

Pervasive Gaming: Testing Future Context Aware Applications

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Abstract: More and more technical research projects take place that weave together elements of real and virtual life to provide a new experience defined as pervasive. They bank on the development of mobile services to drive the expansion of pervasive applications and in particular pervasive games. Using geolocalisation, local networks and short range radio frequencies technologies like RFID or other tagging technologies, pervasive games rely on a close relationship to the environment and thus explore the space between fiction and reality. This is their main quality but possibly their main weakness as the development relies on the production of specific contents in relation to the context of use. In this article, we propose to explore what this entirely new paradigm for game design implies in terms of production and how to overcome the limitations due to this dependency of contents and context. Based on our experience of three pervasive games developed within research projects on adhoc wifi (ANR-Safari and ANR-Transhumance) and RFID networks (ANR-PLUG), this paper presents different options to reducing the cost of content production relying on either traditional editors or grass root contributions.

Key words: pervasive games, content production, game design, geolocalised technologies.

In this article, we want to present a new expansion of mobile games that is still largely an area of research: pervasive games (PG). Pushed by research projects in mobile and adhoc technologies, these games now face the question of their possible evolution as a specific gaming branch. Only a limited number of commercial PG were published either as downloadable games on a mobile phone - "Mogi" (LICOPPE & INADA, 2005) or Botfighter, a mobile version of "Counterstrike" (MONTOLA & WAERN, 2006), promotion tools for a movie in a pluri media marketing campaign - "The Beast" for the movie IA by Steven Spielberg (SZULBORSKI, 2007), or as part of public relation events - "Shape project"

(BENFORD *et al.*, 2001). These applications have not yet reached the main stream gaming market though all tests seem to indicate that they were particularly enjoyed by the players. In this paper we want to present our own experiments over three research and technology development (RTD) projects ¹, and in particular explore how the rationale of PG could eventually lead to such a deployment through different options of production.

Walther Bo Kampmann describes pervasive technologies as mobile, location-based, since real places are the setting of the activity. Pervasiveness is ubiquitous and relies on communication infrastructure of everyday life. It also mixes virtual and real elements. Pervasive games (PG) therefore imply "the construction and enacting of augmented and/or embedded game worlds that reside on the threshold between tangible and immaterial space, which may further include adaptronics, embedded software, and information systems in order to facilitate a 'natural' environment for gameplay that ensures the explicitness of computational procedures in a post-screen setting" (BO KAMPMANN, 2005). Bo Kampmann not only underlines mobility and ubicomp, he also points to the diversity of technical infrastructures (WiFi, Bluetooth, network of captors) and devices (mobile phones or PDA and multi standard devices) and the transmediality of contents. Users own, produce, store, process and circulate a great diversity of media contents.

Jane McGonigal emphasizes that ubiquitous computing "is the merging field of computer science that seeks to augment everyday objects and physical environments with invisible and networked computing facilities" (McGONIGAL, 2007). As was underlined by Magerkurth, Engelke and Memisoglu, pervasive games not only throw video games in the outer world - streets, malls, countryside, school yards, etc. - they also open the closed system of videogames by including elements of real life within the game play (MAGERKURTH, ENGELKE & MEMISOGLU, 2004). For instance "Barcode Battler", developed and published by Epoch Co in 1991, can be considered as one of the first pervasive games. It was first launched in Japan where it was quite successful then worldwide. Thanks to a barcode reader device, stickers delivered not the price of the product but attributes to the players: strength, weapons, life points, etc. Barcodes therefore belonged to two realms, that of products consumption and that of a role-playing environment.

¹ 2003-2005, ANR-RNRT, Adhoc wifi research project SAFARI; 2006-2008, ANR -RNRT, Adhoc wifi research project TRANSHUMANCE, 2007-2009; ANR-RIAM, PLUG (Play Ubiquitous Games, and Play more).

Since then, the term pervasive has encompassed different versions of games: ubiquitous games, augmented or mixed reality games, mobile games, alternate reality games, live action role play, affective gaming, smart toys, etc. They all show narrative qualities as Rich Gold's playful vision for ubiquitous computing quickly pointed out as early as 1993: "the everyday objects themselves become a kind of ruse" (GOLD, 1993). The user holds an object and its possible double, its potential connection to another kind of logic altogether. Hence, Jane McGonigal defines a topology of PG in terms of social alterations. Some games like "Can you see me now" (2001), "You're in control" (2005) are "to colonize new objects, environments and users in the name of ubiquitous computing" (Mc. GONIGAL, 2006). The idea is that every object can be "computerized" and connected to each other. The mode of action and metaphor is colonization by network. The second type of games aims at a critique and disruption of social conventions in public places. "Big Urban Game" (2005), "Pacmanhattan" (2004) are more like urban performances that are relayed by the internet. The mode of action is disruption. The last strategy relies on translating narrative codes of fictions into the material, real world. "I love bees" (2004) and "Perplex City" (2005) work to materially replicate the interactive affordances of traditional digital games in the real world. The mode of action is activation ².

■ Matured social and technical features: challenges of content production

As noted by Omer Rashid *et al.*, "within the cellular industry itself, this new genre (PG) is not without its detractors, and many indeed are asking: will users pay to play the games? Will users want to play these games, and will the devices and enabling technologies reach critical mass?"(RASHID, MULLINS, COULTON & REUBEN, 2006). We will argue that a few trends should be considered that point to the possible development of such games. First, as can be construed from these different examples, pervasive technologies seem mature enough and the different games show great cultural and narrative opportunities. PG thus seem to open a promising new avenue of development for the video game industry, in the footsteps of

² Papers on these games can be found in BORRIES, WAALZ & BÖTTGER (2007). A list of augmented reality games is available at: <http://www.christydena.com/online-essays/arg-stats/> and a list of pervasive geolocalized games can be found at: http://www.induce.net/archives/locationbased_mobile_phone_games.php

mobile games that are taking a growing share of the whole market, with two billion USD in 2008 according to the NPD group and the ESA out of a total U.S. video game console software sales that reached \$8.9 billion (189.0 million units). The evolution of uses points in the same direction. In particular mobile devices have fostered gestures based on short range radio wave that allow contactless payment, transportation, entertainment (Nabastag reading tags on books). The NFC norm (Near Field Communication) developed in 2004 by Philips, Sony and Nokia is available on a growing number of mobile phones. IDATE estimates that by 2012, 14% of mobile phones sold in the US and Europe will be equipped with NFC chips. More mobile devices also accommodate multimedia contents and allow internet connection as well as geolocalisation. These spreading uses and our own experiments tend to show a trend to multi standard communication platforms that will have to be considered for pervasive gaming.

In fact, the principal difficulties of developing pervasive games might lie in the production of their contents. While most of today's videogame strategy does not take into consideration the anthropological data pertaining to the context of use - when and where, are not relevant to the game design - the core advantage of pervasive games is indeed that they are based on a specific time and location. The three pervasive games we developed - "The Secrets of the Museum", "Team Exploration" and "Treenor"³ - showed that the link between play, users, spaces and objects should be carefully worked into the game scenario for a seamless experience weaving device and environment together. This close relationship between place and content raises the editorial stakes to new levels and could be a major problem for pervasive game business models. While Stéphane Natkin evaluates that "four to eight people are needed to develop a very simple game on gameboy or mobile phone" (NATKIN, 2004), creating specific contents for a specific place means that a considerable amount of time is devoted to producing a cultural product that few are actually going to enjoy. Either, pervasive games are limited to the discovery of a new place. And then it is a one shot experience that will be not reiterated. For instance, if one creates a game for a museum, one must not take for granted that players will come back to play again to get a better score. Or, as our testers pointed out, urban mobility or cultural behavior are primarily concerned by repetitive journeys (to commute or shop, accompany children to school, etc). These can be spiced up by localized information or social relationships. Then the scenarios should

³ Information on these games is available at:
<http://perso.telecom-paristech.fr/~gentes/CoDesignLab/>

change everyday to avoid repetitiveness and boredom. This double type of urban and cultural mobility presents a challenge. How do we adapt contents to repeated or exceptional trips or stays? Are we going to follow the trend of online games that keep their players by constantly renewing their contents and offering subscriptions. As Sebastien Genvo, following Bernard Miège's analysis of the cultural industry puts it: what model are we going to find? Either traditional editorial production or a model of flow? (GENVO, 2006).

As we developed our own experiments in pervasive gaming, we were very much aware of such challenges but it is really after our user tests that we came up with a new perspective. Each test worked as a breaching experiment that linked production and reception, while several parameters could be isolated and commented upon by the testers. This global creative assessment allowed for certain features to be pointed out and testers suggested further improvements of our games that we comment on here by comparing them to other mobile applications and practices. The interviews addressed different questions on game practice, mobility practice and social and cultural expectations in terms of services. Testers were explained the technical functions and rules of the game, then they tested the device, to get used to it, and finally they played. In each case, we conducted open qualitative interviews to assess the experiment but also to explore any kind of analogies, comparisons, recollections that the experience triggered. We were interested in practical details as well as in larger imaginary views. We did not limit ourselves to game design but encouraged any kind of suggestions concerning the situation. This type of creative assessment based on people's experience produces both very focused remarks on the device and game and a clear analysis of how people feel about their mobility, their relation to the city or to the museums and what they expect from a technically mediated relation. In other words, these interviews show how people confronted with the technology and its services can integrate them in their own experience and build up a new meaning that is a hybrid between different experiences. This is no guarantee for the market acceptance of such products but it gives a comprehensive understanding of the way people are ready – or not – to blend them into their everyday life.

In this particular instance, testers expressed a great variety of needs related to local information and social network. The games revealed a longing for services and contents that would enrich our relation to the city and its institutions. Testing pervasive gaming opened up not only a playful renewal of everyday or cultural mobility, it showed how people perceive the pervasive paradigm as a way to diversify repetitive activities and city life anonymity.

■ Designing and testing pervasive games

We designed and tested three games within three different research projects on distributed systems. The purpose of these research projects was to develop new networks based either on adhoc wifi (ANR-Safari and ANR-Transhumance) or RFID networks (ANR-PLUG) and to test pervasive gaming options. We will briefly introduce these games and focus on the question of contents production as it appeared to be not only one of the main assets but also one of the main constraints for pervasive gaming development.

Treenor: playing in a railway station

Playing with schedules

Our first pervasive game was designed for the French National Railroad Company (SNCF) and called Treenor⁴. In Treenor, players choose a clan of either Humans or Robots. They can visit the Treenor planet that reproduces the architectural features of the station though the look of the world is different. They meet other players with whom they can chat if they are within Wifi reach. When players wish to embark on the active phase of the game, they consult train timetables (that are, otherwise, shown regularly and automatically on their interface) and go to the dock to board the train/spacecraft they choose to "fly" with. The game is synchronized on the actual schedule of train arrivals and departures. The player has to stand on the platform of the actual train to be able to board the virtual spacecraft. Then, the second phase of the game starts where Humans and Robots chase each other. In this phase, the player is in control of his armed space ship and faces the opposing clan. Players of the same team have to fight and kill the enemy's spacecrafts. If neither clan is wiped out before the actual departure of the train from the station, the game ends for all players positioned on the platform. They land back on Treenor to take a new train/space craft.

Here we want to point out the correspondence between the architectural dimensions of the railway station with the virtual world, the latter being literally mapped on the former which allows players to evolve similarly in

⁴ 2003-2005, ANR –RNRT, adhoc wifi research project SAFARI.

Caught in world events

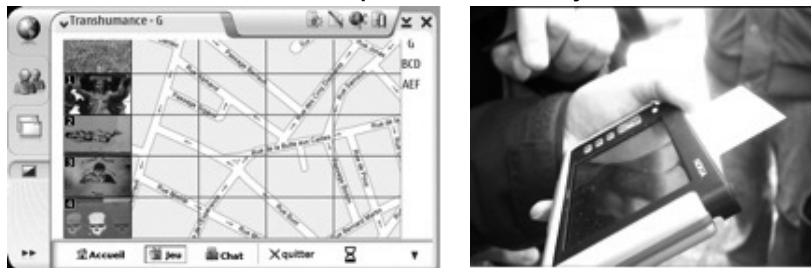
The game used a traditional "shoot them all" scenario that was based on the classic videogame genre. The game design was nonetheless influenced by current events. We had thought of developing a game of train attack in pure cowboy fashion. But then on the 11 of March 2004, a terrorist attack on trains in Madrid killed 191 people and wounded 1,800. We no longer could imagine a game that would remind everybody of what happened then. As well as the tragic elements of the situation, we also learned that pervasive game design, because it relies on the real world, has to cope with real events and to take into consideration a whole array of feelings, activities and perceptions that are delicate to handle.

Team exploration: exploring the city***An urban treasure hunt***

The Transhulance project ⁵ tried to address a certain number of issues that were pointed out by the players and testers of Treenor, more specifically on how to provide rich contents on the premises. Each player is given a PDA equipped with a wifi card in adhoc mode which means that the network relies on actual people. The game consists of finding a mysterious place of meeting thanks to clues scattered in the historical Parisian area of "la Butte-aux-Cailles". Two teams of four players each are opposed and must gather as many clues as possible and be the first to reach the mysterious place to win the game. The interface allows team mates to communicate among themselves and to collect the answers. The whole game is designed so as to let the players be disconnected from their team so that they can freely explore new premises. When a player comes close to another one a connection is immediately established. During the game, players will lose and get the connection, although, to validate an image, all members of the team must be connected. A topology of the network displayed on the right of the screen shows the connections to other players (and the number of hops to a player). The interface of the game is provided by a map of la Butte-aux-Cailles partitioned into twenty rectangles. On the left of this map, five pictures are displayed. The top one appears "blurred", it is the place of final meeting.

⁵ 2006-2008, ANR –RNRT, adhoc wifi research project Transhulance.

Screenshot of Team Exploration Game – Players in action



©2006-2008, ANR –RNRT, *Transhumance*

The pictures correspond to photos that were taken in the area. Players have to find in which area (a rectangle on the map) each of the four photographs was taken. There is a limited time to localize the pictures and when a proposal is made, it must be approved by the other members of the team through the game interface.

Looking for urban details

In "Team Exploration", as in Treenor, there is no geolocalisation. The feeling of getting to know the city intimately was based on the discovery of fine details (different from a tourist approach of major buildings) located on a map. The question of scale in contents was very important because the game was designed for walkers, taking some time to stroll the city and not for people who wanted to go somewhere as efficiently as possible. Testers were not looking for what was obviously there (a bakery, swimming pool, etc.) that they could find without virtual help. They were looking for a complementary insight in the city, a tool that would pinpoint hidden or discreet signs. We made a photographic reportage on street art, including such artists as Misstic⁶, or Space Invaders⁷. This led to a new reading of the area even from people who thought they were familiar with the place. They appreciated that La Butte aux Cailles would not only be a stage for their activity but almost an actor in the activity.

⁶ Photographies of Misstic murals may be seen at: <http://www.missticparis.com/>

⁷ http://en.wikipedia.org/wiki/Space_Invaders.

Human spontaneous network/ local contents

Another important asset of the game is that technical network and people are fused. This is important in several respects. First, the dynamics of the game is necessarily collaborative. Second, for the designers of the game as well as the testers, the contents have to be related to a definite place. Hence, the importance of local narratives and the longing for communal contents. Third, it also means that the game is at the crossroad between what local people can offer and what passers by, tourists, or commuting people expect from it. This is a possible way to develop pervasive gaming that we will address later in this paper.

**The Secrets of the Museum:
meeting other visitors through cultural artifacts*****Scoring in a museum***

Eventually, "The Secrets of the Museum", within the ANR PLUG project ⁸, made us test another technology: RFID, and the specific relation to a cultural institution where the quality of contents and the legitimacy of their author is crucial. The purpose of the "Secrets of the Museum" is to discover the Musée des Arts et Métiers in Paris (MAM) by retrieving and collecting cards that represent objects in the museum. It is a pervasive game deployed throughout the building of the museum. Players / visitors look for the real objects in the museum and then explore the terminals equipped with RFID tags that are located near these objects. In these terminals some cards are hidden and they may retrieve one that completes their collection. The goal is to score points by collecting cards of the same family, trading with other visitors who collect and store cards on their own phone, a Nokia 6131 NFC that can read and transmit information on RFID tags. Players can exchange, collect and replace the cards.

⁸ 2007-2009, ANR-RIAM, Play Ubiquitous Game, and Play more.

The secrets of the Museum - Mobile phone interfaces



©2007-2009, ANR-RIAM, PLUG

Through the game interface, the player discovers and investigates artifacts in the museum but, above all, must show qualities that stand for the values of research. The player scores the same amount of points by tidying cards – showing civic quality by putting the right card in the right place, close to the real object in the museum; swapping them with other players – proving a collective spirit; as well as by answering the quiz – demonstrating curiosity. The device and game were therefore not copies of audio-guides. The Secrets of the Museum are more focused on knowledge gained through practice than top-down curatorial explanations.

Producing cultural contents

In the context of the museum, the question of contents was at the center of the game design. For only 16 artifacts, five people produced 288 audio dialogs, read by ten "actors" who were recorded. The audios were treated and downloaded on the phone application. 80 quiz were written for the 16 selected objects. For each quiz the player had to choose out of three possible answers. The quizzes were of different levels of difficulty to allow for different players to play (from pre teens to adults). 16 "zooms" gave background information for each artifact. All these objects were chosen so that a global picture of their correlation could be understood by the gamer (family of objects) which actually meant that the museum changed its current narrative (thematic for each main hall) into a transversal viewpoint. Even though the photos belonged to the database of the museum, they had to be edited to fit the system and the game. The different services in charge of the

collections and of public relations checked all the contents. Though we considered the production to be quite sufficient, testers expressed that they did not get enough information. They wanted to know more about each object, and to be explained more thoroughly why they were related. "The game should force us to gather more cultural information and make it a condition to win"⁹. Players considered the game as a service offered by the museum and therefore were expecting more contents. We concluded just as Joelle Le Marec when she notices, in her analysis of the relations between visitors and museums (LE MAREC, 2008), that visitors have a clear idea of the responsibility of a cultural institution. Our players knew that they could rely on the quality of the information because of the legitimacy of the museum. They regretted that this cultural eminence was not more emphasized by the game or its complements. The game design can bank on this confidence and on the perception that pervasive games necessarily tap into the knowledge of the museum.

■ Content production: the specific challenge of pervasive game development

From our own three experiments, we learnt that expectations were high in terms of renewed experiences to urban and cultural practices but that even in the least costly game - in quantitative terms - we still needed to devote a lot of time to developing specific contents either to replicate the place or to make it meaningful. This raises the issue of who will be willing to pay for the production of these contents in particular if they do not rely on the telephone network but rather on free communication channels such as Wifi, RFID, Bluetooth and so forth. One option would be to use these "free" channels but then make it necessary through the game design to switch to the phone network. This solution is not so far fetched as, in all experiments, either users asked to be allowed to use the phone to accelerate the game and increase their efficiency or used it when the option was offered. In the "Secrets of the Museum", players used an NFC phone that allowed them to exchange cards and information between RFID terminals and phones. In addition to the information they could get from reading the memory of RFID tags and of phones, they could contact all the players to check if they were willing to swap cards and negotiate with them how and where they could do

⁹ Interview with a player of "The Secrets of the Museum".

it. The game play therefore can gradually lead to some income for the operator as calling other players appears to be a way to win the game more quickly. Apart from this solution to pervasive games business models, we focused on the production of contents per se to see how enriched contents could be provided and by whom.

In particular, we want to analyze who are the legitimate producers of contents within pervasive games. So far, most experiments rely on the participation of major cultural institutions that are used to producing large amounts of cultural data and who challenge the traditional ways of relaying them to an audience. We can mention *Via Mineralia* in the *Terra Mineralia* Museum in Freiberg where players have to find a specific exhibit, answer some questions and earn points, with a PDA coupled to an RFID reader (HEUMER, GOMMLICH, JUNG & MÜLLER, 2007). *Soundspot* is also an entertainment system experimented in The Museum of Nature and Human Activities in Hyogo. It is "a location/user-dependent audio guide system. It can track the positions of visitors and then only provide sound information to the limited spots around them" (DEGUCHI, MIZOGUCHI, INAGAKI & KUSUNOKI, 2007). We can also mention *REXplorer* as a successful example of an outdoor exploration game in the historical city of Regensburg, in Germany (WALZ & BALLAGAS, 2006). But we also want to follow a few paths that the testers were eager to suggest and that meet global trends in contents production. In particular, we want to point out contents that are collaboratively written and shared, mashups and other "global made local" grass root production.

Local producers of contents for local uses

As we said, time and location are key elements of pervasing gaming. The game context helps to define strategies for the production of content and marketing of the device. Whether pervasive games take place in cultural institutions or in public areas such as cities or train station, the producers of contents are local actors: museums, cities, local governments.

Museums such as the Louvre ¹⁰ in Paris or the Tate Modern ¹¹ in London, for instance, handle large amounts of data and also want to experiment with digital devices to create new cultural practices. Indeed

¹⁰ <http://www.museumlab.jp/francais/>

¹¹ <http://www.tate.org.uk/modern/multimediatour/>

cultural institutions try to find new forms of visits based on recent devices, original activities and narratives that can attract diverse audiences and keep customers' loyalty. The challenge is also to adapt the cultural offer to evolving cultural and social behaviors (continuous connection, peer to peer communication, grass root cultural production). Therefore, they diversify their offer with guided tours, workshops, games, conferences, confrontations with other cultural fields, etc. In particular, the Louvre museum created a special department devoted to the creation of multimedia contents adapted to PDAs. The production of audio contents was based on an elaborate process including journalists, curators, editorial supervisor. Journalists asked questions to curators who would comment freely on a work of art. The editor in chief selected and edited parts of these interviews. The journalists questions are finally cut out from the footage but the huge benefit is the tone and spontaneity of a text induced by a dialog. It avoids the stilted style of a recitation and is perceived as a testimony.

Museums are interested in pervasive technologies because they improve three characteristics of the visit: mobility and autonomy for the visitor and precision of information. A good number of museums choose to develop interactive multimedia devices that gradually replace the fixed interactive stands. The user carries a tool or is spotted by the environment, getting relevant information to the here and now of her visit. (LUYTEN & CONINX, 2004). These technologies can help the visitor to benefit from a virtual guide that can suit her profile and leave her free to organize her own visit, such as "Visit +" in the Cité des Sciences et de l'Industrie in Paris where the user chooses to record certain data that are stored on a personal account and can be retrieved after the visit (TOPALIAN, 2007). The RFID technology has been used by many institutions, especially science museums to provide targeted information. The Industry and Science Museum in Chicago, Tech Museum in San Jose, Walker Art Center in Minneapolis, National Museum in Tokyo, or Legoland museums currently use RFID for the management of their collections (with location tracking systems) or for audio guides and other self-guided tour options. In Lyon, the Museum of Confluences in collaboration with the research Center Museolab ERASME put up two exhibitions "Ni Vu, Ni Connu" and "Objets en transit", where visitors could experiment the traceability of their own visit and reflect upon the social uses of pervasive technologies (SERMET, MANDRAN & CANDITO, 2007).

Localized contents made global: using the context to produce information and foster interactions

The second solution lies in the possibility to create a global platform out of localized contents and to connect places that will channel information and communication as in an extranet of collaborative institutions. The idea comes out of our experiment with the Musée des Arts et Métiers in Paris especially after that "The Secrets of the Museum" was described as a generic game, adaptable to new game fields. It also stems from an observation of new services where inhabitants of a territory offer their services to guide visitors as in Guideal.¹²

A ring of museums: connecting places

One of the frequent suggestions made by the testers of The Secrets of the Museum was to enlarge the scope of the game by distributing it on other cultural sites. They thought museums should be connected together to form a "metaverse" of museums.

"In 1983-1984, I offered to mix people who are actually in one place with people who would like to know what is happening there. We could create a virtual parallel universe where real people meet. I am in Virzon, I am interested in Bordeaux. If I find someone who is located in Bordeaux, I can speak with him. Or in a museum and I speak with him."¹³

This suggestion is close to what researchers did with the game "Interference" (within the IPerG project) because it is "an urban adventure game that has been designed to be restaged in different locations" (BICHARD & WAERN, 2008). Our testers thought that instead of collecting cards only in one museum, they could collect and exchange cards with people in other museums.

"Perhaps all museums could have an equivalent of the Secret of the Museums. Each museum would zoom in on certain works. Yes I think that could work. That could become a commonplace practice as people may end up having so many points in a museum and so many points in another. A bit like in the rankings that are on xbox live."¹⁴

¹² www.guideal.com

¹³ Interview with a player of "The Secrets of the Museum".

¹⁴ Interview with a player of "The Secrets of the Museum".

Testers not only see a larger scope for the project, they insist that getting information and icons should be made on the premises then exchanged through the channels of the museums. Museums are no longer perceived solely as editors of contents, they are seen as a steppingstone to a larger cultural ring. The notion of qualified contents extends therefore to qualified access and networking. Then, the game could welcome social relationships between museums as it did within the museum. The collection of virtual objects would give an opportunity to communicate impressions or comments in a "secure" enlarged context where one would meet other museum goers.

"It's a generalized chat. But not from office to office. A chat much more lively, much more active. I would like to see pictures with someone and discuss with her if she agrees." ¹⁵

The social network thus created is a selective one. And the production of contents relies on a collaboration of actors that share and thus augment the game scope. Designing such games means creating the platform that can accommodate a diversity of interactions.

Contributing to the environment: adding to the "here and now" experience

In our experiments we also noticed that players wanted to leave a trace, to leave a message, to act on the game's content so that their intervention could be visible for other players. This principle is reflected in the Gopher Game project (CASEY, KIRMAN & ROWLAND, 2007) that incorporates created blogs into the gameplay. In fact pervasive gaming can easily benefit from collaborative web mapping.

"In a society where 'computing means connecting', being able to capture and visualize affective meaning is vital to enhance our perception of space, deepen our connections with the urban and natural environment, and stimulate reflection and discussion about the places in which we live and that we share" (GIACCARDI & FOGLI, 2008).

Giaccardi and Fogli propose the term of "affective geographies" to express the digital representation of space and place enabled by cartographic semantics that reflect the affective meaning put into maps.

¹⁵ Interview with a player of "The Secrets of the Museum".

This contribution to the real and virtual environment can take place on the actual premises of the experience. It can also be produced away from the context of use and reinvested in the here and now experience as we shall see now.

**Global contents made local:
digging into the world wide web to enrich the context**

The third solution emerges from web2.0, systems of enriched cartography and "geospatial" web. A whole field of research analyzes the social workings of applications based on open source platforms like Facebook, Goggle Earth and Flickr that allow new forms of content re-edition and spatial mapping and connect contents placed on the internet with localized practices. Elisa Giaccardi and Daniela Fogli explain that: "people are increasingly using web map to connect with each other and with urban and natural environment in ways no one had predicted" (GIACCARDI & FOGLI, 2008).

Physical space as a new component of digital life

Google map has popularized the use of maps and the sharing of cartographic contents for a local use. Kaj Grønbaek observes a renewed sociability through new social networks, (Wikis, BSCW, Weblog), and proposes to focus on local public spaces and on interactions between people who share the same physical space. He tries to work out the relation between social computing and local interactions.

"I will argue that there is a need to focus on and conduct research in new ubiquitous hypermedia infrastructures and interaction techniques to also support social interaction and networking among people who share the same physical environment" (GRONBAEK, 2006).

Grønbaek and Hansen work on urban and social computing applications for mobile users in a city environment. They develop infrastructure for urban web applications based on tagging and mapping ubiquitous anchors. Working from hypermedia, geo-spatial and physical hypermedia, the authors focus on how to provide a rich variety of ways to anchor digital information in a physical environment. They work precisely "on infrastructure that provides a backend that can be used to provide multimedia blogging and other services via physical anchors on top of contents in arbitrary existing web sites and content management systems" (HANSEN & GRONBAEK, 2008).

Semapedia is a good example "which uses tags on things like buildings, books, airplanes, cars and so forth as links to the corresponding Wikipedia pages" (idem). Another example: ContextBlogger uses semacodes to relate information from blogs to physical objects in order to support mobile learning (DE JONG, SPECHT & KOPER, 2008).

The use of global contents: "global made local" mashups

Mashups are web applications that integrate data from multiple web sources to provide a unique service. This web application has been used to create free travel guides, such as Schmap.com. Schmap uses Yahoo maps and tags places with comments, descriptions of touristic sites, and with photos from Flickr. The guides are continuously updated and can be consulted, downloaded and printed at any time. One can also produce one's own guide. These aggregated contents from different web sites can be used in real time in a city with a 3G phone. The Nokia research center with the collaboration of several universities produced a game using the whole mashup process: "Manhattan Story Mashup". People contributed both by writing stories, fictions, and by taking pictures on site to illustrate them (SCHEIBLE & TUULOS, 2007).

Legitimacy of content producers: operators, users, cultural editors?

Legitimate cultural institutions versus "illegitimate" operators

Though pervasive game design can certainly bank on these practices to reduce the cost of content production, the issue of "authorship" is fundamental when one takes into account the cultural context of the game. In *The Secrets of the Museum*, quiz items were produced by the museum. They were subjected to a review and validation process to ensure their scientific quality. Another case in point, is the EECOOT project that assessed usability and acceptability issues for a phone guide to visit the old centre of Lyon listed as a UNESCO World Heritage Site. Visitors could download cultural urban and architectural comments on their phone for a small price. After 18 months of observation, it appeared that visitors agreed to pay if they could ascertain that the contents were delivered by competent authorities. On the contrary:

"If they thought that it was a service delivered by a phone operator, they would not consent to pay anything, they would even resent that the phone operator was taking place in this particular field, cultural practices" (LE MAREC, 2009).

People are willing to contribute to the workings of an enlarged cultural and institutional space, but not to consume an operator's products.

Identifying legitimate commercial and non commercial editors of contents

In the Transhulance project "Team Exploration", we reached almost the same conclusions. Two distinct strategies were evoked. Either the legitimate contents were cultural, or they could, under certain circumstances, be more commercially oriented. Many testers suggested that contents should be designed by people actually living on the premises, leading to the discovery of crafts, tiny details of architecture, original anecdotes. A kind of grass root tourism. But then, as other players pointed out, shop owners, restaurants, and consumers alike might also want to contribute to the picture. Consequently, our testers feared spam and commercial invasion. This controversy does not only reflect on the general weariness provoked by shop keepers in real streets and traditional media. It raises the question of the legitimate authors and actors of pervasive gaming. Our testers revealingly turned towards actors of the public sector as an easy way out of the dilemma. Not only the city, associations, but also public transporters were deemed legitimate and trustful editors of contents. A kind of hierarchy of authors could therefore be established. In a train station, fellow commuters are worthy participants in an ad hoc network, but the railway people are felt more competent when it comes to train planning information or train station services. Researchers such as Burke, Girardin or Nova show that participatory approaches emphasize the role of users as knowledge authors. Nevertheless, the city or the museum could be moderators or co-authors of the web.2.0 contents produced in a cultural context by users so that trust would be preserved. The legitimacy of the authors can be supported by the institutions.

■ Pervasive game design: designing an ecology of actors and environment

In our introduction, we gave a technologically oriented definition of pervasiveness. But we have seen that the relation to the context is also what

defines pervasive games, not only in terms of physical environment but also in terms of narrative potential. The major difficulty in designing PG is that environment, technical devices, and contents have to be woven together in a seamless and enriched experience. Consequently, conceiving a game turns into designing or rethinking its environment. The success of pervasive applications relies on this integration and 3G devices in pervasive mode will be appropriated if the whole ecology of the experience is taken into consideration.

In particular, pervasive games can rely on a diversity of actors as every object, person, institution can become part of the game (and not only a player). For instance, in Monopoly live ¹⁶, players on line get virtual money when actual taxi drivers stop by the places they "own" on the Monopoly real/virtual board of the city of London. But pervasive games can also rely on a diversity of authors, local, global, private, public, etc, who contribute to the authenticity of the experience. Game design will include traditional producers of contents who have a specific interest in offering original ways of accessing information, new strategies of cooperation between these producers that can entice a user to go from one place to the other so that the whole ring of actors benefits from the connection, and/or grass root production that can possibly be aggregated with more institutional information. This diversity of actors/ authors, gestures linked to mobile devices, web2.0 production, diffusion of geolocalised services, urban playful practices (flash mobs or other urban performances such as Parkour or Street Golf), and in general the renewal of cultural practices, point to social acceptability of pervasive games.

¹⁶ <http://www.monopolylive.com/rules.html>

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