for research into the social aspects of gaming and game designers have tried to structure in-game activities to encourage interaction between players. For example, Ducheneaut et al. (2004) conducted a study to identify how locations in games can be designed to encourage different styles of social interaction. Through a combination of quantitative and qualitative data collection and analysis, it was found that the MMOG Star War Galaxies attempts to maximize social interaction through the careful design of the game structure and mechanics, e.g. some locations are designed in such a way that players have to wait there and socialize.

Similarly, using virtual ethnography, Kolo and Baur (2004) observed that most MMOG players seek more than merely strategic considerations (instrumental play) when interacting with other players. They search for communication and persistent social relations (social play). They also showed that social play not only exists within the game, it often spills beyond the demarcated boundary of the rule-based system and soaks into the players’ physical life through various means, such as e-mail, online forums and chatting tools.

Qualitative studies using approaches such as ethnography and virtual ethnography are becoming important methods for studying game playing activities, particularly social interaction in games (Ducheneaut et al. 2004; Kolo and Baur 2004). However,
analyzing the rich data yielded by such studies is often a challenging task. We
believe that a theoretical model of sociability in computer games could facilitate a
more focused research approach to the study of such games and would also help guide
the development of social computer games for learning purposes. It is within this
context that the work reported in this paper is situated, the objectives of which are:
– To present a model that helps analyze the in-game social interaction in computer
games
– To provide some insight into how this model can be used in practice to inform
sociability design in computer games
– Our aim is to develop a theoretical model that:
  – provides a conceptual framework that helps us describe and understand the
game world and play activities, such as the implementation of certain sociability
functions in games.
  – has a standardized vocabulary that lets us communicate with others in the area
of game research. More importantly, it should help us talk about game playing
particularly social interaction by naming important aspects of the conceptual
structure of the play activity.
  – can be applied in the real problem space. It must be able to inform and guide
game design.
  – makes inferences about game playing phenomena which are not yet well under-
stood. It should provide some insights to inform the sociability design for a novel
situation.

COMPUTER GAME THEORIES

Computer games have been studied from different angles, borrowing conceptual
and theoretical frameworks from various fields. Narratology (Jenkins 2002; Murray
1997; Ryan 2001), for instance, focuses on the story presented and enacted within
games, but overlooks the structural and functional aspects underlying the narrative
layer. On the other hand, scholars who approach this subject from the perspective
of simulation studies (Frasca 1999; Juul 2001) believe that games can be, and should
be, examined as a formal system that operates on a set of rules. Literary theorists
(Järvinen, et al. 2002) study games as linguistic and visual signs, thus analyzing them
as textual artifacts without giving proper attention to the active participation, or the
agency of the “reader”: the role of the reader who constantly manipulates the text.
Although Aarseth (1997) as a literary theorist acknowledges the “ergodic” (or the
interactive) element of “game texts”, his work does not include the social interaction
among “the readers”, or the “collaborative ergodic” element of a game.

Each of these theories has its strength in analyzing certain aspects of computer
games. However, as far as we know, there is no unified framework that describes the
sociability element of computer games. Computer games do not exist in isolation.
Instead, computer games exist around the social context forming a community
of players. Although classic work on games by Huizinga (1944) and Callois (1961)
has emphasized game playing as a social practice, it is dated more than half a
century ago when computer games did not exist.
ACTIVITY THEORY AND SOCIABILITY

We propose using activity theory (AT) to study social interaction in computer games. We believe that AT provides powerful theoretical tools for exploring various aspects of games. However, before probing further into how AT might be useful for game studies, let us take a look at AT in general.

AT is a theoretical framework which describes how humans take motivated action in the social world and thus is presumably applicable to any domain in which this takes place. AT has its foundation mainly in Vygotsky’s (1930) work on psychology of child development and play. His approach to psychology was contextual and social: he believed that development happens through interacting with other people before it is internalized within a person. Engeström (2001) subsequently developed and expanded Vygotsky’s work to place greater emphasis on the social aspects of activity theory.

Engeström viewed all human activities as contextualized within an activity system. He presented a model of an activity system that consists of seven elements Engeström (2001). The subject is the individual who is selected as the focus point of the analysis. The object refers to the raw material or the problem space at which the activity is directed and which is transformed into outcomes with the help of tools. Tools are the concepts, physical tools, artifacts or resources that mediate a subject’s interactions with an object. The community refers to those with whom the subject shares the same general object. The division of labor is the classification of tasks among the members of the community, while the rules are the regulations, norms and conventions within the activity system.

3.1 The Application of AT in Social Systems

Activity theory (AT) has been used as a source of inspiration in the context of computer supported collaborative work (CSCW), for example in the work of Kuutti (1995) and Nardi (1995) who developed models of cooperation that can be helpful as a theoretical background for the design of CSCW systems. A practical application was reported by Fjeld, et al. (2002) who employed AT in shaping their design process for augmented reality groupware based on the two concepts of tools and objects. Applying AT brought structure to their design practice and the vocabulary of activity theory proved to be useful during design discussions. AT is also commonly used as an analytical lens that informs and guides the analysis of learning activities. Based on Engestrom’s model of an activity system, Barab (2002) examined the relations of learners (the subject) and object as mediated by the primary components that constitute an activity system in designing a learning environment for astronomy. Barab concluded that AT is useful in educational technology research because it characterizes design activities by illuminating the challenges of designing learning communities.

Less commonly, some researchers have attempted to study computer games with activity theory. Squire (2004) used activity theory in a study to examine the implications of using games in history learning by treating the game as a mediating artifact in the learning activity system. He reported that activity theory gives an insight into
the contradiction of using games as a tool in learning and thus helps participants understand and react to changes.

Another study, known as The Fifth Dimension, was conducted to design an educational game activity system for school aged children (1995). After-school systems were implemented based on activity theory in order to study individual and collective activities in educational games. In addition to tasks within the game activity itself, the project team designed out-of-game tasks to help participants orient to the game, to form goals, and to trace progress toward becoming an expert.

3.2 Suitability of AT for Game Studies: A Preliminary Study

We believe Engeström’s AT model could be used to analyze the social activity in a game community. We also interpreted a substantial amount of classic and contemporary game literature in light of AT to investigate how game studies and AT can be brought together. Based on the extensive review of game literature and the AT model, we argue that AT is suitable for studying sociability in computer games because:

Games as artifacts and activities: Games can be studied as artifacts/tools (e.g. conventional game studies such as ludology and narratology), or as activities (e.g. play activities oriented towards an objective).

Individual focus: Many computer games are intended for individual play. Therefore, theoretical approaches that focus solely on social aspects may not be appropriate.

Collective focus: Instead of approaching game play merely as an individual activity, we also consider the social activities each individual is engaged in. In AT, although the perspective of the individual is at the center of everything, it focuses on the process of an individual situated in a social context.

AT provides a clear visualization of the concepts: AT has named its theoretical constructs well. Naming is very useful both for communicative as well as descriptive reasons. Being able to manipulate data along with the names in AT provides an additional advantage.

AT has a clear focus on process and dynamics: Dealing with process is built into the structure of how AT is presented. Activity systems keep process in the forefront of the analysis, highlighting the concepts of contradiction and development thus enabling us to examine the dynamics of play activities.

METHODS

In addition to the work summarized in the previous section, we conducted an observational study of sociability in game playing to inform the development of the model.

4.1 Data Collection Method

Ten computer games were used (Super Mario Bros. 3, Harry Potter 2, The Sims, Civilization 2, CSI: Dark Motives, Myst, Neo Bomberman, Art of Fighting 2, Shock Trooper 2, Magical Quest 2) (Mobygame 2006). The game selection was carefully
AN ACTIVITY THERORETICAL MODEL

based on the high level game typology proposed by Lindley (2003): ludic, simulation and narrative games. Two games were chosen from each category. In addition, four console-based multiplayer games were included. This gave us a representative cross-section of the wide range of games currently available. Single player games were included in the study because we wanted to investigate how social interaction is affected by individual play and we believe that the understanding of individual play is significant in analyzing social interaction. In preparation for the observational study, we played all ten games to familiarize ourselves with them. External information (game magazines, online review, game walkthrough, etc) was also gathered to enhance our understanding of the games.

Twenty four (24) participants (12 male, 12 female) aged 18–25 years old with educational levels ranging from school leavers to postgraduates were recruited. The majority of them (21 participants) played computer games for 1–6 hours a week. Each participant was required to play two games – one single player and one multiplayer game (in which participants play with or against each other) – each for about 30 minutes. Through pilot studies we found that the first 30 minutes was the time in which novel activities emerged. It is because this is the learning curve for most games and thus we are positive that we have captured the most insightful actions. Besides, we had participants with different levels of expertise. That provided us with richer data in 30 minutes. To enable us to capture the game-playing activities of the participants, they were instructed to explore the game at their own pace, try to do their best when playing and verbalize their thoughts. During the game playing session, the screen was captured on video and think alouds were recorded. After the playing session, interviews were carried out to clarify issues observed during the game session such as why a certain action was performed. About 25 hours of video and interview audio were collected and transcribed.

4.2 Data Analysis Method

The model was developed using the approach of grounded theory, in which the theoretical model emerges through an iterative cycle of qualitative data analysis (Glaser and Strauss 1967). We examined the data focusing on both individual play and social interaction and on identifying the relationship between the two. For instance, we examined the themes of social interaction through various elements of activity theory (division of labors, rules, etc). A deductionist method (Braun and Clarke 2006) was employed in which we started with the original Engeström AT model and through the emerging themes (e.g. fictions and various types of game rules) from the data, we reshaped and remodeled AT in the context of computer game playing. In other words, the activity of individual and collective play as observed and identified from the data was modeled with the AT model. For instance, two rules, paidea and collective rules (discussed later), that emerged from the data were mapped into two different elements of the AT triangle because they mediate individual and collective play activity respectively. As new themes emerged, the model was modified so that it could explain all types of play activities that were observed in the data.

We went through a series of iterative cycles of data analysis and stopped only when theoretical saturation was reached (Glaser and Strauss 1967). The validation
of the model was achieved through cycles of analysis which demonstrated that the examination of new data revealed no new information regarding the theoretical constructs and their relations. To further validate the model, we ran a focus group with three researchers experienced in similar qualitative research. We started by explaining the model to them. Then each participant was required to apply the model to check if it could be used to explain the actions in samples from the video data. Feedback was gathered and any discrepancies were discussed and resolved. Therefore, our proposed model is data driven in both its construction and validation (Glaser and Strauss 1967).

FINDINGS: THE MODEL

In this section, we describe how we have used activity theory to conceptualize social interaction in game playing. We present a theoretical model of individual and collective play for computer games, which is largely derived from Engeström’s conception of activity theory. Figure 1 shows a graphical representation of the activity system of computer game playing.

Firstly and most obviously, the “subject” in this case represents the “player” of the game whose perspective is taken during the analysis. The “tool” is the computational tool which includes the hardware and the software. The hardware consists of input/output devices while the software is the virtual space of the game.

The “community” in the original AT is replaced by “group” since a group of players playing a game together does not necessarily constitute a community as their relationship might be temporary (Preece and Maloney-Krichmar 2003; Rheingold 1993). Thus a group refers to other players who are interacting with the “player” and act together on the object.

Instead of using “rules” from the original AT model, we have “collective rules” which are the norms that define the relationship between players. These “collective rules” mediate interaction between players, rather than player-game interaction. This distinction is very important as there are many different types of rules in computer games. “Division of labor” is adapted to become “division of roles”, referring to the responsibilities of each player in the game. This is mainly an adaptation of terminology as the fundamental concept remains the same.

The “object” is the goal of the game. The model shows that the object will then be transformed into the “outcome” which in this context is the development of the

Figure 1. The activity model for game playing.
activity system of game playing. The outcome is one of the most problematic concepts of activity theory when it comes to play. This is because often play is treated as something that is unproductive and hence yields no outcome at all, although some (Ponti and Ryberg 2004), contend that the outcome of a game is fun or relaxation for the player. In line with Huizinga’s (1944) arguments, we believe that the outcome also includes the development of the play activity, which leads to learning among the players.

In the following sections, we expand our discussion of the play activity model by focusing on two key aspects – games as artifacts and games as play activity – with an emphasis on social interaction in computer game playing activity. Where appropriate, we support the description and conceptualization of these aspects through examples from the analysis of the qualitative data we collected.

5.1 Games as Artifacts

Games are artifacts with various rules which the player needs to learn in order to achieve the goal of the game. With the emergence of realistic graphic technologies, computer games have evolved from a simple rule-based system into a complicated artifact with virtual world with rich visual audio descriptions, characters and stories. In general, game artifacts consist of tools and objects.

5.1.1 Individual and collective tools of play. One of the main concepts of activity theory is that all human activities are mediated activities. This applies also to game playing activities in which the player does not act directly on the object; instead it is mediated not only individually by various tools, but also collectively by collective rules and division of role (which are the collective tools).

According to Vygotsky (1930), a tool is crystallized knowledge in the activity system. Hence, a tool refers to the parts of the game world which have been thoroughly learned by the player and are used by the player to achieve the game’s objectives. For example, once the “detection tool” in CSI: Dark Motives is thoroughly learned, it becomes a tool that mediates the game’s objectives, e.g. to detect new evidence from the crime scene.

In computer games, tools can be physical (hardware) or virtual (software). Physical tools are game controllers, keyboards, mice, etc.: they are the media that connect the real world and the virtual game world. They provide the mechanisms for the player to communicate with the game space. Virtual tools are anything within the game software, including graphics, audio, and of course rules. Virtual tools consist of two layers: fictions and paidea rules which are the most studied areas of conventional computer game studies. Simply put, fictions are representations of the game world while paidea rules define how the world should behave (Ang 2006; Frasca 1999).

Thus, fictions could be images, animations, audios, or even videos that represent the game world. For example, our observation shows that fictions in Super Mario Bros 3 are the Mario images, the sound of Mario growing (after touching the mushroom), animations that show Mario returning the key to the King after defeating the boss monster, etc. On the other hand, paidea rules are most of the time neither
visible nor audible in the game, but they are a crucial tool as they define how the
game world behaves. For example, paidea rules define what happens when the player
presses the A button on the game controller, what happens when the Mario touches
the mushroom, what happens when Mario jumps, pulled down by gravity and stomps
on a monster.

It is worth mentioning that some fictions are operated by paidea rules while some
are not. For example, in Super Mario Bros. 3, the fictional mushroom is operated
by paidea rules (when it is touched by Mario, it vanishes and Mario grows). On the
other hand, the clouds at the background simply do nothing (i.e. there is no paidea
rule behind the visual representation). The same is true of some video cut-scenes
(e.g. in Harry Potter 2) that are simply played to give the player some information
in the form of a narrative. However, all paidea rules are represented by fictions to a
certain extent. For example, the paidea rule that defines the damage Mario suffers
when he runs into the monster is represented by a change to Mario’s image and some
sounds. If paidea rules were not represented, the game would be understandable by
the players.

Our study also revealed that game playing is centered around two types of tools:
designed tools (tools pre-designed by the developers) and emergent artifacts (tools
constructed, negotiated and agreed by the players as they play the game). The
individual tools are largely pre-designed by the developer although it is possible for
the player to hack the game and modify the paidea rules and the fictions to create
emergent artifacts.

When playing together with others, the player needs to interact with them and
this interaction is mediated by collective tools, i.e. collective rules and division of
roles. Whereas paidea rules define player-game interaction, collective rules are rules
that define player-player interaction. For example, we found in our study of Shock
Trooper 2 that some players came to an agreement with each other not to pick up
each others’ items. While paidea rules are fixed and thus are non-negotiable, collec-
tive rules are rules that arise through constant negotiation and agreement between
players. This was evident in our data; for instance, although the paidea rules of
Magical Quest 2 do not restrict a player from collecting all the coins in the game, the
players did agree that they should not collect coins that are supposed to belong to
another player.

Division of roles is a subset of collective rules that defines the responsibility of
each player. It usually refers to collective rules which split the responsibilities of each
player in the game. For example, we observed that players of Magical Quest 2 split
responsibilities among themselves, with one player being responsible for diverting
the attention of the boss while the other player attacks. Although both avatars (Mickey
and Minnie) in the game were designed to have the same abilities and thus the
same responsibilities, the emergent roles were created through social interaction in
the game playing.

There are also collective tools pre-designed by the developers that define possible
social interactions between players. In our observations of Shock Trooper 2 for
example, one pre-designed collective rule was that the players could not attack
each other even if they wanted to.
5.1.2 Objects of play. **One of the most fundamental concepts of play activity in computer games is that the player is acting on an object.** It describes the specific play through the perspective of the nature of objects, where the object (or the objective) motivates play and gives a specific direction. Usually the object/objective is defined by the game designers and it shapes the action of the player although often the players will also shape the object as they play.

Paidea rules, as introduced in the previous section, are rules about how the game world works, while ludus rules are rules about how to win or lose the game (reference removed for blind review; Frasca 1999). Thus ludus rules are the game objective to be achieved by the player. When playing games, players are usually driven by ludus rules. For instance, in CSI: Dark Motives, the ludus rule is to solve the crime while in Harry Potter 2, it is to defeat the monster in the secret chamber. There are some games without pre-defined ludus rules. The Sims for example, does not have a clear objective as to what the player needs to do in order to win the game, for one can never “win”. This does not mean it has no ludus rules. We observed that players create their own ludus rules while playing the game. For instance in The Sims, players might set their own ludus rule, to reach the top of the career ladder. Once the ludus rule is established, the player’s action will be driven towards it. Objectives which are pre-defined by the game designer are known as extrinsic ludus rules, while objectives which emerge from the players are known as intrinsic ludus rules (reference removed for blind review).

However, there are also cases when a play activity is not driven toward an objective, or in other words the player’s action is not driven toward achieving any ludus rule. For example, some of the players we observed were sometimes simply flying around with the “Cat Mario” in Super Mario Bros. 3, or decorating the house in The Sims. In this case the object of play is driven toward the game world rather than the objective of the game. We summarize our observations in Table 1 with an example.

<table>
<thead>
<tr>
<th>Tools</th>
<th>Examples of designed tools</th>
<th>Examples of emergent tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paidea rules</td>
<td>The way the game characters interact with the enemies and items</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Fictions</td>
<td>The graphics, animation and audio of the game world</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Collective tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collective rules</td>
<td>Game characters cannot shoot each other</td>
<td>Players should not collect items that belong to other players</td>
</tr>
<tr>
<td>Division of roles</td>
<td>Each game character has its own special power thus implicitly dividing the roles</td>
<td>Players divide the game screen into two areas and each player is responsible for one</td>
</tr>
<tr>
<td>Objects</td>
<td>Ludus rules</td>
<td>To collect a more powerful weapon</td>
</tr>
<tr>
<td></td>
<td>To defeat the final boss monster</td>
<td></td>
</tr>
</tbody>
</table>
We want to emphasize that object in AT according to Leont’ev refers to the overall objective of an activity which in the case of computer games, is “to have fun” (this will be discussed further in the next section). Engeström’s activity triangle fails to visualize the hierarchy of activity. Thus we incorporated Leont’ev hierarchy of activity into the triangle. This results in an alteration of the connotation of objective in the triangle. In the game context, we can use the triangle to visualize play activity at various level according to Leont’ev. The “object” in the triangle can represent activity, action and operation. In the examples in Table 1, we modeled game play at “action” level.

5.2 Games as Play Activities

Computer games are not merely an artifact or a collection of tools and objects. They are also the dynamic process of play that arises from the artifact, is oriented toward an object and results in development.

5.2.1 The structure of play. Based on the hierarchy of activity proposed by Leont’ev (1978), the player operates the tool unconsciously to act on the object at a conscious level. In addition to this, we propose that actions and operations also take place at the collective level. The subject collectively operates (co-operates) with the group to collectively act (co-act) on the object (reference removed for blind review). (see Figure 2).

The structure of play explains the process of the play system and how collective play is related to individual play. As in other forms of activities, there are three levels of activity in computer games – activity, action and operation – an important concept of AT proposed by Leont’ev (1978). We have made some adaptations to the terminology and the concepts in order to suit the context of computer games.

The first level is the play activity itself which is oriented toward a generic objective of computer games which is to have fun; for example to socialize, to explore,

Figure 2. The structure of play.
to achieve and to kill (Bartle 1996) or to learn in the case of educational games. The second level, actions (or co-actions in the case of multiplayer) refer to something the player does consciously toward a game objective whether it is extrinsic ludus rules (objectives pre-defined by the game designer) or intrinsic ludus rules (objectives created by the player) in order to have fun or to learn. E.g. for an intermediate player, he or she would probably have to focus a lot when trying to kill a monster boss. Finally, we have operations (or co-operations for multiplayer cases) which are something the player does subconsciously. E.g. an intermediate player would probably press the key or click the mouse without thinking about it.

The play structure is by no means static as its state keeps changing as the game proceeds. The object is transformed from time to time depending on the player’s needs and the game world. As the player transforms the object, the transformed object affects the player’s actions. Let us look at a typical example extracted from our observation data (see Table 2).

When playing CSI: Dark Motives, the participant started by trying out the game’s user graphical interface. Operating on the computer mouse and his/her coordination skills (tools), the participant was acting on the objects which were the graphical icons (fictions) and the internal behaviors of the icons (paidea rules). The outcome of this individual action was the learning of the graphical interface i.e. the object (graphical interface) was transformed into a tool (the knowledge about the graphical interface).

Table 2. An example of game as individual and collective play

<table>
<thead>
<tr>
<th>Action/object</th>
<th>Operation/tools</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual play (CSI : Dark Motives)</td>
<td>The user interface</td>
<td>Coordination skills</td>
</tr>
<tr>
<td>The crime scene</td>
<td>Coordination skills, the user interface</td>
<td>The knowledge about the crime scene becomes a tool (development)</td>
</tr>
<tr>
<td>To solve the case</td>
<td>Coordination skills, the user interface, knowledge of crime scenes</td>
<td>The solving of the case</td>
</tr>
<tr>
<td>Collective play (Magical Quest 2)</td>
<td>To defeat the boss monster</td>
<td>Initial collective rules: implicit agreement to do one’s best</td>
</tr>
<tr>
<td>The division of labor</td>
<td>Individual tools (or learned skills of each player)</td>
<td>New division of labor is agreed, one player distracts the monster and another attacks (development)</td>
</tr>
<tr>
<td>To defeat the boss monster</td>
<td>New division of labor (distract and attack)</td>
<td>The defeat of the boss monster</td>
</tr>
</tbody>
</table>
Then operating on the newly learned tool (the icons of the interface), the participant was able to act on the crime scene (the object) and the outcome was the discovery of evidence about the crime. Operating on the new knowledge about the crime (the new tool), the participant was now able to act on the new game objective (to find the criminal) and the outcome was the solving of the crime.

Similarly, the collective play structure keeps changing as the game proceeds. The object is transformed from time to time depending on the mutual needs of the players as well as the game world. Let us look at an example extracted from our observation data (see Table 2).

When playing Magical Quest 2, both players were trying to defeat (co-act) the monster boss (the object). The collective rules or division of roles weren’t clear at the beginning. The initial social rule (if any) was that “both players must try their best to kill the monster”. During the observation, it was found that players were acting on their own at the beginning and it resulted in them being killed in the game.

Then the players started to shift the focus from the monster boss to the division of roles. They negotiated and quickly (as it was a fast paced game) agreed on a new division of roles. The outcome was the creation of a new role for each player. They agreed that one of them should distract the monster while the other attacked it. Then, co-operating through the new division of roles, the players co-acted on the object (which was now the monster boss), resulting in the killing of the monster.

Although the discussion so far has treated individual play/tool and collective play/tool separately, in most cases, they are inter-related. From our observations, we identify the following ways in which these two dimensions are connected to each other.

– individual tool affects collective play

– Collective play often cannot take place without the development, to a certain degree, of individual tools. For example, if a player has not yet learned the basic controls of the avatar, it would not be possible to negotiate and agree on a mutual strategy.

– collective tool affects individual play

– Sometimes agreeing on collective rules/roles will affect the individual play as the individual player needs to follow the collective rules. For example, after splitting the game area that each player is responsible for, the player will be limited to act within a specific boundary.

– collective play structure results in individual tool development

– Collective tools often result in the development of individual tools. For example, two players discussing and helping each other might improve each other’s strategy rather than improving collective rules.

– individual tool limits collective tool

– Collective tools often emerge under the constraint of individual tools. Since collective tools are negotiated and agreed by the players, they rely on the individual tools of each player. For example, if a player has not yet acquired
knowledge of how to jump on top of the monster boss (tools), it would not be possible to assign the role of attacker to that particular player (agree on and create a new collective rule/role).

**DISCUSSION: PRACTICAL USES**

In this section, we demonstrate how the model can be practically useful in analyzing social interaction in computer games. We believe that by extracting practically useful information from the theoretical model researchers and practitioners can get direct guidance for studying computer games. With a focus on our theoretical model, we derived an application framework that helps us identify the issues of social interaction in game play.

### 6.1 The Application Framework

The framework contains a visualized diagram consisting of two components (Figure 3) and a set of evaluation questions. The two main components of the framework are individual play and collective play. The individual play component consists of the action on the object and the operation on the tools while the collective play component stresses the co-action on the object and the co-operation through the rules or the division of roles. Both individual and collective play result in two types of outcomes which are individual or collective development. Individual development refers to the update of individual tools while collective development refers to the update of collective tools.

![Figure 3. The application framework for computer games.](image)

The principles of activity theory are rather abstract to be applied to the actual analysis of design and evaluation (Kaptelinin, et al. 1999) of computer games. To make it more useful, we applied the application framework and the experiences we gained from analyzing the data to specify six aspects of analysis we think are useful to
capture the social aspects of game playing from large volumes of observation data. Each aspect is summarized below together with some evaluation questions:

Aspect 1: individual action toward the object
What actions occur between the player and the game? What goals are these actions serving? Do these actions fit the goal? Are they intrinsic goals that determine the actions? Is the actions’ focus on tools rather than on goals?

Aspect 2: individual operation on the tool
What tools are involved in the actions we observe? What are the operations on the tools? What are the already learned operations/tools before the play? How does the player learn the operation? Where do they get the information from? What (if any) information about the operation that the player needs to achieve their goals is unavailable? Are the tools capable of helping players achieve the goal? In what way are the tools influencing the way of play?

Aspect 3: collective action toward the object
What actions occur between the player and other players, or between a group of players and the game? What goals are these co-actions serving? Do these co-actions fit the goal? Are they implicit goals that determine the co-actions? Is the actions’ focus on collective rules/role rather than on a goal?

Aspect 4: Collective operation through the rules and the division of roles
What collective rules/roles are involved in the co-actions we observe? What are the co-operations through the collective rules/roles? What are the already learned/agreed co-operations/collective rules/roles before the play? How does the player learn/agree on the co-operation? Where do they get the information from? Are the collective rules/roles capable of helping players achieve the goal? In what way are the collective rules/roles influencing the way of play? Have players agreed to co-operate through the available collective rules/roles?

Aspect 5: relationship between individual and collective play activity
In what way individual tools affect collective play and vice versa? In what way individual play/tools rely on collective play and vice versa? How is collective play limited by individual play and vice versa? How is collective play expanded by individual play and vice versa?

Aspect 6: contradiction and development
What contradictions are observed in the play and what are their consequences? How do players respond? Why do contradictions happen? Is the contradiction resolvable? If so how? Do players construct and introduce new elements into the play activity. If so what are they? Do players modify existing elements? Does collective/individual play result in the development of individual/collective play/tool? These questions should be asked together with aspect 1–5.

CONCLUSION
We have presented a theoretical model which was based on empirical data for analyzing social interaction in computer game playing especially console based
multiplayer games. AT provides a sound basis for modeling game playing. Thus, in this study we customized Engeström’s original triangle model to make it more appropriate to the context of computer games. We then derived an application framework from the model for sociability design in games.

Our model covers two important aspects of computer games: games as artifacts and games as individual and collective activities. Activity theory has been very helpful in modeling these aspects of game playing by highlighting key concepts and their relationships.

The application framework emphasizes the relationship between the individual and collective activities. As part of this, we have also proposed a set of evaluation questions which helps identify design issues when analyzing sociability in computer games.

We believe that the theoretical model has a lot of potential in tackling issues in designing and evaluating game-based learning, particularly the sociability aspect. For instance, one emerging topic of importance is the use of community-of-practice in learning, and computer games can provide a simulated virtual environment for learners to collectively practice a specific set of skill. To design such a system is not a trivial task as it involves not only the technology (the tool in activity theory sense) but also the whole socio-technical system of learning activity. The model can thus provide a guideline to analyze and design various relevant aspects of the system.

Furthermore, future investigation can be undertaken to explore how other forms of sociability around computer games (e.g. competition) can be studied using our model. In addition, we believe the model can be applied to other modes of multi-playing or learning, such as the Xbox live in which console-style social interaction is mediated through internet technologies. In such a case, players are not interacting in the same physical location. Thus other design issues might arise and it will be interesting to see if the proposed model can help analyze such interaction styles particularly in an educational setting. A different mode of social interaction worth studying is that of MMOGs. The main characteristics of MMOGs are that they involve much bigger groups of players playing together and that relatively permanent relationships are established among players, resulting in the emergence of online game communities which could be powerful for learning.

Another often overlooked perspective of games studies is the play activities that can arise around computer games, even in the case of single player games. In fact, some games such as The Sims have placed a lot of focus on community building and the production of fan materials. In order to support such communities, design issues for both the game and the community should be addressed. These issues could be investigated and applied to a wide range of game (different console system with novel modes of interaction such as Nintendo DS with microphone and touch screen, handheld/mobile devices such as mobile phones) in a learning context.

REFERENCES


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