Integrating E-Commerce and Games

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Abstract: This paper investigates how many users of commercial interactive systems are not properly agents within the interactive narrative, largely due to the dynamics of branding in cyberspace. Parallels are drawn between the dynamic personalization of e-CRM engines and context aware computing systems. Several seminal games are discussed as examples of systems in which very different relationships exist between users and the system. Arguments are made for designing e-commerce interactive systems that install into games, inside the game narrative.

Keywords: Agency; Brand; Context awareness; E-commerce; e-CRM; Games; Interaction design; Narrative; Simulation; User

1. Introduction: What's Wrong with the World Wide Web?

Much of the discourse in response to this question can be viewed as traffic between modernist and post-modernist projections of what an artificial global electronic parallel dimension should be like. William Gibson's vision of cyberspace, with its "mass hallucination" of oceans of data, cliffs of code, canyons, slate gray nether-spaces and walled cities [1,2] has contributed enormously to the collective imagination. In reality, we experience more mundane personal computing, with traditional activities of word processing and spreadsheets.

Computer games have kept more in step with Gibson's vision. Being a form of entertainment and therefore granted a broad license for invention, narrative and technical development, games concepts, content and architecture have leaped ahead of those found in 'serious' personal computing applications [3].

We are currently experiencing a pause in the progress of personal computing and telecommunications as the technological weather vane swings around somewhere between interactive TV, broadband and wireless, with ubiquitous computing and augmented reality suggesting radically alternative frameworks potentially very well suited to 3G and subsequent technologies [4]. We take this opportunity to outline a new direction for electronic commerce applications, which sees them integrating into games. The principle behind this new model is to restore the user to full agency of her own interactive narrative. We examine how commercial interactive design focuses interactive narrative too narrowly on the brand, and how breaking down the barriers between entertainment and 'serious' contexts can lead to exciting new ways of thinking in the field.

2. Personal Computing and Gaming

The first home computers, appearing in the late 1970s and early 1980s, were not capable of connecting over networks. Networking remained limited to specialized use in industry, research centers and universities [5]. Machines like the Sinclair *ZX Spectrum*, the Commodore *64* and later the Atari *ST* and Commodore *Amiga* were highly idiosyncratic and mutually incompatible, thus they were sold in heterogeneous vertical markets. The incompatibility and different features of the different machines combined to produce a tribal dynamic among user communities, bonded by shared investment in the future of a particular machine Although the marketing held out promises of 'serious' applications, like word processing, spreadsheet manipulation and programming, these machines were in fact bought mainly for games [3].

It is worth noting the physical form of these early computers: The Sinclair ZX Spectrum, for example, was very small, able to fit without disruption into existing living-room setups (much like the later Sony *PS-1* console). It

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connected entirely to already familiar machines – the television as monitor, and the audio cassette player as storage device. If it had not been such an expensive and delicate luxury, we could say that the Spectrum was an early ubiquitous computer. Pressing its keys, the user was aware of the circuit boards immediately underneath. In encounters with (often very simple) computer-generated opponents, the player was able to empathize with them as frail *dei ex machina*, conjured into life from a source (code) that lay literally under her fingertips [6].

The early personal computer was simple enough for human programmers to map its entire workings mentally, from application or game level down to the contents of registers and buffers. We can say that early games possessed a simplicity that

- allowed rapid development of diverse narrative prototypes,
- *required* players' active imaginative participation in shaping game narratives, and
- located developers, players and machines in equipotential relation to each other.

3. On the Desktop

The original motivation of the internet's technical platform, the TCP/IP protocol, was the provision of a homogeneous transparent layer over heterogeneous network media and diverse node machines. Different electronic actualities were linked up through the use of a common protocol. Over successive phases of evolution it logically followed that a common user interface would emerge.

The military industrial complex's sponsorship of computing gradually gave way to that of business, signalling a tide of business terminology into everyday language. Documents, folders and trashcans were translated into simple bitmap icons on the desktop/computer screen. At the same time, the complexity of physical and virtual machinery was exploding, and technical languages lost the simplicity that had engendered their original open source democracy of narrative. Programming languages became codified into sprawling libraries and CASE tools, operable only by a highly trained elite. Although the use of metaphor is crucial to the design of usable human-computer interaction, the desktop has become a limiting factor in the development of computing concepts and interfaces.

In summary, multiplying technical complexity meant that

- production required generally applicable and reusable abstract tool kits (virtual machines),
- virtual machines separated developers from physical machines and both developers and machine from users, and
- the persistence of the desktop metaphor limits HCI development.

4. Broadcast and Multicast

As Internet connectivity made its way into the home, the business desktop metaphor was further reinforced through the development of the World Wide Web as a document sharing system. At the same time (mid-1980s) networked computer games were emerging from electronic bulletin boards in the form of text-based MUDs, developed by people keen to test the limits of the medium outside the constraints of business applications [10]. There are crucial differences between these two divergent strands:

Web	MUD
Users view public documents	Users collocate in a virtual space
Users are not aware of each other	Users interact with each other
Users affect only their own session	Users make lasting changes to the virtual world

An interaction with a web page is largely a matter of receiving a broadcast message. The user may select aspects of that message, but cannot change the message itself. In contrast, interacting with the system and with other users in a MUD is more like taking part in a conference call. Quickly evolving towards more sophisticated control for users over the virtual world, MUD programmers soon developed object-oriented models and made source code freely available (the first was James Aspnes' TINYMUD in the late 1980s). We will see below that e-commerce, with a few notable exceptions like *Napster*, has entirely followed the broadcast model, although it has enhanced this model by delivering customised messages to targeted groups of users.

The bifurcation between what we might call broadcast and multicast modes has persisted to the present – the boundaries are only now becoming blurred. Web sites such as Yahoo! *Egroups* form repositories of information available to communities of users. Users can interact with other members of the community asynchronously via web message boards and upload documents and pictures to commonly accessible spaces. To interact in real time, users might use a peer-to-peer channel such as *ICQ* or MSN *Instant Messenger*. For a more palpable sense of real time collocation, users might use another channel – the internet chat room.

Networked games have developed to a state of the art that currently derives largely from the 1991 first person shoot-em-up *Doom*. Powerful servers with high-bandwidth connections support multi-user 3D levels in which tribes of players congregate to battle each other. Using avatar gestures and chat engines built into the game's 'dashboard', tribal communication dynamics are becoming ever more sophisticated. As we shall see, a healthy cyberculture, incorporating breadth, complexity and diversity reflective of real world culture, may develop healthy commerce.

5. Brandspace

Commercial (broadcast) communications have always performed the trick of reaching diverse audiences through uniform media like television and outdoor billboards. There is of course something to be said about the non-diversity (and anti-diversity) intrinsic to any mass audience [7]. However, we observe here that convergence of personal computer technology, towards the pervasive Microsoft Windows and Internet Explorer virtual desktop model, provided the uniformity of human computer interface that allowed the mass colonization of the web by corporate brands. Consider the three overlapping spheres of online branding:

5.1. Banner advertising

An obvious method of branding cyberspace is the purchase of virtual space for the purpose of advertising. A brand message is delivered every time someone views a web page and is served the banner. Specialized technology has emerged to handle the distribution of banners onto virtual spaces. The mechanics of this technology itself contributes to the form of the web today. A cyclical process exists in which

- the value of virtual advertising space is determined by some measurement of the number of times it is viewed, and
- revenue from advertising provides spend on channels whose sole purpose is to drive traffic to the space.

5.2. Branded services and channels

The AOL browser physically delivered on CD-ROM to millions of homes every month ties the user into a customized AOL homepage as her own perennial homepage. This user may benefit from inexpensive access to other channels like web mail and instant messaging, but these channels are heavily covered by live brand messages. Every email sent from an AOL account has an AOL brand message and hyperlink appended to it. The free version of Real Networks' *RealPlayer* has banner ads streamed directly into the interface. One of these ads presents the ad-free version, available for about $30. Although I am not an AOL user, I have somewhere picked up some internet script that every now and then drives a new browser window to my desktop loaded alternately with the homepage of an American online dating service and a large banner advertising a piece of software that will eradicate such unwanted pop-ups from my system.

5.3. Brand as cyberspace

Modern branding continues a practice developed in the dotcom phase, of extending the brand *as cyberspace*, as *online user experience*. As major brands create physical spaces in which one enters into the brand itself (Disneyland), so they create virtual spaces in which every click, every turn is measured to be 'on brand'. The 'interactive user experience' becomes a business of acquiescing to a sequence of options in a synthetic narrative engineered elsewhere.

Because these artificial realities are generated by off-the-shelf commercial packages, they can be massively reproduced. That which can be massively reproduced tends to be what ends up 'out there' in the world. Over time:

> The real is not only what can be reproduced, but that which is always already reproduced: that is, the hyperreal, which is entirely in simulation [8]

6. Loss of Agency

The web user who explores *brandspace* enters a simulation in which weighted choices constituting a 'narrative' are pushed to them. The precise calculation of weightings is one of the goals commerce seeks through its employment of interaction design and e-CRM technologies in branded solutions. The field of *usability*, a particular application of information architecture, has emerged from commercial concerns. While there is clearly something desirable about designing usable systems, Nielsen and others have exhorted designers, at all costs, to build undemanding interfaces for today's web users, lest they stray from the business critical purchase path [9].

Our natural desire for *agency* within the environment corresponds to a sense of satisfaction at being able to affect things around us. In a MUD, the sense of agency comes with moving forward, towards finding the one way out, towards winning. In an architected e-commerce solution, we navigate through the maze of options with the goal of successfully completing a transaction. But current e-business models cannot afford for users to navigate off the critical path, to break off from the preconceived process of booking a ticket, or stocking a virtual shopping cart and checking out. How does this affect the user? "Our desire for agency in digital environments makes us impatient when our options are limited. We want an open road with wide latitude to explore and more than one way to get somewhere" [10].

Current practice in the information architecture of e-commerce solutions is to maximize "user capture" through the design of content management and personalization systems that recursively subdivide the construction blocks of the interaction. Thus the shape of the maze is made to shift according to choices the user has already made. As the user navigates she supplies *implicit input* to the system, which then generates the next view according to a business logic rulebase. The narrative through which the user navigates is generated by the application of the business logic, which is designed specifically to limit options and outcomes within expected parameters. The user is thoroughly removed from the system as the workings of the various machine layers and business logic are hidden.

At the same time the web has attained a virtually infinite, constantly shifting complexity. Users are individually suspended within micro-customized spheres of targeted content and statistically appropriate links, hovering in perpetual proximity to point of sale attractors. Even though they might be browsing the same web site, each user occupies a secure space unique to her particular session. Within the same session, the user may find it impossible to revisit a certain page. The space presented to the user is not what it seems. Essentially, the e-commerce site often abuses spatial metaphors such as 'sitemap' or 'shopping cart' and the user's success at navigation – which is crucial to the sense of user agency – is subject to complex invisible elements like the back-end security system. Baudrillard observes that "genetic miniaturization is the dimension of simulation" [8]. In this context interactive design denies users the empowerment of agency of their own virtual narratives, fixed points of reference, like certain pages or images, within a site are broken down into dynamic, e-CRM driven components. Henceforth these points appear differently to different users, or to the same user at different sessions.

7. Modeling Context

e-CRM engines in many ways compare to context aware computing systems. The classic context aware system delivers information to museum visitors [11], equipped with wireless PDAs, about nearby exhibits. Content and presentation are tailored according to the system's deductions about the users' context, which here consists of the users' dynamically determined geographical position and some fixed facts collected through a short questionnaire at the start of the session. But what should happen if, for instance, the user is standing next to an exhibit but not looking at it? What if the user is suddenly distracted to another area and then returns? There are inherent problems in modeling user context for adaptive systems [12].The driver of an ABS-equipped car might experience poor braking power because he is pumping the brake pedal, unaware that the car is ABS-equipped. Or consider an aware driver feeling disempowered because he cannot lock out the

wheels when he wants to do so. There is a fine line between adapting to a modeled context and pushing a narrative to the user, removing him or her from agency.

"Research into context aware computing risks losing sight of the user" [13]. As a remedy consider adding detail to the context model, perhaps by ascertaining a larger body of facts about the user, including long-term attributes such as height, weight, gender and age. Aside from the problem of such quizzes invading users' privacy or simply becoming a bore, what might it be like for users to interact with a system that purports to know them better than they know themselves? What if the museum visitors wore devices that monitored intimate information such as their pulse rate and body temperature and the system adapted to these variables, for example instructing an overheated visitor to leave the building? If a detailed context is modeled by collecting lots of data from implicit user input, reality is *augmented for the system*, again distorting the relation between system, designers and users.

In amplified reality the expressions of objects or people in the world are enhanced with virtual information [14]. People and objects provide their own context. Considering the agency of the user in augmented and amplified realities, there are interesting questions of how public or private access might be made to public or private information. For example the Japanese *Lovegety* [14] wearer can make the information that she likes karaoke available to all other wearers. The *BubbleBadge* [15] wearable device can function as a mobile outdoor medium, displaying broadcast messages in the public domain (read 'advertising'). If the device can identify the viewer, it might instead display information private to that viewer, for example that he has a new voicemail message. There are similar issues in providing contextual information to mobile phone users. Should the caller be able to detect that the target is in the cinema before she makes the call [16]?

It seems clear that to maintain an equilateral relationship between designers, users and the system, we should investigate mixed realities, in which users augment their view of the world in their own personalized fashion, while at the same time presenting to the world a context over which they have complete ownership. It is from the dance between amplified expression and augmented impression that a true cyberculture will take shape.

8. Restoring the Games Principle

Modern computer games have not entirely escaped the fallout from the digital simulation movement – the dropping away of the real out of sight below a more familiar and more readily reproducible and therefore available hyperreal. There has been a tendency for games to be explicit trials of astounding graphics and special effects. But for interactive games players, identification with the primary agent of game narratives depends upon games' success as "dramatic models of our psychological lives" [17] more than their performance as simulations. What is needed is a restoration of agency to the individual, in anticipation of *naturally emergent collective narratives* (tribal narratives). This does not mean that everyone should build their own games, or their own webspaces.

If we do indeed inhabit a virtual world whose commercialized map has been superimposed over the real, to the extent that our understanding of and access to the real is totally mediated through the map, and furthermore the map is constructed by genetic miniaturization, it seems the status quo is a difficult one to overturn. Where are the edges, the fault lines? In designing from within such a seamless system, i.e. within the simulation, how can the 'reality fallout' side-effect be avoided?

The situation resembles the sociopolitical one against which Hakim Bey's polemic "The Temporary Autonomous Zone" appeals. Here, the dialectic is "revolution, reaction, betrayal, the founding of a stronger and even more oppressive State" [18]. Translating this back into our virtual domain, we observe that re-empowerment of the user will not come from retooling or reconfiguring content management systems. The user cannot be restored to agenthood of her own narrative from outside that narrative. Rather than a formal revolution, which would only be simulation, we need an *insurrection:*

> the insurrection is the forbidden moment, an unforgiveable denial of the dialectic [18]

This is not to advocate a head on confrontation with the host brand, but to look towards

interactive platforms in which users can appropriate or co-opt objects into different uses and meanings – as they do in the physical world. Thus the re-empowered user stands in a designed and branded world which, despite its artifice, now and then allows some uncertainty of construction, some ambivalence of fabric, some degree of bleed between *objects as things* and *objects as signs* [19].

The re-empowered user shifts across the presented behavioral space around her, according to her own conventions. The 'cocoon' of navigational functionality and proximal content around her online self is an *augmented reality* of her own construction, infiltrated now and then, of course, by viral brand messages.

9. Democracy and Diversity of Narrative

Typically, business strategy would map the user profiles directly to separate sets of products or services. This sets up the brand to talk to its different audiences through targeted interaction envelopes developed directly from the user profiles. The success of the brand as an interactive experience owes mainly to the audience's unconscious identification – through implicit input to the system – with user profiles that are hidden from the user.

This approach produces the kind of interactive architecture that ultimately alienates users. The user profile is itself a narrative used to construct a user experience narrative that is focussed on the brand. In designing functions within interactive envelopes, designers implement a top-down tyranny of virtual space. It is as if a magic carpet is offered that can *only* be used as a vehicle to fly from A to B, and cannot be used, for example, to just sit on.

Consider a networked *Quake* setup, in which potentially large numbers of players simultaneously collocate in the same 3D space. ID Software, designers of the *Doom* clones, originally set out with an open source business model in mind. Level and avatar editors were made freely available to the public at an early stage along with game server software for UNIX and Linux machines. The availabilty of the editor software, exactly the same as that used in-house at ID Software to design the commercially released versions of *Doom* and *Quake*, encouraged members of the community to build their own spaces. Although the original idea of these games is to progress through the levels, shooting everything in sight, people realised immediately that they could design levels to support a wide range of narratives. Most importantly, levels were built simply as virtual spaces for people to meet. The developers recognised that the networked game level could serve as a virtual meeting place and built on the communicative power of the avatars by adding capability for gestures (again making the source code available). Instant messenger and live chat bolt-on modules soon followed, allowing players to communicate with each other through 'in helmet' displays. Thus the game developers have supported a highly democratic evolution of the technology, collaborating with the games community to allow all sorts of narratives to flourish. To the original one and two player combat and collaborative modes of gameplay, a host of new options – new games – have been added. Now virtual orienteering, hide and seek, avatar beauty contests, virtual building projects, mass meetings and online dating take place over the same medium.

Majestic was an Internet-based, interactive game that pulls you into the center of a suspense thriller wrapped around a grand conspiracy: a government cover-up of crashed UFOs and the existence of aliens. Electronic Arts (EA) uses original narratives to draw players into the game. In most computer games, players sit in front of a monitor or television screen and interact with the game via a joystick, keyboard or some other input device. In *Majestic*, players are immersed in a world where characters interact with you through mobile phones and fax machines as well as a host of Internet channels. Players need to collaborate in order to locate information and solve puzzles.

Electronic Arts' brand sits in an unusual relationship to its subscribers. The brand is an entity within the narrative rather than a commercial mark stamped onto the outside wrapping. The game is highly innovative in its design of narratives that deliberately blur the boundaries of game and real worlds, taking advantage of devices like spoof corporate websites and authentic-looking fax documents to provide an exciting level of realism.

Computer gaming is a useful area for developing human-computer interactions:

> due to the entertaining nature of the interactions, users are willing to explore innovative metaphors, modalities and hardware even when they are not as apparent or fluid as the designer might have hoped. [20]

The designers of *Majestic*, *Quake* and *Doom* have taken full advantage of their respective media to glue together experimentation, commercial success and large user communities. Let us finally consider how locating electronic commerce functionality within an entertainment mode might help to liberate both users and designers from the straightjacketed approach of current e-commerce best practice.

10. Commercial Applications within a Games Environment

As a thought experiment, imagine that modules were made available to the *Quake* level-designing community that would install customizable shopfronts, complete with secure credit-processing back-end. To begin with, commerce might develop in a grass roots fashion. For instance, members of the community with record collections to sell might benefit from adding a virtual record-stall to their level. Later, major commercial institutions might appear: online retailers, banks, travel brokers and so on. The owner of a level containing a virtual bank branch would no doubt benefit from either a leasehold agreement or from some kind of franchise arrangement. Meanwhile, players moving around the level could do their banking within an environment they already feel thoroughly at home in. There would be fascinating developments as the dynamics between players adjusted to the new feature on the landscape. The sheer novelty of welding together a virtual entertainment environment with a real world 'serious' application like online banking would generate a huge wave of excitement. It would not be long before rival banks were in on the act, building extra features into their virtual bank branch modules.

Integrating such modules into a multi-channel game like *Majestic*, where the game narrative weaves together real and virtual elements, presents enormous potential for commercial entities to engage with user communities *within the narrative*.

We observed earlier that computer games in the age of innocence enjoyed a highly familiar relationship with their users. We should also note that the cracking and demo scenes that shadowed games development testified to the dialogue bounced back and forth between stakeholders and other interested parties. While illegal hacking of games may have cost developers and publishers large sums of money, the dialogue afforded an exchange of technical ideas and leant users a sense of ownership over the technology, a stakehold in what happened next. The open source debate still carries excellent arguments for commercial developers of code to make source code available to the user community. Mostly, commercial parties have proceeded very cautiously with open source experiments – Macromedia have dipped their toes in this direction with *Flash,* for example. There are of course complicated issues in the field of intellectual property ownership that are not covered here.

At this point we should note the enormous publicity that has surrounded the 77-th richest country in the world, the *Norrath* virtual world run by Sony from servers in San Diego, California [21]. *Norrath* is the name of the games world of *Everquest*, one of about a dozen major online role-playing games that have been around since 1995. Shortly after its launch *EverQuest* players began trading the game's internal currency – the platinum piece - for real dollars on internet auction sites. Despite adverse pressure from Sony – who have not yet found a way to control this hybrid market – there is still a highly liquid exchange rate between the *EverQuest* platinum piece and the US dollar. It would seem to be a matter of time before the Internet auction houses migrate into the *Everquest* virtual world itself.

We need new ways of thinking about how users and brands interrelate. As electronic technologies progress, expectations of empowerment, enhanced experiences and extended boundaries for cyberculture will rise. Commercial entities will experience a law of diminishing returns in continuing to tweak the artificial intelligences that tell e-commerce systems what sort of user they are talking to. Similarly, context aware computing systems will always run into problems through not being able to model the user's context completely. The solution lies not in beefing up the system, but in designing platforms whereby users express their own context.

11. Summary

Examining the side effects of commercialization of the web, we found that the end user has been displaced from a formerly equipotential relation to the machine and to the designers of interfaces.

The practice of usability, in refining interfaces primarily in the interests of obtaining easy to use purchase paths, sets up a behavioural space for users that is limited to a narrowly engineered narrative corresponding to a user profile. E-commerce is moving away from architectures based on fixed user profiles towards those in which the profile is shaped by automated processes which poll implicit user inputs. In an increasingly branded cyberspace (brandspace) these processes steer users towards statistically determined points at which brand messages are delivered or sales transactions take place. The situation is paralleled in context aware systems that generate information about the user on the fly, and use this information to shape the subsequent interactive user experience.

To a large extent, brands own the physical means of production of interactive systems. Post dotcom era, the majority of users still experience cyberspace (the World Wide Web) as brand-extending online spaces. These spaces, designed to implement a particular brand narrative, place the user in a disempowered position – without flexible tools, without access to relevant peers and without any significant control over the narrative.

Networked 3D level-based games like *Doom* and *Quake* have developed new relationships between users and developers through open source policies. By making production tools freely available to the community, diverse different applications for the game medium have evolved. Multi-channel games like *Majestic* have used everday real world devices like telephone and fax to blur the boundaries between game and reality. The virtual world-based game *Everquest* has evolved a large economy that spills over into the real world economy through Internet auction sites like *Ebay*.

The plasticity of the digital dimension lends itself to a process of genetic miniaturisation wherein elements of interactive user experiences are iteratively deconstructed, ready for redeployment by increasingly fine-grain content management systems. E-commerce developers are now faced with a choice: Do they continue to enhance the artificial intelligence of e-CRM engines, building more control over the interaction into these systems? Or should they now start to recognise that users tend to remain at arms length from such systems once they are displaced from proper agency, unable to affect the virtual world, to manipulate it according to their own intentions and form their own attachments of meaning and signs to objects.

I have argued for an approach to devolving the power of ownership of interactive narratives from brands to diverse communities of users interlinked through gameplay. Users are restored as the agents of their own interactive narratives. Brands release their total control of virtual behavioural spaces in favour of a more equipotential relationship with users. If the economy and rate of development of the 77-th richest country in the world are anything to go by, there are rich rewards awaiting the pioneers.

References

1. Gibson W. Neuromancer. Grafton, London 1984
2. Gibson W. Idoru. Penguin, London 1996
3. Holmquist L, Bjork S, Falk J, Jaksetic P, Ljungstrand P, Redstrom J. What About Fun and Games? PLAY, Viktoria Institute, Sweden, 2001
4. Frohlich D, Thomas P, Hawley M, Hirade K. Future personal computing. Personal and Ubiquitous Computing 1997; 1(1)
5. Herz JC. Joystick Nation: How Videogames Ate Our Quarters, Won our Hearts and Rewired Our Minds. Little, Brown and Company, New York, 1997
6. Davis E. Techgnosis, Myth, Magic and Mysticism in the Age of Information. Serpent's Tail, London 1998
7. Klein N. No Logo. Flamingo, London 1999
8. Baudrillard J. Simulations. Autonomedia Foreign Agents Series, 1983
9. Nielsen J. Designing Web Usability: The Practice of Simplicity. New Riders 2000
10. Murray J. Hamlet on the Holodeck: The Future of Narrative in Cyberspace. MIT Press, Cambridge, MA 1997
11. Petrelli D, Not E, Zancanaro M, Strapparava C, Stock O. Modelling and adapting to context. Personal and Ubiquitous Computing 2001; 5(1)
12. Cheverst K, Davies N, Mitchell K, Efstratiou C. Using Context as a Crystal Ball: Rewards and Pitfalls. Personal and Ubiquitous Computing 2001; 5(1)
13. Jameson A. Modelling both the context and the user. Personal and Ubiquitous Computing 2001; 5(1)
14. Falk J, Redstrom J, Bjork S. Amplifying Reality. PLAY, Viktoria Institute, Sweden, 2001
15. Falk J, Bjork S. The BubbleBadge: A Public Wearable Display. Extended Abstracts of CHI '99, ACM Press 1999
16. Ljungstrand P. Context awareness and mobile phones. Personal and Ubiquitous Computing 2001; 1(1)
17. McLuhan M. Understanding Media. Routledge Classics 2001 (first published 1964

18. Bey H. The Temporary Autonomous Zone. Autonomedia 1985
19. Levy P. Cyberculture. Electronic Mediations Series, University of Minnesota Press, USA 2001
20. Starner T, Leibe B, Singletary B, Pair J. MIND-WARPING: Towards creating a compelling collaborative augmented reality game. Proceedings Intelligent User Interfaces (IUI). ACM Press. 2000; 256–259
21. The Guardian Newspaper, Manchester, 21 March 2002

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