
GAMING

DAVID BOREHAM

Inaesthetia: Science Fiction and Computer Games

A student of pop culture aesthetics making even the briefest traversal of the literature surrounding computer game and science fiction texts cannot help to notice some thematic commonalities and imagine the possibility of a preliminary critical conversation. Both computer games and science fiction literature are very visible texts in the popular culture landscape. But investigators of their respective narrative forms always confront the same question; computer games and science fiction may be cultural texts but are they art? This question, whether asked from a defensive, an apologetic or even a dismissive position, echoes the high culture – low culture debates on which Cultural Studies was founded. Both computer games and science fiction are framed as low-culture texts and their popularity often dismissed as the simple boyhood appeal of swash-buckling adventures involving new technology. Studies of science fiction and computer game narratives are on the margins of the literary and academic establishments – trapped in an aesthetic tension field that I have playfully called “inaesthetia.” In the same way that “inopia” is used to describe a state of oxygen starvation sometimes experienced by pilots, “inaesthetia” is used here to evoke a sense of aesthetic suspension – a sense of suspension in the fields of tension between high and low culture, between mainstream and popular culture, and between the ‘two cultures’ of science and the humanities. The important point is that regardless of the academic valorisation attached to these textual forms they possess cultural, economic and historical mass and are, therefore, more than worthy of serious study.

The core proposition, in this paper, is that both science fiction and computer games suffer from a tendency to transfer theoretical frameworks designed mainly to study other textual forms. In doing so, some essential characteristics are reduced or even filtered out. This paper proposes to explore the possibility

that science fiction and computer games are metaphoric networks that place a much greater emphasis on narrative associations external to the text than do other fictional forms. In this sense, the students of computer game and science fiction narrative might consider themselves as playing a similar role to the players of virtual reality game "Better than Life" in the BBC series *Red Dwarf*. That is, as the players of a virtual reality game embedded within a virtual reality game.

The approach is to log observations of some metaphoric themes found in both games and science fiction, themes which may help to reveal similarities and differences between textual forms, while simultaneously promoting transference of investigative strategies from one semantic domain to another. To paraphrase Sabine Heuser, a metaphor or system of metaphors comes to be constructed in the form of science fiction or a computer game as the result of a hermeneutic disposition brought by the reader to the text. "A hermeneutic disposition that arises from the generic signals, contexts, thematic complexes and publishers labels, as well as the readers previous knowledge and familiarity with the genres and its scripts" (xxvii). The unrealised but overarching objective motivating this traversal is the search for a synthesis of models that may inform ways of building better multimedia projects and criticism, especially as it applies to the representation of knowledge and learning. In defence of these conjectures I can only offer ignorance and assert my rights to my own cross-disciplinary reading.

Many science fiction books and films have virtual reality settings for their stories. The action in William Gibson's cyberpunk novels, for instance, segues between a dystopic material world and the "consensual hallucinations" of the matrix. Neal Stephenson's novel *Snow Crash* promotes the idea of virtual worlds in which people regularly live, play and socialize, virtual realities which are partial, if not total, substitutes for a less appealing material reality. Indeed, many science fiction plots have involved characters trapped inside virtual realities. Steven Lisberger's film *TRON* and the Wachowski brothers' *The Matrix* are explorations of this idea. Also, the British television comedy *Red Dwarf* and the Japanese anime *Serial Experiments Lain* used the idea that, unbeknown to the characters in the series, life itself is a virtual reality video game. These stories are set in simulated realities made possible by an imagined flawless virtual reality technology. Unlike the current virtual reality technology of video games, which are easily distinguishable from the experience of the "real world," these stories propose highly detailed simulations impossible to tell apart from the reality of our daily lives.

Margaret Wertheim points out that this bifurcation of reality between the physical world and a non-material, virtual world is nothing new. For example, medieval Christians believed in a physical space that can be described by science (earth) and a non-physical space that existed outside the material domain (heaven). Dante's inferno was essentially an attempt to categorize and classify the terrain of a non-physical virtual space (233). However, it could be argued that since the mid-1950s and the introduction of television, we have already been living in a collective parallel world. Television may be seen as

creating a "consensual hallucination" in William Gibson's sense of the term (38). For many people our knowledge, experience and understanding of the world we live in, outside our immediate environment, is merely that of a media-represented world.

Science fiction authors have noted various difficulties which inhabitants of simulated realities may encounter, such as being a legally recognized entity with the right to own property, and the legal relationship between the original and virtual duplicates of the self. Several criticisms of the simulation argument exist. Some consider the idea little more than a more modern and believable rehashing of an old idea put forth in the middle ages, the idea that the world is only a dream.

Others see the proposition of simulated reality as having little or no real life relevance even if we do assume the human race could produce such a technology. Essentially, the claim that life experience is a simulated reality contains an infinite regress problem. The existence of a simulated reality would be unprovable in any concrete sense, because any observable evidence could be part of another simulation and that other simulation is embedded in a simulation and so on indefinitely. Thus, the argument can be made that even if our perceived lives are a simulation it is still the only reality we have ever known and as we have no example of a non-simulated reality to compare it to – the simulation would be reality as we understand it. In the end, any distinction between reality and simulation becomes essentially impossible. Sabine Heuser suggests:

The 'trick' of virtual reality springs from the tension of underlying metaphors – metaphors which are often in absentia. Reading is thus guided by a radically reverse process of generic presupposition, or induction, as opposed to the more traditional narrative expectation of deduction. (xliv)

This tension of underlying metaphors can be seen in the virtual "point of view" predominant in many computer games. For example, a virtual viewpoint is common in first person shooters and adventure games like *Doom* and *Myst*. In these games there is no character to which a viewpoint is connected, and with whom the player can identify. The disembodied player is the camera. It is rare in cinema to see this coincidence of the camera with the eye of the character. However, *Johnny Mnemonic* presents us with a high-speed road trip through the datascares of a futuristic Internet from this perspective, as does *The Matrix* when we enter its virtual world. The almost overwhelming high-speed flow of images in these scenes produces a kind of kinetic delirium. We know we have entered an alternative space not bound by normal physics or metrics. Representation of entry into the virtual spaces contained within computer technology requires dramatic demarcations to signify such transitions and moves.

William Gibson's cyberpunk novel *Neuromancer* describes a world in which technology has supplanted geographic boundaries and national governments, a world dominated by an on-line corporate hegemony and the rampant excesses of wired capitalism. In Gibson's cyberspace observed objects are neither physically represented nor, necessarily, representations of physical objects.

In form, character, and action objects in Gibson's cyberspace are made up of pure data, pure information. In other words, cyberspace is conceived as a datascape represented as architectures of information. However, the dimensions, scale and coordinates of cyberspace architecture are not the same as the familiar ones of our natural world. The architecture of cyberspace is derived from the flows of information traffic generated by human enterprise in science, art, literature, commerce and culture.

Why describe cyberspace as some space at all? Just because something is not material does not mean it is unreal, argues Wertheim. When I enter the Internet "my body remains at rest in my chair but I – some aspect of myself – is transported to another arena," while in that other arena "I am deeply aware of a spatial logic and geography" (230). A different geography from anything experienced in the physical world but one that seems no less real for being non-material. The popularity of on-line adventure games suggests to Margaret Wertheim there is widespread desire for some sort of collective mental arena, a place where people may share with their minds. The Internet, she says, has become more than just a hypertext docuverse it has become "a new realm for the imagination and even a new realm for the self" (233). As most cultures happily accommodate conceptions of both a physical and a spiritual space it is not surprising that we find this dualism in the conception of cyberspace and virtual reality. That we should articulate the conception of the non-material arena in spatial terms would not surprise many Lacanian psychoanalysts who, following Freud, believe the human mind has a spatial structure. We simply tend to reflect that spatial structure when metaphorically describing the temporal worlds of computer environments (251-253).

Virtual reality technologies are often described as providing the user with an immersive experience. It is important to be clear about the meaning of the term immersion. Webster's dictionary defines it as "the state of being absorbed or deeply involved." Other descriptions of immersion refer to a sense of being transported. Clearly, immersion can occur while we are reading a book, watching a film, surfing the Internet, or playing a video game, many of which are now examples of desktop virtual reality. Certainly real-time 3D environments and interactive animations aid in creating the sense of immersion and being transported into another world. In other words, immersion should not simply be equated with the use of technology, head-mounted displays, data gloves and 3D animation. Immersion is a cultural, not a technical, phenomenon both mental and emotional while immersion can take place independently of visual and sensory representation.

Gibson's vision of cyberspace is more than a global network of virtual reality environments. It is also a network inhabited by artificial intelligences. Indeed, if we follow the plot line of the cyberpunk trilogy as a whole, a rouge artificial intelligence Wintermute is the only persistent protagonist to appear. As the trilogy progresses we discover that human activity, real or virtual, occurs in response to an abandoned artificial intelligence system entertaining itself by making art. This idea of intelligent machines has been with us for a long time in literature, ranging from *Frankenstein* to Hal in *2001* and the

replicants of *Blade Runner*. However, introducing artificial intelligence functions into the techno-poetic mechanisms of computer games also implies a new textual paradigm. And it is our interaction with these artificial intelligences that enhances the sense of immersion in the game world.

Alan Turing, father of artificial intelligence, believed that machines could be created that would mimic the processes of the human brain. He discussed the possibility of such machines metaphorically, in the "Turing test" for machine intelligence; the machine passed its intelligence test if a person was fooled into thinking the machine was another person. Here the nature or emulation of human intelligence is less important than its appearance. In the Turing Test it is enough if the machine seems to be behaving intelligently (60-63). As Lyotard has said of post-modern knowledge in general, the goal is no longer truth but performance: we do not need to know what intelligence actually is, just how to simulate it.

This conjuring trick is evident in the modern computer game, which combines both the techniques of virtual reality representation and artificial intelligence processing into a unified techno-poetic mechanism to create rhizomorphic fictional texts.

The idea of the Rhizome, developed by Gilles Deleuze and Félix Guattari in *A Thousand Plateaus*, appears relevant to a discussion of computer games. The techno-poetic mechanisms of computer games can conflate multiple language systems through their varying arrangements of programming code and multiple media-elements as they tell us stories. Stories that are not linearly progressed. Deleuze and Guattari employ the term "rhizome" to describe theory and research that allows for multiple, non-hierarchical entry and exit points in data representation and interpretation. The rhizome is not a multiple branching model of a tree and root system that they see as symbolizing hierarchical structures, extreme stratification, and linear thinking.

The rhizome is an acentered, nonhierarchical, nonsignifying system without a General and without an organizing memory or central automaton, defined solely by the circulation of states. (21)

A rhizome, unlike the dendritic structure of trees and their roots, is characterised by connections between a point to any other point and connecting trails that are not necessarily linked to points of the same nature. Connections that can bring into play different regimes of signs and even sign systems. A rhizome is a milieu of multiplicities in a state metamorphosis. Arborescent systems, on the other hand, are:

hierarchical systems with centres of significance and subjectification, central automata like organized memories. In corresponding models, an element only receives information from a higher unit, and only receives a subjective affection along pre-established paths. (16)

The recombinant techno-poetics of computer games displays many of the characteristics of Deleuze and Guattari's Rhizomes. The game's techno-poetic mechanism appears to enable fluid connection between points in the game's story

space. Connections the player can directly manipulate through construction, navigation, action and reaction. Rhizomorphic game play involves exploring variable and changing "states of meaning" as the game brings into play different regimes of signs through operations of its multiply mediated techno-poetic mechanisms. In many ways the computer game appears to be a response to Deleuze and Guattari's challenge to:

Form a rhizome, increase your territory by deterritorialization, extend the line of flight to the point where it becomes an abstract machine covering the entire plane of consistency. (11)

To describe a computer game as a Rhizomatic textual form is, however, misleading. "Rhizomatic" describes a system that adheres to all six of Deleuze and Guattari's principles of the rhizome; connection, heterogeneity, multiplicity, asignifying rupture, cartography and decalcomania. Real time 3D rendering techniques do provide the game player with a freedom of movement within the represented game world in a way that is unfamiliar to film and TV audiences. Also, this free movement combined with synthesised behavioural aspects of characters and objects within the game world add strength to the suggestion computer games are a rhizomatic form. However, the game is constrained and striated by narrative conventions, plot structure and by the limits of technology and economics. It is important therefore to distinguish between the terms "rhizomatic" and "rhizomorphic." "Rhizomorphic" means having rhizomatic tendencies without excluding arborescent features. As Deleuze and Guattari concede:

You may make a rupture, draw a line of flight, yet there is still a danger that you will reencounter organizations that restratify everything, formations that restore power to a signifier, attributions that reconstitute a subject. (9)

Even so, the computer game is demonstrably different from Deleuze and Guattari's rhizome in at least one sense. For example, to suggest the game is asignifying is to suggest that all representations brought about through various combinations of image, sound, text and programming are asignifying, and this is simply not true. More importantly, we encounter in the computer game win-loose objectives and episodic mission structures that are clearly "organizations that restratify everything, formations that restore power to a signifier" and similar qualities that "reconstitute a subject" (9). To this extent, the computer game is neither rhizomatic nor even rhizomorphic. The proposition in this paper is, however, that computer games may be considered rhizomorphic texts when situated in the broader cultural context of consumption.

Science fiction has developed a refined repertoire of metaphoric themes, settings, and temporal devices, which are instantaneously recognizable to readers familiar with the genre. These metaphoric references organize the fundamental narrative events of the novel and become the primary means for materializing the fictional universe. Certain metaphoric references can be dominant in a particular genre, such as space operas, while several metaphoric references may interact and recombine to form new ones, as in cyberpunk.

Normally, a metaphor is a rhetorical trope expressing either a substitution or a direct comparison between two seemingly unrelated subjects. However, metaphor is not only used for description and clarifying meaning; sometimes it is used for purely aesthetic reasons. Metaphor can also be seen as a form of interaction, a feedback process between the literal and the figurative, drawing on either pre-existing likeness or the active imaginative creation of meaning. Meaning which is partly created, partly discovered. Decoding a metaphor involves a problem-solving strategy which is founded in the genre expectations a reader brings to the text. When interpreting the meaning of a sentence, we can apply it to several frames of reference within both the fictional and the real world, depending on the range of "reinterpretive" constructs the reader has available (Hrushovski 228).

Paul Ricoeur explains metaphoric referencing as a process completed by the active participation of the reader's imagination (6-7). Science fiction, in this sense, requires its readers to engage in creative and cognitive labour when imagining the new fictional world and its timeframes. Sabine Heuser expands this idea suggesting that, unlike the reader of a historically realistic novel, who advances by making associational links to the familiar and commonplace before progressing to the particular, specific plot and ideologically governed associations of the novels structure, the science fiction reader follows a different associational trail. The science fiction reader must proceed by inducing the particular from some imagined, general model of the author's fantastic world and then conferring believability on to that construction (xliv). The science fiction reader must provide imaginative input, engaging in a conjectural reconstruction which "materializes" the fictional universe. As Sabine Heuser remarks, the fictional universes of cyberpunk novels consist of "increasingly literalised metaphoric networks," which integrate into both "frames" of reference and "fields" of reference. Metaphoric networks that must be "broken down and reconstructed to reveal the "absent paradigm" on which the entire science-fictional world is built" (xlii).

Metaphors in this sense become an integral part of the cultural contexts individual readers inhabit. Metaphors structure and inform the fibre of our existence, our everyday thoughts, actions, and perceptions while their interpretations serve to delineate in-group status (Lakoff and Johnson 61). With all such group identifications, such as Trekkies and the cyberpunks, there are dialects and preferred interpretations that extend the cultural life of a text beyond the limits of its pages or screens. When a text is situated in this broader cultural milieu it begins to take on a rhizomorphic character.

The idea of metaphoric networks may also be useful when attempting to understand computer games as fictional forms, and to analyse the means by which they create and sustain their fictional worlds. Critics cite games as being unique textual forms in that they are "interactive" and "immerse" the player. Unlike the reader of a novel, game players are not only immersed in the fictional world of the game story, but in the experience of play. To engage with a game the player needs to apply decoding strategies to both the metaphoric networks of narrative and the metaphoric idiosyncrasies of the software.

It is generally accepted that a game narrative must afford the reader some degree of agency. This is generally taken to mean that participants' physical actions will have an appropriate and understandable impact on the story world the computer presents to them. For these reasons computer games are often visualized as "textual machines" in which the user or reader, sign systems, and configurative systems combine equally in the production and consumption of meaning. While sign systems and their readers are common to all media, adding configurative systems to the mix points to a difference in "teleological orientation." Consequently, Espen Aarseth suggests that until we have identified and examined the combination of all these practices in a single textual form then "a significant part of the question of interpretation must go unanswered."

Early in the 1960s, Theodor H. Nelson coined the term "hypertext" to describe a form of interactive electronic text. Nelson described hypertext as non-sequential writing, a text that branches out to other texts and allows choices to be made by the reader (84-100). George Landow observes that a hypertext link is a way of drawing connections between things, a way of forging semantic relationships. In linguistic terms a link plays a conjunctive role, binding disparate ideas. It functions much like the word 'and' in sentence construction (67). A hypertext link plays a conjunctive role between blocks of text, or what Roland Barthes would call "Lexia." The basic hypertext link allows us to create narrative structures that can be episodically represented to the reader as either a linear sequence or as a non-linear pathway through a matrix of pre-structured documents (3). This description of hyper-linked lexia again evokes the idea of a rhizomorphic text. However, hypertext theorists are also quick to point out that hypertexts produce episodic but still lineal readings in any single transversal of the lexical matrix.

The resulting structure of hypertexts is readily recognizable in the *I Ching*, read-your-own-adventure stories and other codex forms, a point Espen Aarseth makes forcefully in *Cybertext*, arguing that a codex, electronic or otherwise, is nothing new and can therefore be readily understood by existing theory. Being able to describe computer hypertext webs as episodic non-lineal interactive texts does not evoke justification for calling them a new media for they appear as a recognizable textual form. Many successful games have been produced with this structural form, *Adventure* and *Myst* for example. However, while we can easily recognize this narrative form in a game like *Myst*, games such as *Tetris*, *Halo* and *Deus Ex* are not so easily explained. Further, the appearance of real time 3D rendering and behavioural artificial intelligence techniques in the computer games techno-poetic mechanism has transformed them into authentic artificial game-worlds that cannot be adequately described by the pre-structured codex forms of hypertext.

The term Ludology was introduced by Gonzalo Frasca to identify a discipline that studies games in general and video or computer games in particular. The term has been previously used in relation to the study of non-computer games and by the board gaming community in particular. Generally, ludologists do not, simplistically, dismiss the narrative dimension of video games, such as

character, settings and events, but argue that video games, as a textual form, are not held together by narrative structure but are an ergodically-dominant medium. Eskelinen argues the dominant user function in literature, film and theatre is interpretive while in games it is configurative. In literature we have to configure to be able to interpret but in games we have to interpret to be able to configure. Ludologists therefore set aside narrative because they wish to focus on configurative practice (32).

With the advent of Real Time 3D rendering technologies in our desktop computers and gaming consoles we are now confronted with a textual form in which scenes are not pre-rendered, as in film and television, but are rendered on the fly in response to user input. The computer game player, therefore, must draw meanings from momentary media combinations, as well as from accumulation of meaning over time juxtaposed with elements of meaning encountered as idiosyncrasies of the software in general. In computer games we encounter the representations of cognitive behaviour in non-player characters and the representations of a virtual world's physics, often beguilingly distorted to match the constraints of the games interface.

The actions of a game's non-player characters (NPC) are determined by the computer's artificial intelligence systems. Non-player characters populate the fictional world of the game and may be allies, bystanders or competitors to the player characters and may have important roles in the development of the games narrative. Technically, minor NPCs are often generated on the fly as needed in response to player's actions and choices. There is much variation in the degree the characterisations of NPCs are fleshed-out in any given game, but the consensus among game designers is the more "real" an NPC feels, the more immersive the gaming experience. Computer game NPCs work by means of artificial intelligence routines, programmed to suit the game rules, the game type, the game world and the game narrative.

Apart from the behavioural aspects of the game worlds physics and the characters who inhabit it, we also find traces of artificial intelligence in the management of game play. The anthropomorphic metaphor "the computer is an opponent" is often reinforced by the software's use of first person pronouns to personalize the gaming experience. More important, however, are the ways a game-engine evaluates, and sometimes even comments upon, the players progress and tactics for engaging with the text. In other words the machine engages in a form of reader-performance evaluation. In the simplest sense, this refers to the way a game has win or lose conditions, with all the potential narrative variations that could be attached, and the processes necessary to evaluating attainment of those conditions. In this sense, the reader's performance in reading the text is evaluated by the text. The text in this sense functions as a synthetic opponent, a synthetic umpire, and as a synthetic critic.

Computer games are also group-marking phenomena, with their own dialects and preferred interpretations. In their communities of interest, players create their own versions of the provided text, exchange anecdotal accounts of gaming experience, and even subvert what developers have provided through practices such as modding and machinima. It is this extended freedom, how-

ever limited, for the player to become, in effect, an author that gives games their distinctive fictional form and unique cultural presence. Constructing complex fields of metaphoric networks, both embedded in the game text and in the extended cultural life of a game, give a rhizomorphic character to the gaming situation.

Concluding comments

All genres are partially constructed through their readers' familiarity with them, as well as through their competence in using a given fiction's protocols for reading. From this perspective, Eskelinen's suggestion "in literature we have to configure to be able to interpret but in games we have to interpret to be able to configure" (32) seems a truncated formulae. In computer games the reader must perform both tasks, game players must read to configure and configure to read in a continuing recursive process. Game criticism should, like science fiction criticism, begin by recognising the unique protocols for reading the genres. A model of game criticism, it would seem, needs to accommodate game design and the culture of design practice; the complex interplay of multi-formal systems of representation, participatory authorship, and reader performance evaluation; as well as game play and the culture of game playing. In the sense that computer game criticism must, as science fiction critics have done, use metaphors to describe the metaphoric networks underpinning the genres it studies. We are indeed like the players of "Better than Life" in the BBC series *Red Dwarf*. Players of a virtual reality game that is itself embedded in a virtual reality game.

Works Cited

- Aarseth, Espen. *Cybertext: Perspectives on Ergodic Literature*. London: Johns Hopkins, 1997.
- Barthes, Roland. *Introduction to the Structural Analysis of Narratives*. London: Fontana, 1977.
- Blade Runner*. Dir. Ridley Scott. Film. Warner, 1982.
- Bungie. *Halo: Combat Evolved*. Computer software. Microsoft, 2002.
- Crowther, and Woods. *Adventure*. Computer software. Crowther Woods, 1976.
- Cyan. *Myst*. Computer software. Broderbund, 1998.
- Deleuze, Gilles and Guattari, Félix. *A Thousand Plateaus: Capitalism and Schizophrenia*. Trans. Massumi, Brian. Minneapolis: The University of Minnesota Press, 1987.
- id-Software. *Doom 2*. Computer software. Activision, 1994.
- Eskelinen, Markku. "Towards Computer Game Studies." *First Person*. Eds. Wardrip-Fruin N. and Harrigan P. Cambridge: The MIT Press, 2004.
- Frasca, Gonzalo. "Ludology Meets Narratology: Similitude and Differences between (Video) Games and Narrative." (2000). Accessed 22 November 2003 <<http://www.ludology.org/ludology.html>>.

- Gibson, William. *Neuromancer*. New York: Ace, 1984.
- Heuser, Sabine. *Virtual Geographies: Cyberpunk and the Intersection of the Postmodern and Science Fiction*. New York: Rodopi, 2003.
- Ion Storm. *Deus Ex*. Computer software. Eidos Interactive, 2003.
- Johnny Mnemonic*. Dir. Longo, Robert. Film. Twentieth Century Fox, 1995.
- Lakoff, George and Johnson, Mark. *Metaphors We Live By*. Chicago: Chicago University Press, 1980.
- Landow, George. *Hypertext 2.0: The Convergence of Contemporary Critical Theory and Technology*. Baltimore: John Hopkins University Press, 1997.
- Lyotard, Jean-François. *The Postmodern Condition*. Minneapolis: University of Minneapolis, 1984.
- Nelson, Theodor. "A File Structure for the Complex, the Changing, and the Indeterminate." *Proceedings of the 20th National Conference*. New York: Association for Computing Machinery, 1965.
- Pazhitnov, Alexey. *Tetris*. Computer software. Spectrum Holobyte, 1986.
- Red Dwarf: Series 3*. Dir. Ed Bye. DVD. BBC, 2003.
- Ricoeur, Paul. *The Rule of Metaphor*. Trans. Czerny, Robert. Toronto, University of Toronto Press, 1977.
- Serial Experiments Lain*. Dir. Ryutaro Nakamura. DVD. Geneon Entertainment, 2005.
- Stephenson, Neal. *Snow Crash*. New York: Bantam, 1992.
- The Matrix*. Dir. Wachowski, Larry. Film. Warner, 1999.
- TRON*. Dir. Verhoeven, Paul. Film. Disney, 1992.
- Turing, Alan M. "Computing Machinery and Intelligence", Ed. Boden, Margaret A. *The Philosophy of Artificial Intelligence*. Oxford: Oxford University Press, 1992.
- Wertheim, Margaret. *The Pearly Gates of Cyberspace*, Milson's Point NSW: Transworld Publishers, 1999.
- 2001: A Space Odyssey*. Dir. Kubrick, Stanley. Film. MGM, 1968.