

Ambient role playing games: towards a grammar of endlessness

Mark Eyles and Roger Eglin
University of Portsmouth, UK

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Mark Eyles

mark.eyles@port.ac.uk

www.eyles.co.uk

www.port.ac.uk/games

Department of Creative Technologies

Faculty of Creative and Cultural Industries

University of Portsmouth

Eldon Building

Winston Churchill Avenue

Portsmouth PO1 2DJ

United Kingdom

Dr Roger Eglin

roger.eglin@port.ac.uk

Department of Creative Technologies

Faculty of Creative and Cultural Industries

University of Portsmouth

Eldon Building

Winston Churchill Avenue

Portsmouth PO1 2DJ

United Kingdom

Abstract

If the seminal 1976 ambient music album *Music for Airports* (Eno, 1978) became a 21st century ambient role playing game, what would it play like? What technologies would be required? What would we need to know for this to happen? Who would be the target audience?

This paper sets out to define ambient role playing games. A computer role playing game definition is suggested; the evolution of ambient technologies is outlined and a prototyped ambient game is described.

The heart of ambient gaming is embodied in Brian Eno's description of ambient music as being 'ignorable as it is interesting' (Eno, 1978). This is compared and contrasted with pervasive gaming (Waern, 2006), alternate reality gaming (Borland, 2005) and augmented reality gaming (such as ARQuake (Thomas, 2002)). There are many computer role playing games and a description of this genre is developed.

The roots and history of role playing games from *Gilgamesh*, *Kriegspiel* (Michael, 2005) and *Lord of the Rings* to *Dungeons and Dragons* (Hallford, 2001) and more recently *World of Warcraft* (Blizzard, 2006) give a route to one possible genre definition and a list of role playing game play mechanisms. Case studies are then used to relate the gameplay mechanisms to computer role playing games and differentiate the role playing game genre. This definition and these properties are then combined with ideas of ambience to give a prescription for an ambient role playing game. The technology required for true ambient gaming is described by looking at the history of ubiquitous computing (Weiser, 1996) and showing how this is leading to an ambient intelligence technology that features transparent, intelligent interfaces (Aarts, Harwig, Schuurmans, & Denning, 2001).

Finally the development and deployment of an ambient role playing game prototype is described and future audiences and applications of this technology are suggested, with particular reference to possible requirements of ambient gaming women.

Author Keywords

games, role playing game, pervasive, augmented reality, alternate reality, locative, live action role playing, collectable card, play by mail, ambient, ambient intelligence, ubiquitous computing, pedometer, fantasy, mobile phones, ludology, narrative, simulation, massively multiplayer, persistent worlds.

Introduction

This paper sets out to define ambient role playing games and suggest ways in which they might be instantiated. The steps to a definition of ambient role playing games are:

1. Suggest a definition for computer games
2. Suggest a definition for computer role playing games
3. Outline the ambient technology suitable for developing an ambient game
4. Define Ambient Games by combining 2) and 3) with an ambient music ethos
5. Describe an ambient game prototype

To complete steps 1) and 2) this paper discusses computer games and then looks at the history of role playing games to see how computer role playing games have evolved. A number of computer role playing games are compared to discover common mechanisms. By combining the history of role playing games and common role playing game mechanisms it is possible to derive a reasonable definition of computer role playing games and hence determine the mechanisms that comprise this genre.

Appropriate ambient technologies are discussed in 3) in order to pave a way to the future creation of ambient games.

A description of ambient role playing games is created in step 4) by bringing together the computer role playing game definition and the technology ideas within the constraints of ideas of ambient music.

This ambient role playing description is then shown to inform the development of an ambient role playing game prototype.

Finally this paper suggests applications and audiences for role playing games and ways in which they might appeal to women casual gamers.

Defining computer games

A video or computer game is an interactive entertainment played against, or with the aid of, computer generated characters or tokens in a computer generated environment. A single player game has a series of interesting obstacles to overcome in order to gain rewards. A multiplayer game has a series of interesting obstacles to overcome at the expense and/or with the help of other players to gain rewards. Games require a commitment of time and effort from the player. This commitment varies widely between games. A large and involving strategy computer game like Civilization 2 (or any other game in the Civilization franchise) requires many hours of play and thought from the player. There is also a substantial learning curve at the start of the game before the player is able to play proficiently. When starting a game like this the player is committing themselves to 50+ hours of play, stretching over weeks or months. This contrasts with a simple game like Tetris which has a very shallow learning curve (the player can start playing almost immediately) and requires very little commitment from the player, though a player may choose to make a larger commitment of time and effort to the game if they wish. The word completion game hangman requires very little commitment and has virtually no learning curve.

Another characteristic of games is where they are played. For example, console games are played in a single location, the console does not move around during play. A game on a mobile phone does not require the player to move around while they are playing, but does allow the player to move around if they wish to. The game may be played in any location (which has conditions that will not damage the phone). Similarly it will be shown that the class of games labelled 'ambient games' may allow the player to move freely around everyday locations while playing. The player does not have to travel to some kind of ambient arcade but can play ambient games in the environment they normally inhabit. There are also games that require the player to move around while playing, especially outside of computer games, frequently in locations specially prepared for the games (such as football fields, tennis courts and so on). There are many sports in which the players are required to move around. The rules for cross country running require the participants to move a large distance.

By plotting player commitment against the distance the player may travel while playing it becomes clear that there is a missing class of games that do not require large commitments and in which the player may move around (perhaps be required to move around) while playing. This class of games has been labelled 'ambient games'. See the 'Commitment and movement when playing games' figure.

This figure has a threshold marked showing the commitment required to start playing any game. Below this threshold the player has not yet made enough commitment to decide to start playing. At, and above, this threshold the player is capable of deciding to start, and actually starting, a game. Below this threshold they have not consciously decided to start playing. Note that it is possible to be unknowingly playing an ambient game and possible to have started playing before consciously having made the decision to play. This is possible since data can be collected in the game before the player has decided to commence playing.

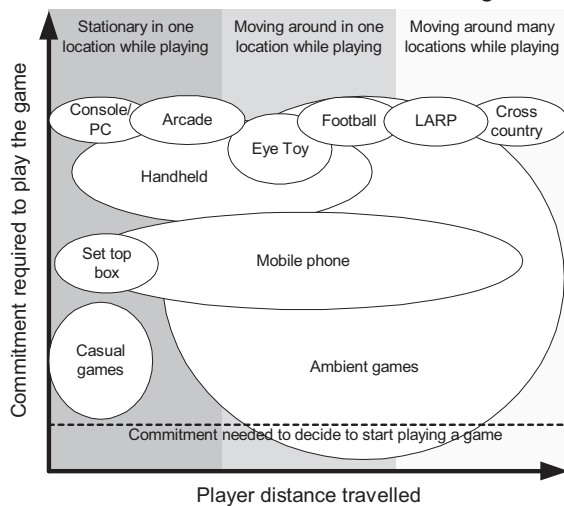


Figure 1: Commitment and movement when playing games

As implied by the 'Commitment and movement when playing games' figure the key component of an ambient game is that the player may choose their level of interaction with the game. They may choose to actively influence events in the game, or may let those events evolve with input automatically gathered from the player's real world activities. This will be discussed later in this paper when ambient role playing games are defined.

Pervasive games are defined as games that extend 'gaming experiences out into the physical world' (Waern, 2006). The ambient games region shown in the diagram could equally well be applied to pervasive games. Ambient games will be shown to be a particular subset of pervasive game.

Brief history of role playing games

Having broadly defined computer games in general, a specific genre of role playing games will next be examined.

Pen and paper and computer role playing games formalise the playful role playing by creating make believe worlds and adding a set of rules. This formalisation of role playing allows details to be shared, so that the game can be shared and seen to be played according to an agreed set of rules. A key component of role playing games is stories. There is a thread of story telling that extends back for as long as ideas have been recorded. Stone Age cave paintings tell stories of the hunt, the Sumerian epic of Gilgamesh was written down around 2000BC, scrolls and books were used to record stories for thousands of years and more

recently stories have been portrayed on cinema screens with moving images. Computer games are one of the latest media for story telling, some of the first games, such as the text based fantasy Colossal Cave Adventure (Jerz, 2004), have explicitly taken the telling of a story and added interactive elements. In popular fiction the fantasy genre, elements of which featured in Colossal Cave Adventure and subsequent computer games, was popularised by J.R.R. Tolkein's The Hobbit, first published in 1937, and The Lord of the Rings trilogy, first published 1954 to 1955.

The nascence of game playing rules that feature in role playing games can be traced back to the first half of the 19th century when Lieutenant George Heinrich Rudolph Johann von Reisswitz created the game Kriegspiel, which was based on a wargame designed by his father, Baron von Reisswitz. In this game the players moved tokens representing troops around a map, under the guidance of an umpire, similar to a modern games master (Michael, 2005). Following the success of Kriegspiel in securing Prussian victories the game was adopted by other armed forces around the world and variations still continue to be used in military training today.

In 1913 a set of rules for playing a war game with toy soldiers was published in the book 'Little Wars' by H. G. Wells. This signalled a key step in the development of table top war gaming. Little Wars built on games H. G. Wells played with his friends using toy soldiers and guns. H. G. Wells also discussed Kriegspiel in Little Wars, exploring the relationship between the two games, concluding that Little Wars is more fun than Kriegspiel, which, 'as it is played by the British Army, is a very dull and unsatisfactory exercise, lacking in realism, in stir and the unexpected, obsessed by the umpire at every turn, and of very doubtful value in waking up the imagination, which should be its chief function'. (Wells, 1913)

There is a thread of tabletop war gaming that leads from Little Wars to the combining of games with fantasy literature to produce the first fantasy table top role playing game 'Chainmail' in 1971.

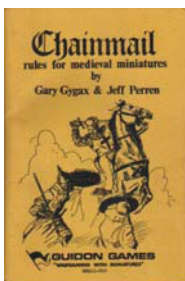


Figure 2: Chainmail 1971

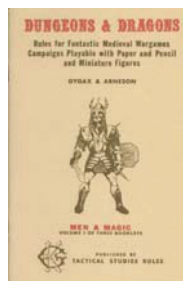


Figure 3: Dungeons and Dragons 1974

This was created by Gary Gygax and Jeff Perren. Gary Gygax teamed up with Dave Arneson to create Dungeon and Dragons, released in 1974 by Gary's company Tactical Studies Rules (TSR). (Hallford, 2001)

Dungeons and Dragons built on traditional the tabletop war gaming by not only introducing a Tolkein inspired fantasy scenario but also by introducing individual goals for characters. This had been previously tried in 1967 by Dave Wesely who passed this on to Dave Arneson. The Dungeons and Dragons franchise rapidly grew in popularity and other paper based role playing games appeared sharing similar game play mechanisms.

Pen and paper role playing games are moderated by a 'game master' (called a dungeon master in Dungeons and Dragons games) who describes what is happening and controls non-player characters. Interactions in the game are affected by dice throws, the game master throwing dice for non-player

characters (monsters and so on). Player controlled characters have sets of attributes which affect how the player characters perform in the tasks created by the game master. A set of rules is used to determine the outcomes of encounters between characters. These sets of rules contain tables that show the dice rolls required to perform particular actions, based on the attributes, armour, weapons and so on carried by opponents. Experience points are earned by players as they progress through the game. At key levels of experience points players move up to higher experience levels, increasing the power of their character.

Play by mail is a variation on the Dungeons and Dragons style of paper based role playing. In play by mail the players post their moves to the game master, or game moderator, who enacts their moves for them and then posts back the results. Games are either moderated by hand (using dice and so on) or computer or a combination of the two. (Mulholland & Mulholland, 1989). With the advent of the Internet the use of email has widely replaced traditional postal play.

The American company Wizards of the Coast, founded in 1990, became a worldwide success when it combined role playing games with trading cards and launched its trading card game Magic the Gathering in 1993. In 1997 Wizards of the Coast was granted 'an exclusive patent on trading card games and their method of play' (Wizards of the Coast: About Wizards, 1995-2006).

Magic the Gathering is played with playing cards which represent territory (lands), creatures, spells, artefacts and so on. Essentially two players compete, each pitting their own pack of Magic cards against the other player's. During play the health of the players (tracked with a token on a play mat) varies until one player runs out of health and loses. The packs of cards, or decks, are constructed by the players from cards that may be bought in boxed packs or in small numbers in foil wrapped 'booster' packs.

Another variation on role playing games is live action role playing (LARP), also known as 'Interactive Theatre' or live role playing, in which game players take their gaming into the real world. Rather than play games with characters represented in computer generated worlds or on paper, in live action role playing games the players dress up and take on the roles of game characters. Some live action games include live combat, others rely on dice rolling (or similar mechanism) which may be run by a games master (Yermish, Horrill, Hill, & Olmstead-Dean, 2000). A key feature of live action role playing is that it is fundamentally a multiplayer game that takes place in the real world.

As these different types of role playing game were evolving another important gaming revolution was underway, the development of computer games. Many of the early games being influenced by fantasy and, as will be shown, by role playing games.

The first computer adventure, originally called 'Advent' or 'Adventure', was written by William Crowther 'around 1975 give or take a year' (Jerz, 2004). This was then expanded by Don Woods to Colossal Cave Adventure in 1976 (Adams, 2004).

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Outside Grate
> down
In A Valley
You are in a valley in the forest beside a stream
tumbling along a rocky bed.
> down
At Slit In Streambed
At your feet all the water of the stream splashes into a
2-inch slit in the rock. Downstream the streambed is bare
rock.
> south
Outside Grate
You are in a 20-foot depression floored with bare dirt.
Set into the dirt is a strong steel grate mounted in
concrete. A dry streambed leads into the depression.
>

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Figure 4: Adventure screen (ibid.)

These were the first text adventure games. In these games the player enters typed text commands to move around an environment of described locations and interact with items and characters encountered within that environment. All interactions are described in text.

One of the first commercially successful text adventures was Zork, created in 1978 and released by the leading text adventure company Infocom Inc. in 1980 (Lebling, 1978).

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West of House                                     Score: 0      Moves: 4
West of House
You are standing in an open field west of a white house, with a boarded front
door.
There is a small mailbox here.
> examine mailbox
The small mailbox is closed.
>open mailbox
Opening the small mailbox reveals a leaflet.
>take leaflet
Taken.
>examine leaflet
"WELCOME TO ZORK!"
ZORK is a game of adventure, danger, and low cunning. In it you will explore
some of the most amazing territory ever seen by mortals. No computer should be
without one!"
>

```

Figure 5: Zork (ibid)

These text adventures were an inspiration for the first multi-user dungeon, or MUD, (Bartle, 2004) created in 1978 by Roy Trubshaw at Essex University. Roy was soon joined by Richard Bartle and together they produced a text based multiplayer persistent world in which players could co-operate and compete. Within a few years more multi-user, virtual world games were created and the evolution leading to more recent graphically rich massively multiplayer games was initiated (ibid).

Inevitably paper based role playing games and computer games, both text adventures and the early graphical videogames, combined to create the first computer role playing games (sometimes called CRPG) such as Richard Garriott's 1979 Apple II game Akalabeth.

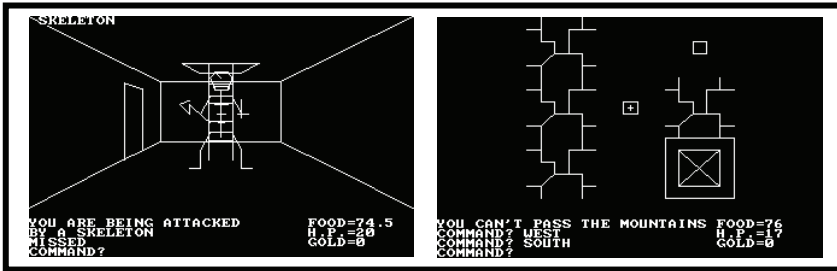


Figure 6: Akalabeth

By 1980 Richard Garriott had developed the first Ultima game (Plaid Dragon, 1995) which was published by Origin Systems Inc. There was a role playing system at the heart of the game as the player gained 'experience' points as they progressed through the game.



Figure 7: Ultima I screens

Dungeons and Dragons (paper)	Ultima I (computer)
Strength	Strength
Intelligence	Intelligence
Wisdom	Wisdom
Dexterity	Agility
Constitution	Stamina
Charisma	Charisma

Table 1: Comparison of D&D and Ultima attributes

Comparing the player attributes of the original Dungeon and Dragons paper based gaming system with the attributes in the Ultima I game it can clearly be seen that the Ultima I game was influenced by the Dungeons and Dragons system.

From this time on computer role playing games were released with great frequency. In 1981 Sir Tech Software released 'Wizardry: Proving Grounds of the Mad Overlord', a game that featured game play mechanisms of race, character class and also featured the ability to control a party of characters in the game, rather than a single character (Hallford, 2001).

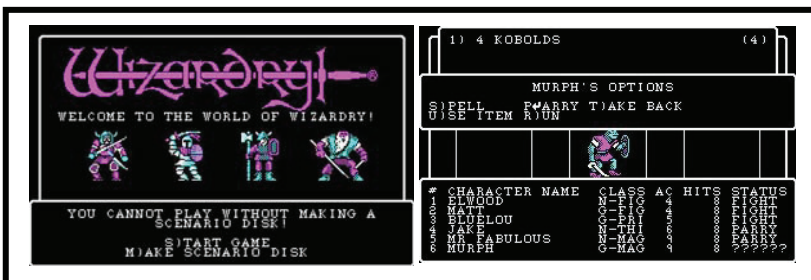


Figure 8: Wizardry screens

Even as the first computer role playing games were being released they very clearly belonged to a well defined game genre. They were so firmly rooted in paper based role playing games, in particular Dungeons and Dragons that the computer role playing game genre almost came into existence overnight. Other game

playing genres evolved as the games and technology became more sophisticated. For example the 2D shooters of the 1970s and 1980s evolved into the first person shooters of the 1990s as different game play mechanisms and interfaces were experimented with and as the computer technology developed.

The evolution of computer technology affected the look and feel of computer role playing games, but at the heart of them there were the familiar concepts of character attributes and experience points. The player characters in computer role playing games developed as the game progressed, in the same way that player characters did in paper based role playing games. These gameplay features have remained at the heart of computer role playing games, even though the graphics and sound became more sophisticated. For example modern games such as Elder Scrolls IV: Oblivion (Bethesda Softworks, 2006) still retain attribute and experience point systems.

Increases in graphical power facilitated the addition of graphics and single player role playing game interfaces to multi-user dungeons. With the growth of the Internet, massively multiplayer games in which hundreds, thousands, tens of thousands and even hundreds of thousands of players co-operate and compete in vast virtual game worlds were created. An exemplar game is World of Warcraft released by the company Blizzard in 2004 and which, according to Blizzard, had over 6.5 million players worldwide by 2006 (Blizzard, 2006). Players pay a monthly fee for this game and inhabit a vast persistent game world.

Not all massively multiplayer role playing games are set in fantasy worlds. There are also science fiction games such as Anarchy Online and Star Wars Galaxies. Eve Online is another successful science fiction massively multiplayer role playing game. In this game players control space ships (fleets of ships, space stations etc.) competing and cooperating in a large persistent volume of space. NCSoft has two superhero games: City of Heroes and City of Villains.

Single player computer role playing games have also moved beyond the fantasy role playing milieu of Dungeons and Dragons:

Milieu	Example game
Fantasy	Baldur's Gate
Science fiction	Star Wars: Knights of the Old Republic
Post-apocalyptic	Fallout
Horror	Vampire the Masquerade: Bloodlines
Superhero	City of Heroes
Cyberpunk	Deus Ex

Table 2: Role playing game milieu

There are some interesting gaps here that are perhaps filled by other games genres (1st person shooters, action adventures and so on). For example where are the equivalents of films such as 2nd World War films, historical films, romantic comedies and so on?

Gameplay mechanisms

Role playing games have outwardly come to look very similar to first person shooters (i.e. Doom) or action adventure games (i.e. Tomb Raider), however, the statistics at their heart have still remained within the games. The players' characters have still continued to gain experience and develop through the game. The screenshot below from the 2006 game Oblivion (Bethesda Softworks, 2006) shows one of the player character statistics screens.



Figure 9: Oblivion character attributes screen

Compare this with the Ultima 1 character attributes screen shown earlier. The graphics might have changed but at the heart of the game there are many of the same mechanisms.

The range of gameplay mechanisms found in computer role playing games serves to define the genre.

Mechanisms found include the following:

- Races
- Classes
- Attributes
- Skills
- Experience points and experience levels
- Combat
- Resource management
- Puzzles
- Story and Quests
- Exploration

These gameplay mechanisms which are frequently found in computer role playing games previously cited will now be described.

Races

Many games contain a variety of sentient species that the player can choose to play. For example in Elder Scrolls III: Morrowind (Bethesda Softworks, 2002) there are:

- Argonian
- Breton
- Dark Elf
- Wood Elf
- High Elf
- Imperial
- Khajiit
- Redguard
- Nord
- Orc

The race selected affects the abilities and attributes available to the player's character. For example if the player wishes to play a brutal warrior character they might choose to be an Orc. If they wish to be a magic user they might choose to be a High Elf.

Classes

Classes determine which profession the player's character is able to pursue. For example a player might choose to be a wizard if they wish to be a magic user. They might choose to be a warrior if they wish to rely

on brawn. In Star Wars: Knights of the Old Republic the player can choose between Star Wars themed classes:

- Scout
- Scoundrel
- Jedi Consular
- Soldier
- Jedi Guardian
- Jedi Sentinel

Attributes

Attributes give the abilities of a character. These core elements define what the character is capable of. Sometimes when games talk about character attributes they include Race and Class as attributes and list the variables given here as 'abilities'.

The attributes vary from one game to another but often have a number of similar elements:

Icewind Dale	Knights of the Old Republic	Vampire the Masquerade: Bloodlines	Final Fantasy 7	Fallout
Strength	Strength	Strength	Strength	Strength
Intelligence	Intelligence	Intelligence		Intelligence
Wisdom	Wisdom	Wits		
Dexterity	Dexterity	Dexterity	Dexterity	Agility
Constitution	Constitution	Stamina	Vitality	Endurance
Charisma	Charisma	Charisma		Charisma
		Manipulation		
		Appearance		
		Perception		Perception
			Luck	Luck
			Magic	
			Spirit	
			Attack	
			Defence	

Table 3: Table comparing character attributes

Some similar or equivalent attributes have been placed in the same row. For example Dexterity and Agility have broadly the same effect as do the Constitution, Stamina, Vitality and Endurance attributes.

As can be seen in the table above attributes like Strength, Intelligence, Dexterity/Agility, Constitution/Stamina/Endurance, Charisma that occur in most role playing attribute systems. There are also other less common attributes that are specific to only one or two role playing systems.

Skills

Skills are learned abilities that improve through use in the game. For example in the game Deus Ex the player's character can develop the following skills:

- Computer
- Electronics
- Environmental Training
- Lockpicking
- Medicine
- Swimming
- Weapons: Demolition
- Weapons: Heavy
- Weapons: Low-Tech
- Weapons: Pistol
- Weapons: Rifle

In this game the player gains skill points during play (through completing missions, finding hidden areas, finding characters and so on). The player can then spend their skill points on the skills they wish to improve. Each of the skills has four levels: Untrained - Trained - Advanced - Master. In the game Elder Scrolls IV: Oblivion skills automatically increase as they are used. So, for example, lock picking skill improves as the player's character picks more locks. Skills are an important way for players to customise and evolve their characters as they progress through games.

Experience

Experience is normally measured in experience points that are earned by completing game objectives. This is a useful mechanism for controlling the increasing power of a player's character as they progress through a game.

When target numbers of experience points are achieved players are able to increase the attributes of their characters. This is called 'levelling up' which not only measures the development of the player's character through the game but also acts as a powerful incentive to progress through the game. New skills may also become available when characters level up, which rewards players for continued play.

Level	Experience Points	Level	Experience Points
1	0	9	250,000
2	2,000	10	500,000
3	4,000	11	750,000
4	8,000	12	1,000,000
5	16,000	13	1,250,000
6	32,000	14	1,500,000
7	64,000	15	1,750,000
8	125,000		

Table 4: Levels and experience points for Icewind Dale fighters (Black Isle, 2000)

The Icewind Dale example above shows the experience points required for a fighter to progress to higher levels. This is based on the Advance Dungeons and Dragons rule set.

Story

Role playing games normally contain long and involved stories. Computer role playing games frequently take 20 or more hours to complete (for example, on the back of the Neverwinter Nights game box it says: 'Over 60 hours of single-player adventure' (Bioware, 2002)). The complexity of stories is evident in the inclusion of Journals in many role playing games. These are used to keep track of current active quests and may be automatically updated by the game as objectives are completed. Completed missions may be recorded and also the text of conversations the player has had with characters in the game.



Figure 10: Journal from the game The Elder Scrolls III: Morrowind

There is normally a central overarching quest to be completed, the main plot. Connected to this are subplots, some of which may be necessary to complete the game, although they do not tie in to the main plot. In addition to the subplots there are likely to be other optional plot arcs that are self contained and completely separate from the main plot.

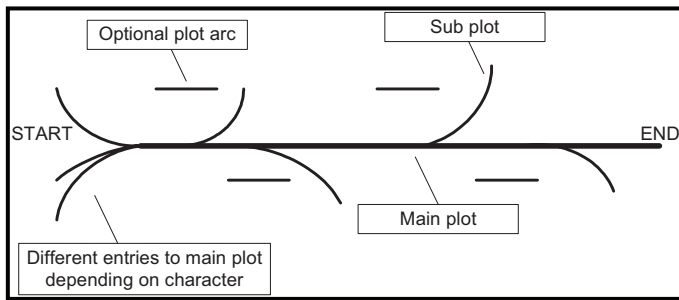


Figure 11: Role playing game plot

Quests

The story in a role playing game is threaded through the quests. They might be viewed as a delivery mechanism for stories in role playing games.

Games have traditionally been divided into a number of levels. This has allowed new graphics and sounds to be loaded up for each level and has been a useful way of dividing up games, like chapters in books, or episodes in television serials. Some computer role playing games are divided up into levels (Neverwinter Nights, for example). Some have large contiguous areas, with a mechanism to load new terrain 'on the fly' as the player's character moves towards the edge of the currently loaded section of terrain (Morrowind, for example). In some games there are a number of these large contiguous areas of terrain, connected by cut-scenes (possibly of a travelling vehicle), portals or similar mechanisms (taxi travel between city zones in Vampire the Masquerade: Bloodlines, for example).

In role playing games the player is frequently given more than one objective to complete. Some of these objectives are achieved quickly in a single area or level, while others require play over a number of levels or areas of terrain. These sections of play, each with a main objective to complete, are called quests or missions. Quests allow game designers to move away from level based objectives to objectives that are level independent. These quests sit comfortably on top of either levels or large contiguous play areas.

Combat

There are two broad categories of combat in role playing games. The combat either real time 'twitch' combat or strategic combat in which the player relies on 'dice rolls' to determine the outcome of combat.

Twitch combat relies on the motor skills of the player. The player must react quickly and accurately in order to defeat enemies. The skill in this combat is in aiming and firing weapons accurately and quickly, Deus Ex contains this type of combat. Strategic combat requires the player to pick an enemy and specify which weapon they want to use and which attack they wish to launch. Once this attack is launched the computer calculates the outcome of the combat from the attributes and skills of the player and the attributes of the enemies, Baldur's Gate contains this type of combat. The hand eye coordination necessary for twitch combat is not the main deciding factor in strategic combat.

There are a number of games in which there is a combination of twitch and strategic combat. For example in the game Morrowind the player may play with a first person perspective, similar to a first person shooter. To launch an attack they must place their cross hairs over an enemy and then press the left mouse button to

strike or fire. As the player repeatedly presses the attack button messages are displayed telling the player the outcome of calculations being carried out by the game.

Final Fantasy VII uses a turn based system where the player's characters and the enemies are transported to a separate Battle Screen where they take it in turns to launch attacks at each other. Each player controlled character has a time gauge on this screen that must refill after each strike before the next strike can be launched. The time gauge controls the pace of the battle and puts time pressure on the players.

The weapons used in combat fall into three broad categories: melee, range, traps.

Melee, or hand to hand, combat may be used with or without weapons and requires the combatants to be in close proximity. Melee weapons would include fists, knives, swords, clubs and so on.

Range combat is used for weapons that act at a distance. The combatants are likely to be beyond each other's reach (though these might be also used close up). Examples of range combat weapons are rifles, guns, bow and arrows, throwing stars, magic fireballs and so on.

The third class of remote weapons, or traps, are set by the player who can then leave them and move on. They are either triggered by enemy proximity or have a timer that triggers them after a preset (user or automatically set) period.

Resource management

Role playing games typically contain many items. They contain weapons and armour suitable for use by each of the different races and classes. They normally contain a range of health potions or equivalent items for healing player characters. Fantasy games are likely to have a range of magic items (spell scrolls, magic staffs and so on). They may also contain items necessary for completing the main quest.

All the items collected by the player are normally managed on an inventory screen of some sort. This screen lists items and may also provide extra information on the items. It may also allow the manipulation of items.

During games players make strategic choices about what they are going to need and what they can carry. The availability of resources and the amount player characters can carry are useful mechanisms for balancing role playing games. Too many resources too freely available are likely to make the game easier, restrictions in quantities of resources and the amount that can be carried are likely to make the game more difficult.

Puzzles

Another very important component of role playing gameplay is the solving of puzzles. The importance of puzzles is evidenced by the inclusion of an intelligence attribute in most computer role playing games. This attribute allows characters to acquire skills that may be used, amongst other things, to solve puzzles.

Typical purposes of puzzles include: unlocking locations, revealing plot, gaining items, defeating enemies, helping non-player character 'friends'.

Puzzles frequently involve 'using' objects. The word 'use' is a catchall for activating or implementing or in some other way applying the particular properties of an object. For example, a player would 'use' a radio to turn it on.

Exploration

A large element of computer role playing games is exploration. Players must search the game world to discover useful items and clues. Environments may contain hidden objects and characters. They may be used to reveal story elements, both background story, sub-quest and main plot elements. They also may provide visual (and auditory) rewards for players.

Exploration is very closely tied in with the story telling in role playing games but does not always serve to move the plot forward. Similarly stories can be moved forward while there is no exploration. For example, imagine entering a location and searching for food. There is very little story in this activity; this is just a background 'housekeeping' activity to keep the player character healthy. The player is exploring the location, but there are no plot events occurring. Now imagine a non player character entering the location and talking to the player character. This conversation may be crucial to the story in the game, but is independent of exploration.

Table 5 shows the range of game play mechanisms and characteristics of popular and successful computer role playing games. All these games have been marketed as 'role playing games' and appear in lists of role playing games and hence are commonly understood to belong to the role playing game genre.

Previously the historical development of role playing games was examined followed by a description of gameplay mechanisms that may be found in computer role playing games. By combining the descriptions with this analysis of role playing games a definition of computer role playing games may be created.

Game	Races	Classes	Attributes	Skills	Experience points	Experience levels	Combat type	Combat resolution	Resource management	Puzzles	Exploration	Many quests	Story	No. of players	Player characters	Point of view (camera)	Milieu
Morrowind	Y	Y	Y	Y	Y	Y	RM	SD	Y	Y	Y	Y	Y	1	1	B	Fa
Oblivion	Y	Y	Y	Y	Y	Y	RM	S	Y	Y	Y	Y	Y	1	1	B	Fa
Baldur's Gate	Y	Y	Y	Y	Y	Y	RM	D	Y	Y	Y	Y	Y	1	T	I	Fa
Knights of the Old Republic	Y	Y	Y	Y	Y	Y	RM	D	Y	Y	Y	Y	Y	1	T	3	SF
Vampire TM: Bloodlines	Y	Y	Y	Y	Y	Y	RM	S	Y	Y	Y	Y	Y	1	1	B	Ho
Pokemon	Y	Y	Y	Y	Y	Y	M	D	Y	Y	Y	Y	Y	1	1	3	Fa
Final Fantasy 7	Y	Y	Y	Y	Y	Y	M	D	Y	Y	Y	Y	Y	1	1/T	3	Fa
Nox	Y	Y	Y	Y	Y	Y	RM	D	Y	Y	Y	Y	Y	1/M	1	3	Fa
Deus Ex	N	Y	Y	Y	N	N	RM	S	Y	Y	Y	Y	Y	1	1	F	Cy
Guild Wars	N	Y	Y	Y	Y	Y	RM	D	Y	Y	Y	Y	Y	Ma	1	3	Fa
World of Warcraft	Y	Y	Y	Y	Y	Y	RM	SD	Y	Y	Y	Y	Y	Ma	1	B	Fa
Neverwinter Nights	Y	Y	Y	Y	Y	Y	RM	D	Y	Y	Y	Y	Y	1	T	3	Fa
Fallout	N	N	Y	Y	Y	Y	RM	D	Y	Y	Y	Y	Y	1	1	3	PA
Planescape Torment	N	Y	Y	N	Y	Y	RM	D	Y	Y	Y	Y	Y	1	1	3	Fa
City of Heroes	Y	Y	Y	Y	Y	Y	RM	D	Y	Y	Y	Y	Y	Ma	1	B	Su

Legend:
Y - Yes, N - No,
Combat type: R - Range, Melee - M
Combat resolution: D - Dice, S - Skill
Number of players: 1 - Single player, Mu - Multiplayer, Ma - Massively multiplayer
Number of player characters: 1 - One player character, T - Team of player characters
Camera: Te - Text, F - 1st person camera, 3 - 3rd person camera, B - Both 1st and 3rd person cameras, I - Character independent
Milieu: Fa - Fantasy, SF - Science fiction, PA - Post apocalyptic, Ho - Horror, Su - Superhero, Cy - Cyberpunk

Table 5: Role playing game feature analysis

There is no definitive taxonomy of games, however games are commonly divided into genres. Table 6 compares the role playing gameplay mechanisms that are found in a range of game genres.

Genre	Races	Classes	Attributes	Skills	Experience points	Experience levels	Combat type	Combat resolution	Resource management	Puzzles	Exploration	Many quests	Story	No. of players	Player characters	Point of view (camera)	Milieu
RPG	Y	Y	Y	Y	Y	Y	RM	SD	Y	Y	Y	Y	Y	1	1/T	B	An
MMORPG	Y	Y	Y	Y	Y	Y	RM	SD	Y	Y	Y	Y	Y	Ma	1/T	B	An
MUD	Y	Y	Y	Y	Y	Y	RM	SD	Y	Y	Y	Y	Y	Ma	1/T	Te	An
MMOG	Y	N	N	N	N	N	RM	S	N	YN	Y	Y	Y	Ma	1	B	An
1st Person Shooter Single Player	N	N	N	N	N	N	R	S	N	Y	Y	N	Mo	1	1	F	An
1st Person Shooter Multiplayer	N	N	N	N	N	N	R	S	N	N	N	N	N	Mu	1	F	An
2D Shooter	N	N	N	N	N	N	R	S	N	N	N	N	N	1	1	I	An
Action Adventure	N	N	N	N	N	N	RM	S	N	Y	Y	N	Y	1	1	3	An
Survival Horror	N	N	N	N	N	N	RM	S	N	Y	Y	N	Y	1	1	3	Ho
Puzzle Adventure	N	N	N	N	N	N	n/a	n/a	Y	Y	Y	YN	Y	1	1	I	An
RTS	N	N	N	N	N	N	RM	SD	Y	N	Y	YN	Mo	1Mu	T	I	An
God	N	N	N	N	N	N	RM	SD	Y	N	Y	Y	Mo	1	T	I	An
Management	N	N	N	N	N	N	n/a	n/a	Y	N	N	N	N	1Mu	T	I	An
Virtual Pets	N	N	N	N	N	N	n/a	n/a	N	N	N	N	N	1	1/T	3	An
Board Game	N	N	N	N	N	N	n/a	n/a	N	N	N	N	N	1Mu	1/T	I	An
Puzzle	N	N	N	N	N	N	n/a	n/a	N	Y	N	N	N	1Mu	1/T	I	An
2D Platform	N	N	N	N	N	N	RM	S	N	YN	Y	N	N	1	1	I	An
3D Platform	N	N	N	N	N	N	RM	S	N	Y	Y	N	Y	1	1	3	An
Fighting (2D and 3D)	N	N	N	N	N	N	M	S	N	N	N	N	N	1Mu	1	3	An
Military Sim: Plane, Tank	N	N	N	N	N	N	R	S	YN	N	Y	YN	Mo	1Mu	1	B	An
Civilian Sim: Plane, Train	N	N	N	N	N	N	R	S	YN	N	Y	YN	N	1Mu	1	B	An
Imaginary Sim: Space	N	N	N	N	N	N	R	S	YN	N	Y	Y	Mo	1Mu	1	B	SF
Team Sports	N	N	N	N	N	N	n/a	n/a	N	N	N	N	N	1Mu	T	3I	An
Solo Sports	N	N	N	N	N	N	n/a	n/a	N	N	N	N	N	1Mu	1	B	An
Racing	N	N	N	N	N	N	n/a	n/a	N	N	N	N	N	1Mu	1	B	An
Rhythm Action	N	N	N	N	N	N	n/a	n/a	N	N	N	N	N	1Mu	1	I	An
Gambling	N	N	N	N	N	N	n/a	n/a	N	N	N	N	N	1Mu	1	I	An
Game show	N	N	N	N	N	N	n/a	n/a	N	N	N	N	N	1Mu	1	I	An
Quiz	N	N	N	N	N	N	n/a	n/a	N	N	N	N	N	1Mu	1	I	An
Card Games	N	N	N	N	N	N	n/a	n/a	N	N	N	N	N	1Mu	1	I	An

Legend:
Y - Yes, N - No, n/a - Not applicable
Combat type: R - Range, M - Melee
Combat resolution: D - Dice, S - Skill
Story: Mo - moderate importance
Number of players: 1 - Single player, Mu - Multiplayer, Ma - Massively multiplayer
Number of player characters: 1 - One player character, T - Team of player characters
Camera: Te - Text, F - 1st person camera, 3 - 3rd person camera, B - Both 1st and 3rd person cameras, I - Character independent
Milieu: An - Any, Fa - Fantasy, SF - Science fiction, PA - Post apocalyptic, Ho - Horror, Su - Superhero, Cy - Cyberpunk

Table 6: Game genre features

The game genre features in Table 6 show which role playing game features are found in other genres of game. This table very clearly shows that there are distinctive features in role playing games that are not found in other genres of games. In particular the following features seem to be unique to role playing games:

- Choice of player races

- Choice of player classes
- Player attributes
- Player skill development
- Experience points and levels

Definition of computer role playing games

Role-play has been present in our culture since children first played games. Perhaps it goes back even further if one considers the pretend play of young animals as role-play. However, the type of role playing that is under investigation here is the more formalised role playing that relies on a well-defined set of rules.

The Oxford English Dictionary talks of role-players taking on the role of imaginary characters engaging in adventures that are overseen by a referee or computer (Oxford English Dictionary Online: Draft Revision, 2004). This gives a general idea of the experience of a role playing game player, but is not enough to define role playing games as a distinct genre.

How role playing games evolved from tabletop war-gaming has been described. How paper based games, such as Dungeons and Dragons, might be considered a fusion of tabletop war-gaming and the fantasy books of JRR Tolkein has been described. The first role playing computer games have been described suggesting that they were firmly rooted in the paper-based games.

A number of more recent computer games that are commonly considered to belong to a role playing computer game genre have been analysed after looking at the history of role playing games in order to generate a list of role playing mechanisms that are commonly found in computer role playing games.

Drawing on the history of role playing games and the analysis of game play mechanisms found in computer role playing games it is possible to posit a definition of the computer role playing game genre:

'In computer role playing games players control one or more characters that gain 'experience' through the completion of game objectives. The 'experience' is manifested as player moderated changes in player character attributes ('strength', 'intelligence' and 'luck' for example) which allow the player character to evolve over the duration of the game.

Additional player character customization is facilitated through modification of character differentia such as race and class when initiating a player character ready for play and by game-play educed character modification during play, such as development and improvement of a skill by repeated use of that skill, or the spending of 'skill points' gained when levelling up.

The player character descriptors (attributes, differentia and game-play educed modifications) affect the in-game interactions between the player character, non-player characters and items in the game environment. The environment, objects, characters and interactions are effected in a virtual environment.'

Having arrived at a definition of computer role playing games this paper will next discuss technology that could facilitate the creation of an ambient game, prior to combining the role playing definition and technology to create a definition of ambient games.

Ambient technology

The descriptions in this section start with some assumptions about ambient games that will be explicitly made in the later section in which ambient games are defined. Suffice it to say ambient games are as 'ignorable as they are interesting'(Eno, 1978). Consequently it should be possible for the player to ignore the game, if they wish, while still playing it. The game technology should physically surround them.

There are may be possibly two ways that an ambient game could be implemented; either the player carries an ambient gaming system/identifier around with them or the game is embedded in the environment that surrounds the player.

For a truly ambient game the interface should be unobtrusive, allowing the player to easily switch between engaging and ignoring it as will be described later when an ambient games definition is suggested. Refer to figure 1 that suggested how the playing commitment to an ambient game could vary greatly. An ambient intelligent environment offers an ideal solution for addressing this suggested requirement and consequently the implementation of ambient games. There are a number of technologies and ideas that make the production of an ambient game possible. The evolution of technology suitable for playing ambient games has a number of key highlights.

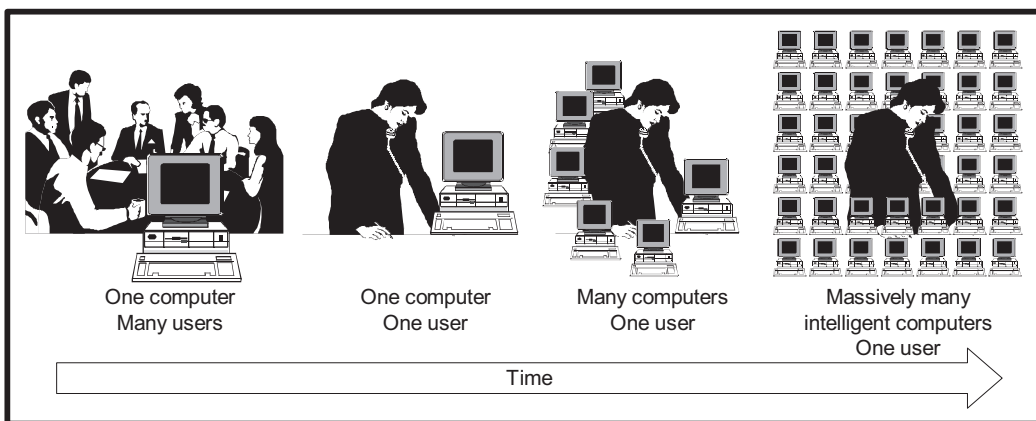


Figure 12: Growth of computers over time

The difference and analytical engines, designed by Charles Babbage from 1821 (Hackmann, 2005) set in place the groundwork for the first electronic computers. On the 6th May 1949 the EDSAC 1 (Electronic Delay Storage Automatic Calculator) ran its first program and became the world's "first complete and fully operational regular electronic digital stored program computer" (Jones, 2001) and computers started to enter commercial service. There were many users supporting each computer, the Cambridge computer laboratory staff list for 1948 contained fourteen people (ibid), though the computer was of interest to many more. This was the age of 'one computer – many users'.

The increasing computing power that has been key in making advances in computing possible was described by Gordon Moore in his 1965 paper in Electronics magazine, his now famous 'Moore's Law' (Moore, 1965), where he predicted that the number of transistors on a chip would double every two years (Twist, 2005). This has proved to be a conservative estimate with the rate of increase nearer to doubling every 18 months. In 1981 IBM introduced the 'personal computer' or PC and computers rapidly found their way onto desktops worldwide (IBM Archives: 1980s). The age of 'one computer – one user' had arrived.

Mark Weiser defined ubiquitous computing on his Xerox Palo Alto Research Center web page in 1996 (Weiser, 1996). He specified that there should, for example, be hundreds of wireless devices in an office that are invisible to the user. Invisible meaning that the system does not demand the user's attention, it is "...so imbedded, so fitting, so natural, that we use it without even thinking about it" (ibid).

By the turn of the 20th century computers had pervaded western industrial societies. People in regions like North America and Europe came into contact with many computers daily. For example the authors of this paper interact with many devices containing computer systems daily: home desktop PC, work desktop PC, car (car engine), mobile phone, mp3 player, television, satellite receiver, DVD player, dishwasher, microwave oven, rowing and exercise machines and games consoles. Many of the devices listed are networked to other systems, exchanging information and tapping into even larger computing resources.

Current computer game technology may be found in commercial devices such as consoles (PlayStation 3, Xbox 360, Nintendo Wii), computers (in particular those with Windows Vista that has been designed to better support gaming), handheld devices (mobile phones, Nintendo DS, Sony PSP), set-top boxes (Gamestar on Sky Active, delivered by Sky through Sky Box satellite receivers) and arcade machines.

The PlayStation Eye Toy and Nintendo Wii have interfaces that require users to stand and move around while playing, although within a very small area. There are other gesture interfaces that predate this. The Mandala 'video-based interactive gesture control of computer processes' system was patented by GestureTek corporation in 1996 (GestureTek). The other devices listed previously are not normally mobile, except the handheld devices. Even when playing on handheld devices the user is normally in a single location though the player may be moving while playing (on a train journey for example); these location changes are not currently connected to gameplay. However, devices with global positioning systems can be used for playing locative games. The obsolete Gizmondo was an interesting example of a device that combined location and connectivity with gameplay (BBC News, 2005).

Currently we are in the age of 'many computers – one user'.

With the emergence of ambient intelligence and ambient intelligence environments the age of 'massively many *intelligent* computers – one user' is arriving.

Ambient intelligence, also known as 'ambient technology', is being driven by interaction technology (new ways of using content, such as time shifting television programmes on hard drives, and new technologies, faster computers, greater storage and so on), experience economy (people do not just pay for goods, but for the experiences that are connected with them, for example eating at an exclusive restaurant) and ambient culture (the development of social groupings based on interests rather than on a geographical basis, for example virtual web special interest communities, like the Independent Digital Games Research Association at <http://www.digra.org/>) (Aarts et al., 2001).

There are a number of different technologies that are enabling the development of ambient intelligence: interconnectivity, artificial intelligence and the proliferation of computers. These technologies support the ubiquity, transparency and intelligence of ambient intelligence (ibid).

Ubiquity refers to ubiquitous computing in which a massive number of interconnected computers are embedded in the environment. 'It is invisible, everywhere computing that does not live on a personal device of any sort, but is in the woodwork everywhere.' (Weiser, 1996)

Transparency indicates how invisible ambient intelligence environments are (Aarts et al., 2001).

Intelligence relates to the interfaces and ways these interconnected computers respond and interact with people through user friendly interfaces. They are able to “exhibit specific forms of social interaction” (ibid).

The European Union’s Information Society Technologies Advisory Group (ISTAG) predicts that ambient intelligence will emerge from the convergence of three key technologies: Ubiquitous Computing, Ubiquitous Communication, Intelligent User-Friendly Interfaces (Weyrich, 1999).

The research division of the Netherlands company Royal Philips Electronics (Philips) has determined that ambient intelligence should have the following characteristics: context awareness, personalized, immersive and adaptive (Philips, 2004-2006). Context awareness entails devices knowing where they are and responding appropriately; for example a mobile phone might automatically switch to a silent profile when carried into a cinema. Personalized devices are able to deliver information and experiences tailored to the user. For example, a portable device carrying games and music selected by the user and also monitoring the user’s health. This definition is far reaching in places and also clearly aimed at supporting Philips’ products, such as their ‘Ambilight’ television technology in which a light located at the rear of televisions react to the colours and brightness of images on the screen. However it is a very strong indication of the acceptance and future growth of ambient intelligence.

Ambient intelligence systems may also require locative information, specifying their location and also identity knowledge, they may need to differentiate between different people. For example if one of the functions of an ambient intelligence is to control the lighting within a house it not only needs to be able to turn lights on and off as people move through the house, but also set brightness levels according to the preferences of individuals.

In order to fulfil the transparency requirement communication with ambient intelligences should be seamlessly integrated into the environment. Computer workstations or input panels do not fulfil transparency. The user might expect to be able to communicate with ambient intelligences through speech or gestures, with the ambient intelligences responding in speech or with their available interfaces (perhaps momentarily dimming lights to indicate that a request has been received and stored).

As devices proliferate it becomes useful to be able to identify them. Different components in ubiquitous systems need identity in the same way that in games each of the non player and player characters need identity. If there was no way of identifying individual components then it would be impossible to know the outcome of interactions.

Currently items may be tagged in the physical world with Radio Frequency Identification tags (RFID) tags. These are transponders that respond with a unique serial number when a reader sends a signal to them. They are frequently used for tracking goods through supply chains, where it is useful to know the location and identity of the goods (RFID Centre, 2005).

People may be tracked in the real world using face recognition systems (Zhao, Chellappa, Rosenfeld, & Phillips, 2003). This recognition has great implications for ambient intelligence environments where they might be used to recognise and track people as they move around and also to ensure that the systems respond appropriately to known individuals (Grgic Ph.D, 2006).

Augmented reality and pervasive gaming

The introduction of existing, commercially available, devices able to track the position of people in the world, such as global positioning systems, is opening up many opportunities to explore new ways of playing games, in augmented reality games and pervasive games for example.

Players of augmented reality games wear a head mounted display that allows them to move around the real world with computer generated images superimposed onto the real world. The equipment tracks the player's location and where they are looking then generates appropriate images.

Examples of augmented reality games include Pac Man at the Mixed Reality Lab, Nanyang Technological University (Human Pacman, 2006) and ARQuake at the University of South Australia (Thomas, 2002).

Augmented reality technology gives one route forward for gaming in the environment, but still requires the user to carry equipment around with them. In its current incarnations augmented reality requires the user to make a substantial commitment of time and effort to play the game.

Pervasive games are games which extend gaming experiences into the real world. They include locative games in which players (though not necessarily all of the players) move into the real world while playing and their position and actions in the real world affect, and are affected by, events in a virtual world (Waern, 2006). There are a number of different variants of pervasive games; the IPerG research consortium lists the following areas of pervasive gaming: crossmedia games, socially adaptable games, massively multiplayer reaching out, enhanced reality live role playing, city as theatre (ibid.). These examples differ from ambient games in the commitment the player makes to the game and the frequent requirement of the player to carry around hardware in order to play the game.

Pervasive game pioneer Steve Benford categorises pervasive games in the following groups:

- Mapping classic computer games onto real-world settings (e.g. Human Pacman)
- Focus on social interaction (e.g. CatchBob!)
- Touring artistic games (e.g. Uncle Roy All Around You)
- Educational games (e.g. Savannah)

(Girardin, 2005)

In their 2005 paper Sonja Kangas and Outi Cavén-Pöysä describe 'utility games' which fall into three groups:

1. Cognitive sensomotoric games (early console, arcade games etc.)
2. Social know how, psychomotoric (haptic, spatial, gesture) games (console, mobile games)
3. Participatory affective games (ambient intelligence, pervasive computing, ubiquitous computing)

(Kangas, 2005)

The ambient games discussed in this paper fall within the third group of 'ambient utility' pervasive games described here. They are concerned with mood, or affectivity. Ambient games are described as a subset of pervasive game.

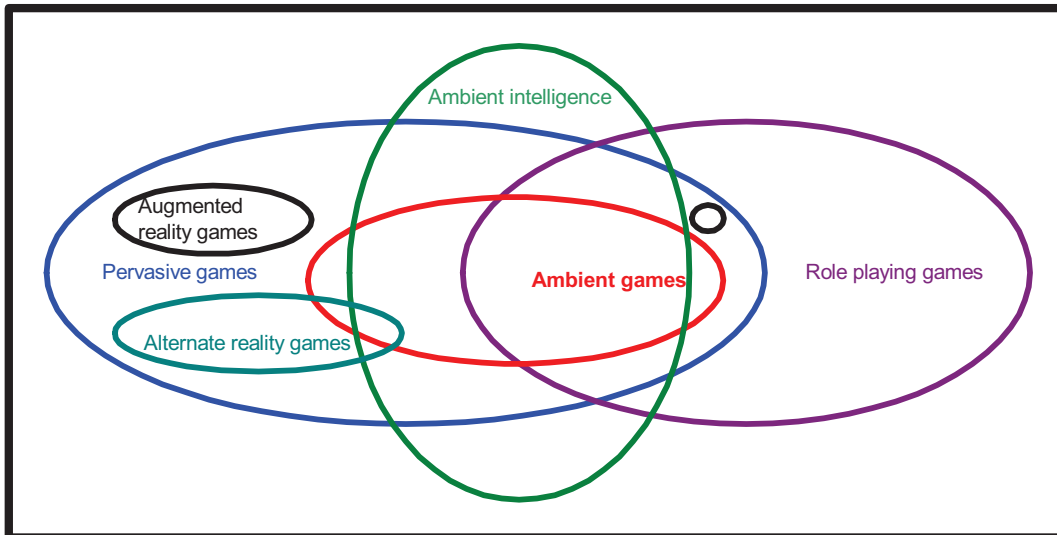


Figure 13: Pervasive games, ambient intelligence and ambient games

Alternate Reality Games (ARG), sometimes known Cross Media Entertainment – (XME), are according to an article on CNET News.com:

"...an obsession-inspiring genre that blends real-life treasure hunting, interactive storytelling, video games and online community..." (Borland, 2005)

The Alternate Reality Gaming Network defines alternate reality games as "an intensely complicated series of puzzles involving coded Web sites, real-world clues like the newspaper advertisements, phone calls in the middle of the night from game characters and more. These games (which are usually free to play) often have a specific goal of not only involving the player with the story and/or fictional characters but of connecting them to the real world and to each other. Many game puzzles can be solved only by the collaborative efforts of multiple players, sometimes requiring one or more players to get up from their computers to go outside to find clues or other planted assets in the real world" (Alternating Reality Gaming Network, 2002-2006). Unlike augmented reality games they do not normally require special equipment to be carried around by the players while they are being played, though players are likely to need access to computers, phones and other sources of information.

Many alternate reality games are used for promotional purposes, for example the first alternate reality game, *The Beast* (archived at Cloudmakers.org (Cox, 2001-2007)), was used to promote the film *AI: Artificial Intelligence* in 2001. More recently, 2006, Volvo cars has used alternate reality game 'The Hunt' to promote the release of a new XC90 car (<http://thehunt.volvocars.net/uk/thehunt/>). The alternate reality game *Perplex City* (<http://www.perplexcity.com/>) is not a promotional tool, but makes money from selling clue cards to players. As well as clue cards *Perplex City* also delivers puzzles and clues via websites, podcasts, emails, texts and live events.

Alternate reality games combine events in virtual computer spaces and the real world to create a coherent gaming experience. They are frequently multiplayer, requiring co-operation between two or more players to solve puzzles and progress. The unfolding stories in these games blur the boundaries between reality and fantasy by incorporating game elements into the real the world that influence game play in online worlds.

Alternate reality games are very similar to ambient games, but still require a different commitment from the player, demanding specific game playing behaviours. They are not normally driven purely by normal everyday behaviours in the same way ambient games may be. Further alternate reality games are frequently designed to engage players in game play that leads to a clear victory condition (i.e. the treasure is discovered by the winning player). They are not designed to create a mood in the player, though this may occur as an emergent property of playing the game. However it is possible to imagine an alternate reality game that is also an ambient game, requiring the same kind of commitment as an ambient game. Alternate reality games and ambient games are not mutually exclusive.

As has been described ambient games are a type of pervasive game that are related to augmented reality and alternate reality games. However they do not require the player to carry around equipment like the augmented reality games and they are not normally driven by the same game play behaviour as alternate reality games. Although ambient games are likely to use computer game technologies, they are different from computer and console games, allowing the player to move around an environment rather than being focussed on single computing device (albeit networked) in a single location. The next section hones in on a description of ambient games.

Ambient music, ambient games

Brian Eno coined the term 'ambient music' on his album *Ambient 1: Music for Airports* released in 1978. In the sleeve notes of *Music for Airports* Brian Eno gives a definition of ambient music, "Ambient Music must be able to accommodate many levels of listening attention without enforcing one in particular; it must be as ignorable as it is interesting" (Eno, 1978). In a talk he gave for the Long Now Foundation's series of Seminars About Long Term Thinking in 2003 he talked about *Music for Airports* "I wanted to make a kind of music that would actually reduce your focus on this particular moment in time that you happened to be in and make you settle into time a little bit better." (Eno, 2003)

Since *Music for Airports* there have been many pieces of music produced that purport to be 'ambient music'. On the CD 'Ambient: A Brief History of Ambient Volume 1' released by Virgin Records in 1993 there are artists as diverse as Hawkwind, Gong, Nusrat Fateh Ali Khan and Killing Joke as well as more obviously ambient artists like Harold Budd, Tangerine Dream and Holger Czukay. (Hopkins, 1993)

The description of ambient music and the ambient pieces produced by Brian Eno serve as a guide to the creation of an 'ambient games' definition and acts as a useful reference point and context for the creation of ambient games. The key questions that are addressed in this paper are 'If ambient music was reinterpreted as a computer role playing game, what would the game play be like?' and more generally 'What kinds of technology might be required to create an ambient game?'

Role playing games have been picked because they contain many different game play mechanisms to draw on when developing ambient game ideas. Other genres could have been chosen, though some, such as first person shooters and beat 'em ups, might force the player into interactions that would move the game play away from the ambient area. Without constraining this paper to one genre every game genre would need to be considered and resource and time constraints do not allow this. Future research might look in other areas, such as developing ideas for ambient real time strategy games, for example.

Specifying an ambient game

Progress Quest is an example of a game that requires minimal player intervention (www.progressquest.com (Fredricksen, 2004)). All a player needs to do to play Progress Quest is set the game running. The game displays the player's character's role playing statistics and lists the completed quests and so on. The player need not intervene again as Progress Quest continues to play, all gameplay decisions are made automatically.

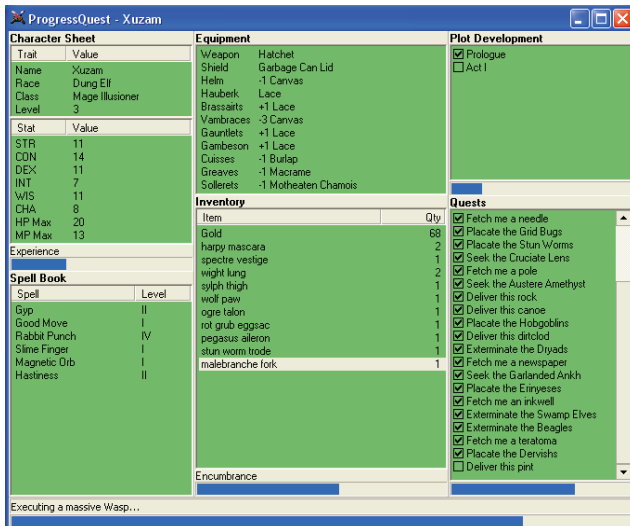


Figure 14: Progress Quest

In order to play Progress Quest the player has to start the game running, consequently it may be argued that there is some (minimal) participation from the player; it is not possible to play the game without starting it running, though there is very little commitment needed by the player. A player might ask someone else to start the game running for them, but they would still have made a decision to play the game, they would be actively involved. There is no possibility of playing the game unknowingly. Even if the player were to set up a program that started Progress Quest at random times while the computer was turned on they would still have made a decision to play the game.

Progress Quest shares characteristics with films. The game requires the same sort of interaction that is necessary for watching a film on DVD. The player starts the DVD playing and then watches the story unfold on a screen. The difference between a film and Progress Quest is that in a film all the decisions have already been made. The viewer will see the same sequence of scenes whenever they watch the film. Progress Quest generates the story in real time. Players assume a new identity every time they start a new game of Progress Quest and become participants in a unique story.

Imagine a game similar to Progress Quest, call it Ambient Quest, in which, when the player starts the game, their actions in the real world affect progress in the game world. The game world consists of a virtual environment containing quests to complete (achieved by defeating monsters at various locations). In this game the player chooses the degree to which they wish to manage events in the game. At one extreme the game runs itself, gathering data from the player's actions in the real world and automatically applying this to the game world. At the other extreme the player can determine how the real world data is applied in the game world, micromanaging game interactions.

The player may choose to manipulate their actions in the real world to generate data required to progress more successfully in Ambient Quest. Alternatively they may ignore the consequences of their actions in the

real world and allow data to gather without consciously changing their behaviour. There is some commitment by the player to play the game, though it is possible that actions and behaviours of the player that occurred before they started the game might be used in the game.

For example, say the data gathered from the real world is the distance walked by the player (and it may be that distances walked before starting the game are included in this data). This distance is converted into the distance the player's character can travel in the game and hence affects the number of activities, or quests, that can be completed. The player can either let the game randomly choose the direction their player character moves (and hence the quests attempted) or they can select where they wish their character to travel and hence which quests they wish to attempt. This choice allows the player to determine the commitment they wish to make to the game. It allows them to ignore the game if they wish or become more involved in the game play, hence giving the player a range of possible behaviours as they respond to the game play mechanisms and the mood created by the game.

In live action role playing (LARP) games a group of players gather and take on game roles, acting out the game in a real world location. This is different to the proposed ambient games in which the actions of players' normal everyday behaviours may affect events in the game world. An ambient game is coincident with real life and has elements that are superimposed on the real world.

In a live action role playing game the players must make a large commitment of time and attention to the game, in an ambient game the game-play is in the background. The player of an ambient game may choose how much attention they focus on the game, being able to bring it back to their attention whenever they wish. Compare this to ambient music which is composed to be in the background, though the listener can bring it to the foreground and focus their attention on it if they wish. Once again this echoes the stated intention of Brian Eno's Music for Airports to be 'as ignorable as it is interesting'. (Eno, 1978) Ambient games may also create similar moods, or affectivity, as ambient music.

At the heart of ambient games is the idea that the players can dip in and out of the game; that the game is running in the background while they are engaged in other activities. The player has the ability to have a low level of affective engagement. This is fundamentally different from, say, playing a chess game where the player might take a break from the game and then return to playing the game the next day. The player is not actively making chess moves during the break; they are not playing the game during this time. Compare this with an ambient game which is always 'on'; there are no breaks. Additionally chess is not designed to create moods in an environment, is played in a fixed location (situated around the chess board).

New ways of playing computer games in the real world, such as augmented reality gaming, pervasive gaming and alternate reality games have been described in order to set the idea of ambient games in context. Ambient games have been both differentiated from these and shown to overlap in places.

Ambient games can be defined as games that are controlled by everyday actions (i.e. not using a dedicated game input device, mouse or keyboard) in everyday, real world environments that have gameplay consequences in a virtual game world. These game play environments may be facilitated by ambient intelligent technologies that embed the game transparently in the surroundings. However, although the enabling technology described here is ambient intelligence, other pervasive or ubiquitous technologies may be used to implement ambient games. Similarly a piece of ambient music may be played on a variety of different sound systems (from mono to surround sound, for example) but still create the same mood.

Ambient games do not demand the attention of the player, they are 'ignorable as they are interesting' (Eno, 1978), allowing players a wide depth of interventions from letting the game play itself to micromanaging game events. They also allow the player to have experiences that range from superficially shallow to profoundly deep. The player is able to choose how they focus their attention on the game, and alter their degree of attention at will. As with Music for Airports an ambient game should accommodate many levels of attention and many levels of involvement or intervention designed to create a mood in the environment. The involvement of the player in the game is not determined by the game, this is not a 'push' technology, but is determined by the player who can choose when to 'pull' game experiences from the ambient game. Most computer games operate by pushing decisions on the player and forcing interactions.

Ambient games are coexistent with the real world and may be seamlessly controlled by the intelligent interfaces of ambient intelligent environments. The interfaces give information on the progress of the player's player character (or avatar) and allow the player to interact with the game's virtual world through gesture, speech and movement. Other things that players do in the real world such as spending money might also be integrated into ambient games. Further the players ideally should not need to carry around equipment to play the game; it is embedded in their environment and there is no equipment that might be distract from the atmosphere or mood, the 'ambience', created.

An example of a game in which the player carries equipment would be Dan Sutch's Fizees (Tamogotchi like digital creatures that are nurtured by the physical actions of their owner) (Sutch, 2006). Other similar applications might require the player's heart rate, respiration and so on to be used to control an avatar. Crucially these are not attached to a specific location but are independent of place.

The ambient game description given allows for single player, multiplayer or massively multiplayer gaming. The number of players is not a defining feature of ambient games.

Drawing together ideas of role playing games, ambient intelligence and ambient music suggests definitions of ambient games and ambient role playing games:

'Ambient games are designed to create a mood in an environment through game interactions with players whose behaviours, mediated by an ambient intelligent environment or similar transparent game interface, create changes in a virtual game world. Ambient games are persistent and are as interesting as they are ignorable, facilitating a wide variation in player determined levels of involvement, from unaware to intensely attentive play.

In ambient computer role playing games player behaviours affect one or more characters that gain 'experience', and other character customizations, through the completion of game objectives in a virtual world.'

Implementing an ambient game simulation

The game Ambient Quest is an example of a simple, inexpensive ambient game simulation for single players. Ideally Ambient Quest would be played in an ambient intelligent environment with a sophisticated 3D virtual world and intelligent interfaces and many more aspects of the players' activities would be mapped onto their avatars. However, in order to test out some of the ideas of ambient games with a moderate budget single player Ambient Quest has been designed to be played using a simple 2D virtual world and the

ambient intelligent environment has been somewhat simplified with the ambient presence being simulated by carrying a device. Only the distance travelled by the players is used to control their avatars. Rather than measuring this using cameras embedded in the environment and face recognition software etc. the distance is simply measured by a pedometer that measures the number of steps taken by the players. Players enter these distances into the game by sending them in an email, or reporting them, to the researcher who takes on the role of the intelligent interface and enters these distances manually into a game engine that then provides a log file that may be used by the players to display the activities of their avatars.

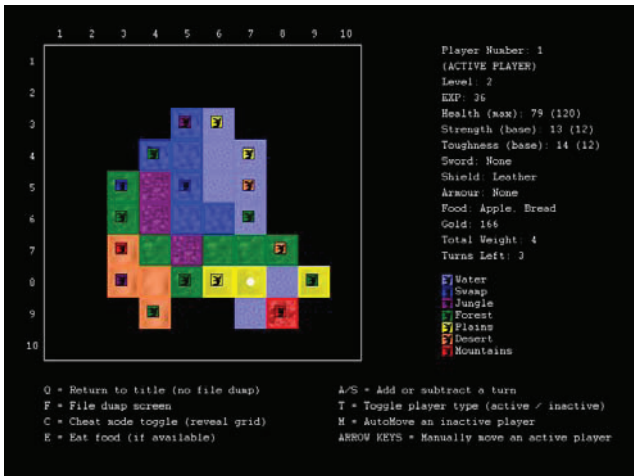


Figure 15: Ambient Quest screen layout

The limitations of this system are that the players do have to make a little more commitment to the game than would actually be necessary in an ambient game implemented in an ambient intelligence environment. However this is kept to a minimum. Players wear pedometers, note the readings on the pedometers, then send these to the researcher who tracks the moves available to the player. The researcher returns log files that the player may use to view the activities of their avatar in the virtual world using a game client installed on their computer. Also the game is not tied to a location, though ideally for analysis of players' changes in behaviour during the game it should be played in a limited area of locations commonly visited by the player.

In addition to supplying the distance walked there are two ways for players to control avatars. Firstly the avatars move in random directions, without player intervention, automatically fighting enemies they encounter and so on. Secondly the player may decide the direction their player character travels, and hence determine the occurrence of fights and so on. These directions are supplied to the researcher with the distance walked for entering into the game engine. For convenience these two modes of play may be termed 'passive' and 'active'.

The virtual game world comprises a two dimensional grid. Player characters can move north, south, east or west (not diagonally). If they pass through a square containing a pickup then this is automatically picked up and any actions triggered by the pick up are resolved immediately. If they pass through a square containing an enemy then they automatically enter into combat, which is resolved by comparing player 'attack' against enemy 'defence', modifying the outcome with a dice roll. If the enemy is defeated then there is a chance it will drop something the player can take.

Within the framework of a game design research methodology Ambient Quest is currently being used as a research tool to explore ambient game playing and player behaviour. The role playing game elements might

be extended in the future with more mechanisms in order to further explore ambient role playing game space.

Ambient Quest has key properties required for an ambient game, but does suffer from a number of deficiencies. It is designed to create a mood in the playing environment, overlaying a sense fantasy adventure on the real world and giving a hint of other hidden worlds. A fully realised ambient game might conjure up a sense of otherworldliness perhaps similar to the version of our world in John Crowley's fantasy novel *Little Big*:

'It is another world entirely and is enclosed within this one; it is in a sense a universal retreating mirror image of this one, with a peculiar geography ... composed of a series of concentric rings, which as one penetrates deeper into the other world, grow larger ... each perimeter of this series of concentricities encloses a larger world within'. (Crowley, 1981)

Players of Ambient Quest may choose the amount of attention they are going to give to the game, either specifying their moves and altering their behaviour (by walking more) to facilitate progress within the game world, or letting the game calculate moves for them and not altering the distance they walk. The pedometers are the game interface that generate a limited intrusion into the real world and also record a change in players' behaviour for a particular aspect of the game that represents the users' real life world. The game itself and the 2D computer environment are the mood, or affective, enhancers or the motivators that are designed to enhance the players' engagement with their 'real world', should the user choose to engage with the game at any point. It is accepted that the game poorly imitates ambient technology and intelligent environments and only mimics a limited aspect of possible engagement with the players' 'real' environment.

An ambient game is designed to positively impact 'the players' real world experience', e.g. affective changes, altering player mood. The application of this may be to change the players' observed real world behaviour. This opens up the opportunity for many diverse applications.

The game is persistent, as long as players continue to wear their pedometers they are involved in playing the game. Using a pedometer makes for a reasonably transparent device, which once clipped to a belt is easily forgotten.

The game Ambient Quest features an experience system and encounters broadly based on the kinds of role playing game system previously described in this paper.

The future of ambient games

Future research in ambient games is planned to reveal their use outside of pure entertainment. Imagine a job which involves fairly repetitive actions which are not in themselves especially rewarding. Could an ambient game be designed that ran alongside this work and brought an element of playfulness to the job? For example, imagine an ambient game that drew its data from supermarket shelf stacking, with employees belonging to different teams that were represented by competing avatars in a virtual world. If ambient games are proven to modify behaviour then they might be designed to have a direct effect on productivity, rewarding productive work practices and penalising poor practices. Outside of the work place ambient games might be used to encourage healthy life style choices, perhaps increasing the amount of exercise that people take. The Ambient Quest game could affect simple choices such as whether to take a lift or use the stairs.

The target audience for ambient games includes both dedicated gamers and casual gamers. There should be no barrier to playing an ambient game. For example there are no complicated control systems to learn, no complex technology for the player to master. Ambient games may present opportunities to open new gaming markets, in particular ambient games offer interesting possibilities for designing games that are tailored to appeal to women. Ambient games do not place importance on achieving high scores or penalising players for errors, both cited as barriers for women playing games by game designer and producer Sheri Graner Ray. They offer opportunities for activity based game play in preference to goal orientated gameplay preferred by men (Graner Ray, 2004). Ambient games are also able to offer co-operative gameplay opportunities. Imagine an ambient game in which players are together trying to nurture the plants in a virtual garden through their actions in the real world or a Sims like game where the players' real world actions affect relationships of avatars in a Second Life like virtual world.

Conclusion

This paper has described a novel way of playing games, building this description from a number of different areas that meet in ambient games. The ambient music roots of ambient games have been described, showing how the former informs the latter. Definitions of computer games, and more specifically computer role playing games, have been suggested. The growth of technologies suitable for implementing ambient game systems has been described. The relationship of ambient games to augmented reality, alternate reality and pervasive gaming has been described. A way forward for research into ambient games has been suggested with the description of a simple ambient game prototype, Ambient Quest.

Future applications of this exciting (ignorable as it is interesting?) gaming technology have been suggested, showing that this is not only of theoretical interest but may have a significant impact in a number of serious gaming areas. In addition, ambient games are a way in which game players may play even when they are not playing! They offer a mechanism to embed mood and behaviour altering game playing in the world around us. The open ended, endless nature of play in ambient games points towards new mechanisms and ways of playing games that forces us to consider new grammars of play.

References

- Aarts, E., Harwig, R., Schuurmans, M., & Denning, P. (2001). Ambient Intelligence. In *Ambient Intelligence* (pp. 235-250). Blacklick, OH, USA: McGraw-Hill Companies, The.
- Adams, R. (2004). Colossal Cave Adventure Page. Retrieved 2005/05/10, from <http://www.rickadams.org/adventure/>
- Alternating Reality Gaming Network. (2002-2006). What is an ARG? Retrieved 2006/09/11, 2006, from <http://www.argn.com/index.php>
- Bartle, R. (2004). *Designing Virtual Worlds*. Indianapolis, Indiana, USA: New Riders Publishing.
- BBC News. (2005, Saturday, 19 March, 2005, 01:05 GMT). Gizmondo gadget hits the shelves Retrieved 29th January 2007, 2007, from <http://news.bbc.co.uk/1/hi/technology/4361847.stm>
- Bethesda Softworks. (2002). Elder Scrolls III: Morrowind [Computer game]. USA: Take 2 Interactive.
- Bethesda Softworks. (2006). The Elder Scrolls IV: Oblivion [Computer game]. USA: Take 2 Interactive.
- Bioware, C. (2002). Neverwinter Nights [Computer game]. Europe: Infogrames Entertainment.
- Black Isle, S. (2000). Icewind Dale [Computer game]. United States: Interplay Entertainment Corp.

- Blizzard, E. (2006). Blizzard Entertainment Company Profile. Retrieved 2006/12/14, from <http://www.blizzard.com/inblizz/profile.shtml>
- Borland, J. (2005). Blurring the line between games and life - CNET News.com. Retrieved 2006/09/11, from http://news.com.com/Blurring+the+line+between+games+and+life/2100-1024_3-5590956.html
- Cox, P. (2001-2007). Cloudmakers.org. Retrieved 15th March 2007, 2007, from <http://www.cloudmakers.org/>
- Crowley, J. (1981). *Little, Big* (1983 ed.). London: Methuen London Ltd.
- Eno, B. (1978). Ambient 1 Music for Airports. United Kingdom: EG Records Ltd.
- Eno, B. (2003). The Long Now - Transcript. Retrieved 2006/09/14, from <http://www.enoshop.co.uk/words.asp>
- Fredricksen, E. (2004). Progress Quest (Version 6.2): Fredricksen, Eric.
- GestureTek, I. Gesture Xtreme - Introduction. Retrieved 2006/09/11, from <http://www.gesturetek.com/gestxtreme/introduction.php>
- Girardin, F. (2005). Pervasive Game Development Today. Retrieved 16th April 2007, from <http://www.girardin.org/fabien/catchbob/pervasive/>
- Graner Ray, S. (2004). *Gender Inclusive Game Design: Expanding the Market*. Hingham, Massachusetts, USA: Charles River Media Inc.
- Grgic Ph.D, A. P. M. (2006). Face Recognition. Retrieved 22nd June 2006, from <http://www.face-rec.org/>
- Hackmann, W. D. (2005). "Babbage, Charles." Microsoft® Encarta® 2006 [DVD]. In *"Babbage, Charles." Microsoft® Encarta® 2006 [DVD]*. Microsoft Corporation.
- Hallford, N. w. J. H. (2001). *Sword and Circuitry: A Designer's Guide to Computer Role-playing Games*. Roseville, USA: Prima Publishing.
- Hopkins, S. (1993). Ambient: A Brief History of Ambient Volume 1. United Kingdom: Virgin Records Ltd.
- Human Pacman. (2006). Human Pacman. Retrieved 2006/06/22, from http://www.mixedrealitylab.org/research/HP/HP_webpage/research-HP-infor.htm
- IBM Archives: 1980s. IBM Archives: 1980s. Retrieved 2006/06/15, from http://www-03.ibm.com/ibm/history/history/decade_1980.html
- Jerz, D. G. (2004). Colossal Cave Adventure --Will Crowther (c1975); Will Crowther and Don Woods (1976). Retrieved 2006/11/23, from <http://jerz.setonhill.edu/if/canon/Adventure.htm#References>
- Jones, S. J. (2001). A brief informal history of the Computer Laboratory, University of Cambridge, Computer Laboratory. Retrieved 2006/06/15, from <http://www.cl.cam.ac.uk/UoCCL/misc/EDSAC99/history.html>
- Kangas, S. M. C.-P., O. I. (2005). *Ambient Utility Games: Connecting Utility to Play*. Paper presented at the The IASTED International Conference on Internet and Multimedia Systems and Applications ~EuroIMSA 2005~.
- Lebling, D. B., M. (1978). Zork. USA: Activision Inc. (Infocom Inc.).
- Michael, D. R. (2005). *Serious Games : Games That Educate, Train, and Inform*. Boston, MA, USA: Course Technology, Incorporated.
- Moore, G. E. (1965). Cramming more components onto integrated circuits. *Electronics*, , Number 8, 38(8).
- Mulholland, C., & Mulholland, K. (1989). *Games Mastership - How to Design and Run a Play-By-Mail Game*. Birmingham, United Kingdom: Time Patterns.
- Oxford English Dictionary Online: Draft Revision. (2004). Oxford English Dictionary Online: Draft Revision. Retrieved 2005/09/07, from <http://dictionary.oed.com/>
- Philips, R. (2004-2006). The technologies of Ambient Intelligence. Retrieved 2006/06/15, from http://www.research.philips.com/technologies/syst_softw/ami/breakthroughs.html
- Plaid Dragon. (1995). Ultima I. Retrieved 2006/11/23, from <http://www.uo.com/archive/ultima1/>
- RFID Centre. (2005). Introduction to RFID. Retrieved 2006/06/22, from <http://www.rfidc.com/docs/introductiontorfid.htm>
- Sutch, D. (2006). Fizees (Physical Electronic Energisers).

- Thomas, D. B. (2002). About the ARQuake Project. Retrieved 2006/06/22, from <http://wearables.unisa.edu.au/projects/ARQuake/www/index.html>
- Twist, J. (2005). Law that has driven digital life. Retrieved 15th June 2006, from <http://news.bbc.co.uk/1/hi/sci/tech/4449711.stm>
- Waern, D. A. (2006). IPerG. Retrieved 2006/06/22, from http://www.pervasive-gaming.org/index_swf.html
- Weiser, M. (1996). Ubiquitous Computing. Retrieved 2005/03/23, from <http://www.ubiq.com/hypertext/weiser/>
- Wells, H. G. (1913). *Little Wars*. United Kingdom.
- Weyrich, C. (1999). *Information Society Technologies Advisory Group Orientations for Workprogramme 2000 and beyond*. Luxembourg: Office for Official Publications of the European Communities.
- Wizards of the Coast: About Wizards. (1995-2006). Wizards of the Coast: About Wizards. Retrieved 2006/11/16, from <http://ww2.wizards.com/Company/>
- Yermish, A., Horrill, M., Hill, M., & Olmstead-Dean, S. (2000). Live Roleplaying Frequently Asked Questions - rec.games.frp.live-action. Retrieved 2006/11/23, from <http://www.compsoc.man.ac.uk/~richc/lrp/faq/faq.html>
- Zhao, W., Chellappa, R., Rosenfeld, A., & Phillips, P. J. (2003). Face Recognition: A Literature Survey. *ACM Computing Surveys*, pp. 399-458.