

# Emergence of ubiquitous computing in advertising



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## **Everyday Interactions with Advertising & Entertainment in the Emergence of Ubiquitous Computing**

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### **Abstract**

*Technology has been advancing rapidly and although the advances of the past fifty years have not benefited everyone equally, the manner in which humans live out their lives and the functioning of societies has been immensely changed as a result of these advances. Ubiquitous or pervasive computing refers to the new wave of technology which is the result of advances in information and communications technologies which have made it possible to seamlessly embed powerful computing devices into objects, locations and even people. Embedded devices now shift human attention from systems to their contents as they work tirelessly to reduce the cognitive load and perceive how humans can be assisted in performing tasks associated with all aspects of their existence. The physical and the digital worlds are now intimately related and every object in the real world can now have a representation in the digital world. The capacity of ubiquitous devices to be context - sensitive and situation aware has changed the manner in which humans interact with such devices, offering rich new possibilities for applications to advertising and entertainment, which are amongst the oldest of human endeavours. This essay presents a discussion about advertising and entertainment in the ubiquitous age and examines what changes are likely to emerge in the future.*

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## **Introduction**

Ubiquitous computing, which is also referred to as pervasive computing, is about the notion that as a result of continuous advances in engineering, information technology, communications, integrated circuit chip technologies and sensors etc computer technology devices will become smaller, cheaper, more capable and better able to weave themselves into the fabric of everyday life until they become indistinguishable from it (Schuster, 2007, Pp. 9 – 11). It was Mark Weiser, chief scientist of Xerox's Palo Alto Research Centre, who first presented the concept of ubiquitous computing, the third wave in computing and predicted that technology will recede into the background of our lives as computers evolve into quite, invisible servants that will help people to calmly do all kinds of tasks in a manner that will prevent them from becoming overloaded by interactions with computing (Wikipedia, 2007, "Mark Weiser"). Thus, computers will extend the human unconscious and enhance their ability to productively control, interact and sense their environment. Unlike the traditional computing concepts, which regard computers as devices that run programs in a virtual environment to accomplish a task, ubiquitous or pervasive computing

philosophy considers computers as being devices that provide a capacity for interaction with a potential portal into an application - data space that assists users to perform tasks in an information - enhanced physical space, rather than as devices that execute software whose execution must be controlled by a user. Obviously, the capacity of computing devices to act as portals into an application - data space is only rendered possible if the fabrication cost, performance capabilities and reliability of computing devices is enhanced as a result of advances in technology over a broad front(Hennessy, 2007, Chapter 1).

Today, data processing, collecting and emitting devices are to be found all around humans in all settings related to their existence, at home, office, in shopping malls or hospitals as well as in transportation vehicles etc(Stakutis, 2005, Chapter 1). These computing devices have been vastly miniaturised as compared to what was available in the past and they are now very much more energy efficient, with enhanced capabilities in terms of performance and connectivity with other devices as well as having a superior capacity for interfacing well with smarter sensors. To a casual observer, the wide array of computing devices that are to be found all around us are barely detectable and they are there to serve reliably, without imposing a cognitive load on humans, so that the quality of human existence in all environments can be enhanced. Discrete radio tags, mobile phones that have a capacity for acting as gateways for the World Wide Web and for connecting to many other intelligent devices, intelligent displays and maps that can be presented with information needs, chemical sensors, discrete radio sensors, video cameras, intelligent assistive devices and gaming devices that provide entertainment

or information are all testimony to the dawning of the new age of ubiquitous computing. Artificial intelligence is now widely involved with all types of computing to enhance the quality of interactions between human users and a network of intelligent computing devices, which collect and process data on a massive scale. Context, which refers to information that is assistive in gauging, or making judgements about an entity, which may be a person, place or object which is relevant for interaction between a user and an application is now able to be fed into a ubiquitous device which can then react intelligently to fulfil the requirements of its human users without placing any burdens on those that it has been designed to assist (Loke, 2007, Chapter 1). Location of people or objects, time, execution state of applications, user emotions, user intentions, the state of brain activity of users, computational resources that are available, the state of software applications and available network bandwidth are examples of contexts that can be of use to ubiquitous devices in interacting with users in a superior manner. Device designers can now be highly creative about using context information and also in regard to what can be feasibly sensed, the optimal manner in which information can be sensed and how sensor information may be used to judge context to optimise device interactions and utility. A number of contextual cues that have been inferred by a ubiquitous device can be combined to form an idea about a situation and the device can then be made to react in accordance with the requirements for a situation. The notion of situation makes it possible for the ubiquitous system designers to carve the world into manageable pieces that can be sensed by sensors, with a separation of reaction rules for each manageable piece providing an adequate response for different situations. Thus, a context - aware

ubiquitous system should be able to sense, think and act in a manner that is as assistive to humans as possible(Loke, 2007, Chapter 2).

If a sense of context and situation can be programmed into the capacity for intelligence of a ubiquitous device, then it should also be appropriate to expect that norms or expectations of appropriate behaviour from device under given situations involving external contexts can also be incorporated into the programming for the device(Ibrahim, 2007, Pp. 54 - 58). Thus, ubiquitous devices should be able to sense a situation or a set of context in order to try and interact in the most appropriate manner with human users. As an example, location and time context can be utilised to present the most appropriate advertising messages to shoppers on a supermarket advertising board and it may also be possible to incorporate an ability to determine what items ought to be highlighted more, depending on the inventory stock situation for a store, or the rate at which sales are being made. Advertising companies are constantly seeking better ways to promote their goods and services to selected consumers who are likely to be most receptive to such messages and ubiquitous, or pervasive environments will permit delivery of the most relevant advertising messages, which have been selected from a large number of possible messages to consumers in a far more personal, intimate and appropriate manner than the mass media advertising that has been available(Leckenby, 2006, " Advertising Issues")and(Hong, 2007, " Advertising in the Environment"). In the ubiquitous world it will be possible to generate believable, personality - rich story characters on a display that may want to appropriately alter the emotional state of a human, depending on the time and their physical condition as sensed from their body posture(Li,

2006, Pp. 132). Emotion recognition systems may also make it possible for entertainment systems to suggest the right movies, audio clips or interactive games and it may be possible to provide real - time information on a wide variety of issues to bus commuters or to generate music which is influenced by the motion of a human conductor within the ambiance(Li, 2006, Pp. 31, 132, 223, 229, 293, 366, 384 and 433). The possibilities for enhancing interactions related to advertising and entertainment are many and ubiquitous devices generally try to ease the cognitive load and provide intelligent sensing of user needs.

Entertainment and advertising are amongst the oldest concepts that are known to mankind(Vogel, 2007, Pp. 1 - 5). As a result of productivity increases, which have also been assisted by advances in computing and information technology, leisure time has increased and people spend more time on all forms of leisure and entertainment activities. Although demand for entertainment has increased, so also has the variety of entertainment which is available and individuals have the greatest preference for rich media video type viewing activities that are relatively affordable. Although, the advertising industry is doing well also, it has been hampered by strict regulations on what can and cannot be done, with expenditure shifting from the traditional advertising mediums to the new electronic forms of advertising that use emerging technologies(Sweney, 2007, Paragraph 1)and(Ramsey, 2004, Pp. 1 - 2). Online advertising expenditure in the United States in the year 2004 alone exceeded \$ 17. 5 billion and the consumer is in control, wanting unique and attractive forms of advertising and entertainment. Thus, it makes sense to try and understand how individuals

will interact with advertising and entertainment in the new ubiquitous age and this essay presents a discussion about the likely form that advertising and entertainment will take in the future.

## **The Ubiquitous Environment**

It is appropriate at this juncture to try and imagine what the ubiquitous world of tomorrow is likely to be like. The world of the future will be characterised by wireless connectivity and miniature, but immense computing power that is connected to very fine sensors(Mathieson, 2005, Pp. 1 - 10). Global positioning systems (GPS) will make it possible for location sensing to within meters and it will be possible to interact with intelligent computing devices using the most convenient human modes for interaction, speech and hearing. Converged networks that connect ubiquitous devices will be intelligent, high capacity and high speed networks with a capacity for moving huge amounts of data to any connection very rapidly. Short - range wireless networks, similar to Bluetooth, will supplement global connectivity provided by the ubiquitous network. The occurrence of selected events will be able to trigger intelligent responses from devices and as an example it will be possible to inform the police and nominated relatives of an individual's location if air bags in a car were to be inflated as a result of an accident. It will be possible to monitor the activities of the children in a family in order to determine if a child has attended class or if they may have ventured too far away from a neighbourhood. Electronic money contained in RFID tags which are attached to a car, or mobile devices that are carried by a person will be able to pay for any road toll, bridge taxes or minor traffic violations without a requirement to stop. 3G cellular networks will become prolific and they will



make it possible to have unified voice, video and data connections serve all human senses to provide rich interaction experiences. Computers will be able to create close to real life experiences for humans that stimulate all their senses and already scientists are thinking about devices that will stimulate the human sense of smell(Kaye, 2001, Pp. 1 - 20). Smart cloths will have a capacity for monitoring body signals and it will be possible to monitor brain waves to interact with computing devices. Intelligent home appliances will be able to monitor what is available in a home and they will not only alert individuals if the refrigerator is running low on certain items, but tiny “ smart dust” sensors will also monitor food items for biological and chemical agents that determine if such items are still fit for human consumption. Intelligent homes, buildings and stores as well as hospitals will react to individual needs and provide appropriate assistance as required. Prompt and pre-emptive response from computing will have become a reality. Sophisticated avatar characters will provide more pleasing human computer interactions that will convey elements of emotion that has been generated by computers. Japan’s ubiquitous architecture provides an indication of many trends that are emerging for the future(Krikke, 2005, Pp. 4 - 9). Ubiquitous or pervasive computing is the result of advanced networking, powerful personal computing, embedded computing and advanced artificial intelligence based human - computer interaction capability.

The ubiquitous age is characterised by the evolution of ambient intelligent environments and these environments are driven by new interaction technology which provides for new ways of using content, new sensing or stimulus generating technologies, faster and more powerful computers and

far greater storage capacities for data etc(Eyles, 2007, Pp. 4). The ubiquitous age will be characterised by ubiquitous computing, ubiquitous communication and intelligent user - friendly interfaces and the resulting ambient intelligence will provide for context awareness, personalisation, immersion and adaptability. Context awareness refers to a device having knowledge about its environment and acting in accordance with such knowledge, personalisation refers to having the ability to deliver information and interactions in accordance with a user's requirements and adaptability refers to the device having a capacity for modifying its performance according to externally imposed requirements to best cater to a user.

Clearly, many opportunities will exist for utilising new technology for advertising and entertainment. However, in view of the fact that the ubiquitous environment will have the capacity for collecting a large amount of personal data which will be used for enriching individual experiences, but which can also be misused, privacy in the ubiquitous environment is an issue(Mutanen, 2007, Pp. 24 - 43). A number of techniques are being researched to protect individual privacy in the ubiquitous age, but the trusted authority concept is amongst the more promising ways for protecting individual privacy.

## **Advertising in the Ubiquitous Age**

Ubiquitous environments will permit a variety of methods to present advertising messages to people, including email, instant messaging, cell - phone, network television and electronic display boards etc that are linked together as a result of convergence of new mobile technology, IT and media on an integrated global infrastructure(Ihlstr, 2007, Pp. 1 - 5). The ubiquitous

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environment will have a chain of sensors that will be deployed by advertising service providers to sense contexts, including location, weather condition variables, such as temperature and what the intended audience is engaged in at a location, so that the more appropriate advertising message on the right channel may be presented (Leckenby, 2007, "Advertising Issues"). The context information is useful for presenting the right advertising messages to the right people at the right time and on the right channel using the more appropriate form of advertising message. Context is also important for displaying advertising messages that are likely to be important for a particular location, such as those messages that are placed by local businesses in a suburb. Research indicates that although tastes are likely to vary, recipients are interested in the entertainment content of advertisements and this means that the right advertising messages have to be created for the right format. Advertising messages should provide for a means by which a recipient can follow - up on what has been received and recipients will certainly require that their privacy and security be protected. Consumers who are linked to the ubiquitous network of devices can be made to provide information about their preferences and it is likely that they may want to have their more relevant personal attributes made available on a ubiquitous user database. The ubiquitous environment is certain to have a large number of peripheral displays that are mounted at convenient locations, including close to elevators, at convenient points on streets and in shopping malls or other public locations. Serendipitous advertisements are most likely to fit in well on displays in a ubiquitous environment, because other messages can be sent in a more personalised and discrete manner. The advertisements that are required to be placed will be booked with

advertising service providers who will have facilities for creation of advertising messages and the distribution of such messages over the ubiquitous networks.

It is most likely that mobile wireless networks will become even more important in an age of ubiquitous networks and this means that personal mobile devices, especially a PDA type device or an advanced mobile phone which can be used for a wide variety of interactions with the ubiquitous network and other users will assume a higher level of significance in the lives of individual users(Loke, 2007, Chapter 3). Individuals will be using such devices to send and receive emails, transfer funds to businesses or other users, retain data for a wide variety of purposes including inventory for groceries that are in stock at home, immediate purchasing needs and any purchasing transactions that may have been carried out in the past etc. Sensors placed at various locations on the ubiquitous networks will be able to interrogate the mobile device of a user and depending on what information is permitted to be shared the advertising and entertainment service providers will be able to determine what is likely to be of interest to the owner of a mobile. Thus, those who are within an airport terminal may be provided with advertising related to bargain fares, while a short message from a PDA can bring a message containing information about local restaurants offering special deals. Advertising displays may call individuals on a first name basis after having sensed information related to their identity from their personal mobile device when they are in proximity of an intelligent display and it will be possible for such individuals to interact with intelligent displays using speech to present their preferences(Mathieson, 2005, Pp. 1 -

10). It will be possible to shop for pizza, movies, books and music anywhere and at anytime, with the purchase instructions emanating from a personal device along with a payment authority and it will be possible to accept digital delivery in a format which is both highly portable and widely usable.

Today we live in a world in which very many advertising messages influence individuals as they carry on with their daily lives and many of such advertising messages are likely to be of little interest. The rising cost of advertising makes advertising expensive. It is important that if individuals find something that interests them in the large number of advertising messages that they are presented with, then they should be able to quickly retrieve information for further interactions with the advertiser. Beaming is a new advertising technique that is being experimented with by several firms and the idea is to permit those who view advertising on electronic displays to retrieve and store electronic contact information into their mobile devices through their device's infrared or Bluetooth port (Krikke, 2005, Pp. 24). The information that is able to be transferred into a mobile device through beaming is then used by the device to provide links through the network for further interactions with the advertisers. Newer forms of beaming will permit those mobile devices with a camera to "photograph" information that has been coded into black and symbols, called SpotCodes. A SpotCode has been presented in figure 3, below. After a phone has succeeded in "clicking" in information that has been presented on a visual advertisement, it will be possible to use this information to retrieve all the details into an email that can be sent to a nominated address, or if desired, immediate purchase can be made by using the mobile device. Thus, emerging technologies will make

it possible to enhance the effectiveness of advertising by making it cheaper, easier and more convenient to follow up on advertising, which should be of benefit to the advertiser and the consumer. The idea is to facilitate transactions and to enhance convenience in a manner that will not waste resources or the attention span of the consumer. Great opportunities will exist to develop evolving relationships with consumers through ubiquitous advertising and advertisers, or at least their messages, can go where the customer is, with a capacity for initial interest to be rapidly transformed into more information or interaction without any need to move through the physical space.

Advertising message delivery does not have to be visual all the time and “targeted audio” technology will make it possible for laser beams to be pointed to persons who will then be the only ones who will be able to hear an audio message (Krikke, 2005, Pp. 143 - 160). Thus, after sensing individual preferences, it will be possible to direct speech communications to individuals in a location so that only those who are likely to be interested listen to these messages. Thus, it is not just Bluetooth that will be used to transmit short range location based information. The ubiquitous network will follow the user and not the other way round. Augmented reality devices will have been made perfect in the ubiquitous age and those who live in this age will not just be carrying a PDA type device, but they will also be wearing a comfortable spectacle, if they so desire, that will assist in visual encounters with the ubiquitous world. It will be possible to superimpose additional information on to visual advertising messages that may be presented to individuals through the augmented reality devices and examples of such

additional information may include balance of a bank account containing electronic money, or location information for outlets. It will even be possible to interact with large electronic advertising boards through gestures in order to prompt them to provide additional information to either a PDA type wireless device or the augmented reality device which may be worn by a user. Researchers have already tried to develop a gesture recognition language that can change the way in which humans interact with ubiquitous computing devices of the future(Krikke, 2005, Pp. 202). Promotions and special offers can be quickly presented to consumers who can electronically collect coupons and if a loyal shopper is identified during an advertising or promotional campaign, they can be presented especially attractive discounts or offers electronically. Face recognition and the detection of emotions by examining faces will make it possible to cheer - up a loyal customer who may be feeling a bit down and the buying habits of consumers can be examined to determine if certain consumers are losing interest, so that a special effort can be mounted to win them back. It will be possible to embed identity on to each person using RFID devices that may be mounted on to a watch, or even be embedded under a person's skin so that immediate identification and connection to the most appropriate databases that are likely to be of interest can be made possible. Very many possibilities for enhancing advertising present themselves, but the key to have these possibilities becoming reality is the advances that can be made in packing small chips with huge computing power and imbuing networks with capacity and speed.

## **Entertainment in the Ubiquitous Age**

Although better networks and more powerful computers as well as advances in technology on a broad front will enhance the overall entertainment experience in the ubiquitous age, entertainment in the new era will be characterised by its extension into the physical world and a capacity for interaction (Eyles, 2007, Pp. 1 - 5). Augmented reality will have an impact on the entertainment experience by superimposing the virtual on to the real in a number of ways that may also include the use of holograms. Internet will add to the traditional methods for delivering entertainment content to viewers and video appliances will be able to predict what will be the most appropriate viewing choice for individuals based on their estimation of the emotions of a user, their activities and important occurrences in the real world. Video - on - demand is already a reality, but context aware music and wireless networked video - on - demand will be the norm with the entertainment devices of tomorrow. Surround screen systems, using mist or water droplets to project video images and collaborative multiple browsing arrangements are examples of new ways in which the senses can be artistically manipulated (Peterson, 2005, Pp. 8 - 12). Entertainment is likely to be influenced by notions of temporal and spatial mobility as well as context, mood and emotion. The integration of artistic forms and technology, interactivity with a capacity for manipulating entertainment and media experiences, the use of hypermedia concept to link media elements into a personally satisfying experience, immersion which will permit entering a three dimensional environment that approaches complete entertainment and a emphasis on a superior ability to narrate in order to support the moment - by - moment mood of the individual mind will continue to dominate



entertainment in the ubiquitous age with entertainers and artists innovating to exploit the power of technology(Burnett, 2003, Chapter 1). Individual users are more likely to be closely connected to ubiquitous computing devices through cybernetic systems and this will permit a closer connection of the human form with the electronic environment(Burnett, 2003, Chapter 2). This means that the human user will be able to more intimately control a variety of ubiquitous devices through the motion and expression of every part of their body and as an example, dance will be able to influence music and stage lighting effects more closely than ever before, resulting in new and richer forms of artistic impression for the audience. Wireless or sonar tracking systems will eliminate any need to have physical connections between a human form and any ubiquitous devices, resulting in a true freedom of movement and expression with a capacity for artistically manipulating other sensory impulses for the audience. The smart entertainment space concept is illustrated in figure 4, below.

The concept of anytime anywhere entertainment will mean that it will be possible to use an individual's PDA device to shop for a very wide variety of entertainment games, videos or experiences from anywhere and at anytime(Krikke, 2005, Pp. 63 - 64). High speed networks will deliver what has been requested in a flash and the content can be viewed on a portable PDA or a home entertainment centre which will offer more options for enhancing entertainment pleasure or even interacting with the entertainment presentation. Interactivity will mean that as a story rolls on, a viewer can choose options that influence future narration and influence the present in the narration. Wideband network connectivity will mean that it will

be possible to carry on with social interactions with distant human friends while simultaneously interacting with computer generated entertainment which may include avatars that are beamed into the homes of all those who are connected to a social gathering which is distant in space, but close in time. All those who are connected can interact simultaneously with the computer that is generating entertainment animations and view the results in real time. Such entertainment sessions are certainly going to need very high speed networks, immense computing power for the ubiquitous entertainment centres and real time processing power to put together socialisation in an augmented reality world and large amounts of data will have to be maintained in storage for rapid retrieval with such data also being rapidly moved over the ubiquitous networks.

When individuals are indulging in remote interactions, such as those over videoconferencing, it is not possible to touch or feel the people at a distance and this means that a certain loss of emotional information currently exists in computer mediated interactions. Touch, or hepatic interaction devices that are being considered in research today and new forms of interfaces that attempt to present more emotion information by various means, such as colour changing displays or avatars will make entertainment and social interactions more fun (ISMAR, 2007, Pp. 33 - 35). Thus, it will be possible to further improve the tangible content of interactions involving computers. Computer generated reality will make it possible for individuals to either learn or play games, such as squash, all by themselves using a racquet that will contain position sensors that are coupled to a computer that will fix the position of such a racquet in real time, in relation to a computer generated

ball, making it possible for the user to experience the thrill of a real squash game(ISMAR, 2007, Pp. 4 - 9 and 21 - 27). Many different games, including fencing, tennis, table tennis, badminton or even ice hockey etc will be available on the same entertainment centre, which will also provide delights of high speed driving, ice skating or piloting a jet fighter with appropriate gaming attachments. Natural interaction will be possible with contemporary art, including music and lighting patterns emanating from a music wall and this will make it possible for individuals to seek new creative and thrilling experiences(ISMAR, 2007, Pp. 47 - 52). New forms of interactive exhibitions will be possible for art and antiquities etc, with computer generated avatars providing more human like guidance around museums or other interesting places(ISMAR, 2007, Pp. 53 - 58). It will be possible for painters and graphic artists to create on computer palettes and to imbue their work with emotionally responsive features and a certain level of dynamism that will make their work far more interesting as compared to the paintings of today(ISMAR, 2007. Pp. 61 - 66). Changes in te