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Ecology of Embodied Narratives in the Age of Locative Media and Social Networks: a Design Experiment

Kai Pata* – Anatole Pierre Fuksas**

* Tallinn University, Center for Educational Technology, Narva Road 25, 10120 Tallinn, Estonia (kai.pata@tlu.ee)
** Università degli Studi di Cassino, Dipartimento di Linguistica e Letterature Comparate Via Bellini 1, 03043 Cassino, Italia
(anatolepierre.fuksas@unicas.it)

1. Storytelling in the age of Locative Media

The theoretical extent of the 'digital menace', often predicted as a book-killer, has often been overrated, not to say generally mistaken, by common sense. Actually, the rise of new media in the Digital Age slightly affected the popularity of the book as a medium (Carrière - Eco 2009), of literature in general as a crucial communication system. All in all, Calvino (1988) offered a very wise advice when he introduced his «Six memos for the next millennium» with the statement that he trusted in literature's ability to last through the current millennium, because its specific bag of tools is able to do things that are otherwise undoable.

According to the idea of the Embodied Novel (Fuksas 2008), such specific bag of tools basically consists in the dynamic integration of perception and action, which emerge from the individual processing of described narrative events. Indeed, typical narrative formats, namely the novel, describe integrated sensory experiences and interoceptive responses, which lead to the emotional decisions that prompt purposeful goal-oriented actions. Such chain of integrated descriptions puts the typical reader of a novel in the position of looking for answers to questions like when, why, what 'to do', while implicitly suggesting given definitions of 'doing'. Hence, that very novel dynamically interacts with reality in terms that it provides the reader with specific and effective-enough solutions to the crucial problem of developing representational schemes for the planning of purposeful, intentional, goal-oriented actions.

However, literature matter-of-factly survived the digital age, and successfully interacted with web culture and new media, playing an essential part in the development of groundbreaking commercial web based services such as Amazon, originally established in order to sell books online. Moreover, literature has found plenty of room in second generation web-based communities, even representing the main interest which very crowded web based communities of enthusiastic readers share through Social Networking Services, such as aNobii, LibraryThing, or Goodreads (Fuksas 2007). Given that the rise of digital media did not negatively affect the popularity of literature, there is no reason to predict that potential advancements in storytelling based on the forthcoming massive propagation of locative media will do.

Accordingly, the present account of storytelling in the age of locative media would radically reject the traditional assumption that new technology challenges old narrative forms per se. Still, the very probable rise of personal devices based on the Global Positioning System (GPS), Geographic Information System (GIS) or similar geocoding standards and platforms will likely provide storytellers with a very interesting ground for the development of specific and very

new literary applications. So far, such hypothesis is just a subject for science-fiction novels, as in the case described by William Gibson in *Spook Country*:

> "the artist Beth Baker is here, her apartment. You will come, you will experience the apartment, this environment. This is an annotated environment, do you know it?"
> "annotated how?"
> "Each object is hyperspatially tagged with Beth Barker's description, with Beth Barker's narrative of this object. One simple water glass has twenty tags"
> She looked at the white orchid blooming on the taller coffee table, imagined it layered with virtual file cards.

Still, similar applications could actually become part of our world, as soon as locative media spread and define new borders for human experience. Karlis Kalnins introduced such concept at the RIXC Centre for New Media Culture in order to distinguish the latter creative explorations of the medium from the corporate hype surrounding location-based services (LBS):

> «as an artistic form Locative Media explores the social potential of location-aware devices, inspired by the use of tracking technology and wireless media, human relationships, movement and identity, seeking to extend and reappropriate the functions of locative technologies by exploring ways in which they can be socially constructive and facilitate new dynamics to occur within everyday life».
>
> (http://wiki.media-culture.org.au/index.php/Technologies_-_Locative_Media)

Locative media are typically associated with 'ubiquitous computing' or 'pervasive computing', which refer to the proliferation of digital devices in the natural environment. Ubiquitous and pervasive computing are usually intended as the very premise of an 'augmented reality' emerging from the experience of interactive environments which nest digital information in natural landscapes. Indeed, technical solutions, which make it possible to 'augment' reality, rely on pervasive computing and locative media, by nesting social interaction into merged natural and digital environments.

Locative devices provide Location-based services (LBS) developed and distributed by wireless carriers and their partners, which provide locative-specific information, such as the position of the nearest ATM or restaurant or notifications of weather and traffic jams. Location-based services even enable resource tracking of, say, taxis, or rental equipment, and make it possible to find people matching needs and skills by supplying business directories or, say, buddy lists. Proximity-based notification (push or pull) will very likely play a very crucial role in targeted advertising, since customers can be directed or redirected to shops in the area where they actually are.

The provider gets the location from a GPS chip built into the phone, so that data about the actual subscribers' locations and their historical movements are owned and managed by the network operator. Revelations that the U.S. government maintains a massive database of all domestic phone calls suggests that a permanent log of the location of every cell phone may be collected as well. With the passing of the Can Spam Act in 2005, it became illegal in the United States to send any message without the end user specifically opting-in. Regulation will of course change on the basis of political decisions adopted by different countries.

Still, since the aim is to reach potentially every single location on the planet, 'carrier-centric' location-based services and applications are more and more replaced by user-centric ones. The user gets more and more control of the experience, typically by opting in advance via a website or mobile interface for media contents of choice, that are produced, edited and managed offline,

on a standard desktop or laptop. The production and pre-production of the overall experience is planned, designed and formatted by individuals or communities to be of optimal relevance to themselves and/or other intended users, their needs, their likings, their actual location and surroundings.

The downloading of contents on a locative device is triggered by the cross-matching of the user's likings and requests with his current position in the locative field. As soon as the location-aware device enters a new area, satellites trigger media corresponding to new GPS coordinates and interests previously declared by the user. Downloaded media, any combination of video, audio, images and text fed to the locative device by the provider, allow the user to decode the landscape beyond the assessment he may perform on the mere basis of his sensory appraisal.

Users can actually hybridize their perceptual evaluation of the natural environment with current topical feeds providing them with information related to the background and history. Hence, locative media may allow enhanced experiences of the environment by offering explanations, analysis and detailed commentary on the landscape the user perceives by means of his senses. For instance, the location-aware device can be fed with descriptions of cities, parklands, heritage-sites, sporting events or any other natural environment.

Development of 3d platforms such as Second Life (http://secondlife.com/) or WoW (http://worldofwarcraft.com/), eventually enhanced by immersive video experience supported by devices as Headplay (http://www.headplay.com/), definitely soak and seclude users into digital environments, basically implementing the virtual reality paradigm. On the other hand, a huge load of Web 2.0 applications move in the opposite direction, aiming to provide users with contents they carry with them throughout their daily interactive experience of places and people. A significant divide is going to be drawn between people getting isolated into their own purely virtual narratives crowded with avatars, nicknames and digital phantoms, and people exerting media so to hybridize their own perception of the environment and organisms playing a part on it, that his to enrich their personal stories.

Among the latter population, global communities of readers and storytellers are already exerting social networks and interactive media, reshaping the interplay of literature and personal experience. Readers interacting on a local/global basis by means of social networks as aNobii or LibraryThing share stories about books that inspired them traveling to locations described by novels they were/are/will be reading. Others even post their pictures of literary places on a Flickr group space devoted to 'geoliterature'.

Microbloggers interested in literatures, as readers or writers, are even offering some very early, pioneering samples of live updates feeding PMP Portable Media Players, namely portable phones. For instance, TwitterLit provides twitterers with Amazon-linked first liners of books via Twitter. Booktwo and Publicdomain respectively twittered James Joyce's Ulysses, Herman Mellville's Moby Dick at the broadcasting rate of 140 characters every few hours. Even original novels are actually twittered, as in the case Thegreysunset and 140novel, the last entry providing a collaborative work involving four different authors.

Jay Bushman converted and redefined the borders of a famous novel such as Melville's *The Good Captain* and a literary masterwork such as Lee-Masters' Spoon River Anthology into microblogging format (http://www.loose-fish.com/waifpole/the-good-captain/). Such microblogged versions blur the line between the real and 'fictional worlds' (Pavel 1986) by creating embedded fiction starting from streams of nonfiction which constantly feeds our daily lives.

Even other forms of microblogging (eg. Smallplaces in Twitter http://twitter.com/smallplaces; Twiller http://twiller.tcrouzet.com/), mobile text-messaging (eg. Novel Idea http://www.mobfest.co.za/novelidea/default.html) or blogs (eg Protagonize http://www.protagonize.com/) has been used so far for writing narratives. Still, the typical application seems to consist in segmenting and serializing the story into small chapters or tweets so as to make it available to a broad audience allowed to rate and comment the story. Indeed, even though such technology already make it possible to broadcast location-sensible narratives on portable wireless devices which mine media from websites, none of the samples presented above actually provide users with pertinent references such as analogies or interferences aimed at enriching the sensory experience of natural environments.

So as to test potential of location-sensible stories, we planned a design experiment aimed at exploring how an enriched reality actually emerges from collaborative storytelling, according to the idea that the processing of pertinent narrative references induces a semantically primed experience of the perceived environment. Theories of embodied semantics maintain a crucial involvement of the motor system in language comprehension (Lakoff and Johnson 1999, Feldman and Narayanan 2004, Gallese and Lakoff 2005, Arbib 2008, see Aziz-Zadeh and Damasio 2008 for a review). Behavioral studies found compatibility effects between language and action, demonstrating that language processing interacts with or influences motor performance.

For instance, some experiments aimed at demonstrating linguistically enabled facilitation of actions found that objects with the label 'large' printed on top were grasped with an enlarged grip aperture of the hand, suggesting an automatic influence of words' meaning on action (Glover and Dixon 2002). Other experiments tested subjects asked to judge the sensibility of sentences by making a movement towards or away from the body, finding faster responses when the presented sentence described a movement, which was congruent to their direction of responding (Glenberg and Kaschak 2002). Likewise, the processing of sentences which describe rotation of a manual device in the same direction of the actually performed action was found to be facilitating subjects' responses, according with the idea that motor processes support language comprehension (Zwaan and Taylor 2006).

Moreover a recent study found that a simple motor act could either be facilitated or hindered by the concomitant presentation of action verbs (Boulenger and colleagues 2006). If verbs were presented before movement execution, a facilitation was found in wrist acceleration. Rather, reading a verb during movement execution led to slower wrist acceleration, suggesting that motor actions and representation of action-words rely on common neural mechanisms.

Another experiment investigated the retrieval of lexical semantic information during the planning of goal-directed actions, demonstrating that even the preparation of meaningful actions is accompanied by goal-relevant semantic activation (van Elk 2008). Results suggest that action semantics were activated selectively in accordance with the action intention of the performer, since action-word priming effects were only found when subjects prepared meaningful actions with presented objects. So, whereas semantics have traditionally been associated with processes related to language and memory, the presented findings indicate that semantic knowledge is also activated during action preparation.

Such array of evidence supports the idea that action does not seem to be just prompted by sensory information about the environment, which are retrieved by means of perceptual assessments. Rather they likely include selection or deactivation of semantic information congruently with performer's intentions and goals. Namely, action-planning emerging from sensory interaction of perceivers and environments they are situated into may be more or less

influenced by semantic priming, depending on available linguistically encoded informations.

According with previous claims, readers or listeners typically process perceptual events, emotional responses and purposeful actions encoded into novels or stories in general by relying on previously embodied experiences of familiar environments. Likewise, while figuring out places they never visited or people they never met, recruited individual knowledge of people just consists on available visual references or related stories. Even mythological, legendary, cities or people from the actual or just the fanciful past are somewhat processed according with more or less similar previously experienced locations.

Conversely, narrative references may interfere with direct perception of natural landscapes. A typical case involving knowledge based both on direct sensory experience of the environment and related narrative references is the one of travelers staring in amazement at landmarks they have heard and read plenty of stories about in the past. Such enrichments are experienced by tourists looking puzzled while trying to figure out why they spent a couple of paychecks to find themselves speechless in front of a pile of old stones or a very long marble sculpted pillar.

For instance, similar puzzling circumstances are experienced constantly by tourists from everywhere in the world while walking around the Colosseo, the Colonna Traiana in Roma, or any other archeological wonder. Tourist guides, both printed and embodied in people encoding the exposition in spoken speeches, provide them with the very much-needed answer. Basically, by labeling perceived items with annotations, guidebooks and tour guides aim at orientating tourists by modulating through linguistically encoded expositions their sensory experience of the landscape.

In a significantly different way, which is looser and more free, the contextual reading of novels taking place in the very same city or in the same countryside as travelers are visiting, may lead to similar results. Literary presences drawn from books tourists are reading somewhat infest cities and towns, forests and deserts, islands and hills, mountains and shores they are traveling through, enriching the individual sensory experience of given natural or urban landscapes. For instance, American travelers reading Dan Brown's D*a Vinci code* and *Angels and demons* while staying respectively in Paris and Roma certainly aim at complementing and enriching the experience of landscapes, by pairing environmental perception with processed narrative events.

Literary travels even emerged as a peculiar form of tourism, well exemplified by trips such as the 'Alice Munro Literary Tour' and 'Italy Tour - To Hell and Back with Dante', not to mention a 'King Arthur England Tour' featured by the very popular «Literary Travels» website. Among the activities related to the IV centenario de don Quijote the government of the Mancha drew la "Ruta de don Quijote", the largest european literary itinerary, openly defined as a «corredor ecoturístico». Such travels are based on the power transmitted to locations by characters and events featured into the novels referring to them (Pocock 1987, Herbert 2001).

Indeed, environmental descriptions featuring objects, people, items of various kind fit a given range of actual natural landscapes, defining potential 'presences' and related affordances (Gibson 1966, 1977, and 1979 then 1986, Chemero 2003, Stoffregen 2003, Heft 2003). Narrative references processed by means of sensory-motor resonance while reading or listening to stories may interfere with the actual sensory experience of environmental features, enhancing proprioceptive involvement into immersive landscapes. The more the sensory experience of landscapes resonates, triggering embodied narrative references, the more intense the "I've been there" feeling grows fulfilling expectations about travels or other individual involvement in landscapes or situations.

According with such remarks, the implementation of location-sensible stories on mobile devices

could be operating a dramatic shift in the relationship between people and the environment, in terms that it could setup enriched experiences of urban or natural environments. Indeed, locative media may exert environmental geocoding so as to develop potentially infinite narrative tagging of landscapes. Different written or vocal textual tags referring to the same location may be broadcasted on a different 'channel' so as to provide annotations based on different stories or different versions or parts of the same story.

Different channels may provide readers or listeners with stories applying to the very same items, for instance, a bench in the park: channel one may tell the story of a couple of teenagers kissing for the first time, channel two may feature the one of a vagrant sleeping on it, and these narratives may eventually merge on channel 3. Channeled textual variation may eventually entail and provide the encoding of different events or different partitioning of the very same story, so that additional events would be referred to the same items. Hence, different textual versions of the same event may work as different comments referring to the same or different landscapes.

So, while providing a permanently operative level of interaction between narrative contents and natural environments, geo-tagged stories may play a significant role in the literary system. New plastic forms may arise, as soon as web-based communities start playing with landscapes, tagging them with stories, which describe affordances of labeled environmental features. Being part of a community may imply writing, annotating, commenting, tagging stories so as to share a peculiar perception of natural environments of cityscapes marked by narrative tags. Sensory assessment of places and references emerging from reading or listening to stories will very likely become more and more part of an integrated, plastic, ever changing immersive experience.

Crang (1998) observed that different writing modes might express different relationships to space and mobility. On one hand, human geography is filled with emotions about places, on the other, stories contain a set of geographical data and play a key role in shaping spatial awareness of participants. In a hybrid environment based on location-sensible technologies and Social Networking Services, locative devices might become the remote control of the environment, which makes it possible to retrieve stories about everything people see, touch, smell, hear, taste and feel. Such eventual change would of course redefine at the same time both storytelling as a concept and the general meaning and forms of human presence in the environment.

We can eventually describe this environment using the Hybrid Ecosystem term. Hybrid Ecosystem is an ecologist view to the dynamic system consisting of an augmented space in which activities of people with various narrative contents in geographical locations using participatory social software create a feedback loop to this space that influences the evolution of communities and determines their interaction in this space. *Hybrid* refers to the structural property of the world that is achieved by deliberate blending of geographical spaces with virtual environments. An *ecosystem* term describes how such hybrid geographical places and participatory software environments together with their users also represent a complex functional system. Such dynamic Hybrid Ecosystem shapes its participants and itself, and allows the evolution of the new 'habitat' for community actions around narratives.

2. The Design Experiment

Such predictions about new forms of storytelling to appear in Hybrid Ecosystems were tested on the basis of a methodological approach, combining methods from *Design-based research and -learning* (Design-Based Research Collective, 2003; Wijnen, 2000; Ning, Williams, Slocum and Sanchez, 2004) and *Participatory design research* (Muller, 2002) with those of the *Swarming* principles (Bonabeau, Dorigo & Theraulaz, 1999).

The object of the Design-based research in our case is a *Hybrid Ecosystem* emerging from collaborative storytelling supported by geo-locative technologies and Social Networking Services. We assumed that such Hybrid Ecosystem emerges when people experience a given environment through their own sensory-motor system while processing related locative media. Human interaction with a Hybrid Ecosystem would imply direct navigation of the environment alongside the creation, the uploading, the retrieval and monitoring of related contents. We presupposed that the ecosystem evolves and mutates anytime given activity patterns accumulate and leave a trace for future action potentialities in the hybrid environment. Moreover we assumed that individually and collaboratively using such activity patterns could be described on the basis of the *swarming* conception from biology (Bonabeau et al., 1999).

Swarming refers to self-organizing behavior in populations by which local interactions between decentralized simple agents can create complex global swarming behavior (Bonabeau, et al., 1999). In swarms every agent is only responsible for its individual actions, however, they cause the swarm intelligence to emerge, which refers to systems, which accomplish complex global tasks and form complex patterns through the simple local interactions of autonomous agents. Individuals in swarms have ecological relations to the collective. They maintain their individuality and viability as the collective swarm intelligence and viability emerges. Swarming relies on altering the environment as a shared memory, and reading information from the environment and from the swarm members to maintain individual viability.

The swarming behavior that is in the focus of interest in this study is writing narratives in Hybrid Ecosystem (see Figure 1).

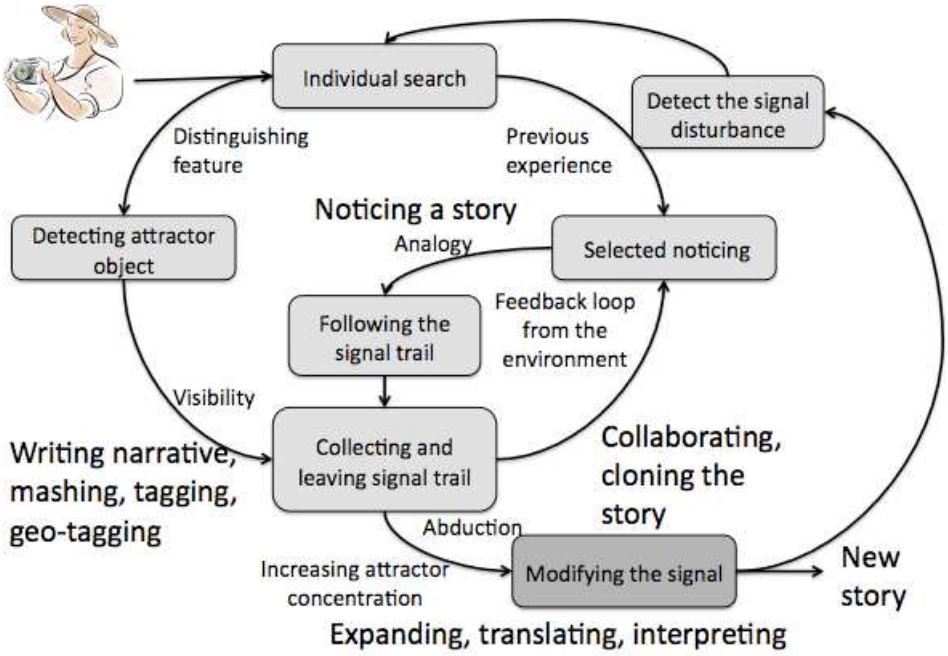

Figure 1. Swarming: Writing narratives in hybrid ecosystem as an analogy of foraging behavior of ants

Analogically to ants' foraging behavior, human storytellers in hybrid ecosystem search for the attractor objects (eg. interesting aspects distinguishing from the environment). When finding something, the objects are locatively geotagged and enriched with stories either by simple tagging with keywords or longer explanations. These serve as signal trails for the narrators

themselves to continue with certain story aspects and also for other storytellers to contribute for the story or to trigger their stories. The application of microblogging environments and social mashups with keywords enables others an immediate access to the new signals of potential attractors, causing selected noticing. Following the signal trail opens the possibility of accumulating more content for a particular story, especially if many individuals strengthen the signal. Strong signal trails may also be attacked and reused, for example by alluring the crowds away from the original trail with various similar signal baits. In storytelling one initial story may thus be modified into many paths.

Hybrid Ecosystem in the particular experimental case was designed and formed as a result of non-organized actions and temporarily rising collaborations of those individuals participating in the design process. The participants of the design-based research had two complementary roles – actors in the yet unexplored Hybrid Ecosystem, and investigators of this same ecosystem. They were individually designing their own environment and actions, enacting the design by telling stories in hybrid space, and observing and documenting their own ecosystem collaboratively to provide a better understanding of the system and its action potentialities. Thereby we experimentally utilized participatory surveillance practices that constitute a new form of gaining awareness, empowering and building subjectivity in social software environments (Albrechtslund, 2008).

Design based research was selected as a research approach because the design process contains both developing and testing practical environment and activity design, as well as, investigating the theoretical aspects (Reigeluth, 1999; Cobb, 2001; Edelson, 2002; Sweller, 2004). Cobb (2001) has focused on the role of design as a strategy for testing theories. He assumed that the strength of theories developed through design research originates from their explanatory power and their grounding in specific experiences. From the aspect of theory construction, the practical process of applying a theory to construct a design naturally exposes inconsistencies in theory, and is more effective than analytical research (Edelson, 2002). Discovering that some activity designs are superior to others can also provide insights into human cognitive architecture that may otherwise be difficult to achieve (Sweller, 2004). In our case we both developed the Hybrid Ecosystem of narratives as an activity design and environment; and we also investigated the changes in narrative forms and the cognition and interaction aspects in this Hybrid Ecosystem.

Traditionally design-based research exhibits the following five characteristics (Design-Based Research Collective, 2003):

- The central goals of designing environments and developing theories or "prototheories" of cognition are intertwined;

- Development and research take place through continuous cycles of design, enactment, analysis, and redesign;

- Research on designs must lead to sharable theories that help communicate relevant implications to the involved participants;

- Research must document how the design functions in authentic settings.

The design process in our case took part as a university master level course "Ecology of Narratives", which aimed to give learners an experience of the design-based research. We used the design-based learning approach (Winjen, 2000) because it enabled simultaneously to achieve research aims and the educational goals, embedding teaching into the contextualized research. Ning, Williams, Slocum and Sanchez (2004) wrote that design-oriented learning takes a unique approach of a combination of objectivism/behaviorism and constructivism because it is a mix of understanding of explicit design parameters and conducting conscious and yet implicit creative

activity. Design-Based Learning is characterized as integrative, going beyond individual disciplines, multidisciplinary, practice-oriented, creative, leading to differentiation, co-operative (teamwork), motivating, competence-oriented, furthering creativity, activating, fostering responsibility, synthesizing in a creative way and leading to professionalization (Wijnen, 2000).

Participatory design represents an approach to design in which the people destined to use some system, play a critical role in designing it besides the designers. It views technology and technology applications in the context of daily life rather than as isolated products. In our case the user and designer roles were different voices of the same students.

Hybridity is in the heart of participatory design, fostering the critical discussions and reflections necessary to challenge assumptions, and to create new knowledge, working practices, and technologies (Muller, 2002). Muller writes that participatory design process takes place in a movable hybrid space and leads to hybrid experiences. This hybrid space is formed as participants take the roles of storytellers and actors of Hybrid Ecosystem, and researchers of the design experiment. Hybrid experiences refer to the practices that take place neither in the participant domain, nor in the researcher domain, but in an "in-between" region that shares attributes of both roles' spaces. This "in-between" region is a fertile environment in which participants can combine diverse knowledge into new insights and plans for action.

Storytelling has been used as a methodological approach in participatory design research. According to Muller (2002), story collecting and storytelling generally require a kind of third space in which to occur. The authors of stories own the stories, they write from their own perspectives, which are sometimes in strong conflict with one another; the authors can make use of one another's materials, effectively moving away from single-author narratives and into a kind of collaborative collage of materials, which conveys interlinked stories; and the community members can negotiate and define their roles. Everyone in third space can learn from everyone and from the environment.

In this design experiment individual narratives were based on visual and textual impacts from the Hybrid Ecosystem. As Muller (2002) noted, images and texts carry attributes of their dual worlds – they are partially informal and related with personal emotions and experiences in Hybrid Ecosystem, and partially formal and documentary observing and monitoring why these stories were extracted from other dimensions, embodied, and finally embedded to the ecosystem. In our case, storytelling was used for dual purposes: for implementing the design of narrative Hybrid Ecosystem by writing stories, and documenting the impressions about the whole process as part of the captured stories.

The "Narrative Ecology" course was run two times with slightly different settings and time-period. At the first run of the course a group of Estonian students and their supervisor (N = 12) started the design experiment about ecology of narratives in the face-to-face meeting. This was followed by individual explorations of the hybrid ecosystem of narratives for 1,5 months. The final meeting was used to summarize the results of the design experiment. The second run of the course followed the same structure, however it was more intensive and lasted 1 week. Participants of that course were 15 international students visiting Estonia and 5 local students.

In both cases the students were prompted to plan the design experiment and raise by themselves various theoretical questions about writing narratives in the hybrid ecosystem.

A four-step strategy for testing theories in design-based research, introduced by Cobb (2001), framed our experiment. This strategy started from developing a theory, continued with deriving some design principles from the theory and translating these into concrete designs, and ended with evaluating the designs in relation to the theory. Combining Cobb's suggestions

with the framework proposed by Kensing and Blomberg (1998), the design process followed the aforementioned steps:

(1) The analysis of possibilities provided by the Hybrid Ecosystem for writing narratives;

(2) Developing a theory of swarm-like actions in Hybrid Ecosystems, and highlighting the objectives of the design experiment as researchers;

(2) Selecting technology components suitable in the experiment;

(3) The individual implementation as participants in the narrative Hybrid Ecosystem, while the ownership of the design framework is created. In this step simultaneous observation and documentation of the process took place;

(4) The final evaluation of the narrative Hybrid Ecosystem, using the initial objectives, as well as, the objectives that were created by each participant in action.

3. Hybrid Ecosystems and Collaborative Narratives

Two design settings were developed. In the first course a distributed community environment (http://ecologyofnarratives.wordpress.com/) was organized connecting various students' individual social software tools (Brightkite.com, Zannel.com, Twitter.com, Flickr.com, Facebook.com, and blogs at Wordpress.com) with RSS feeds, and agreeing about the joint tag "narrativeecology" (see figure 2). Using this tag, mashups of collected content could be pulled together and monitored by the participants and people from outside the community. Each of these social tools enabled alternatively to arrange a set of friends that could be monitored. Each student was asked to contribute to the narrative ecosystem weekly. In the second course, the individual blog solution that was used in the first course was replaced with the joint group blog (http://hybridnarrativeecosystem.wordpress.com/), where all the participants could add their content. This change was mainly undertaken to speed up the story creation in a community and increasing the awareness of participants of each other. The students had to contribute to the narrative ecosystem daily.

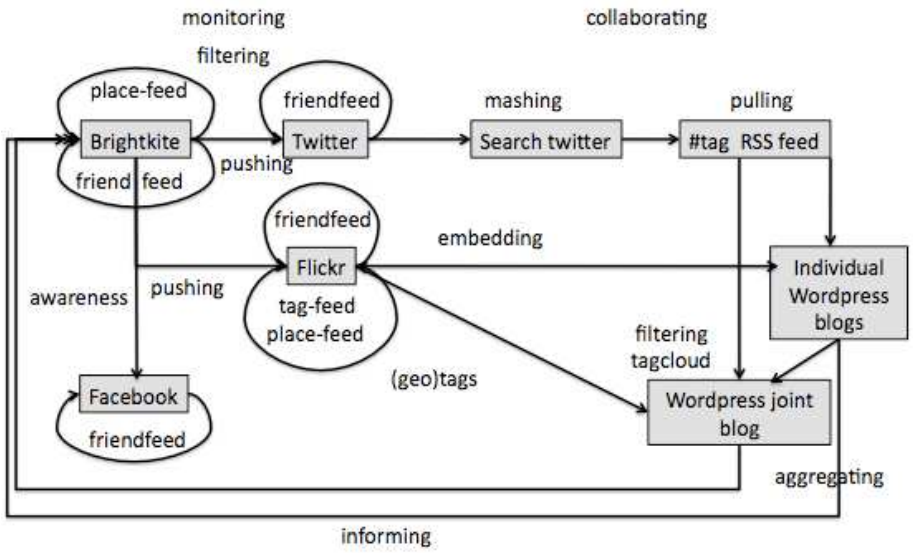

Figure 2. Individuals' social software tools can be interconnected so as to define a system which make it possible for participants to monitor each other while writing narratives

After running the experiment, it became evident that the most followed technological paths were the friend feeds in microblogging environment Brightkite.com, and the mashed feeds arriving from Brightkite and Flickr with the "narrativeecology" tag that could be monitored in blogs. It is evident that new geolocative storytelling supported using the tools that provide quick uploading of the content in locations and constant monitoring of other storytellers. The elaborated stories that participants combined in their blogs were triggered of the materials that were initially uploaded using microblogging tools. These stories were advertised in some cases in the same microblogging channels to catch other students' awareness.

In the design experiment, no initial story topics were deliberately decided. This decision was taken to investigate natural processes that appear in Hybrid Ecosystems. As part of the design experiment, students had to raise initial research questions to guide their observations. Simultaneously, new questions could appear in the cause of action. Students' final group reports opened some of the issues and characteristics of narrative Hybrid Ecosystems.

First off, it has to be pointed out that the individual connection to a collaborative source of data worked as predicted, in terms that individual participants actually relied on items posted by others while processing their own personal narrative. Of course some participants even worked as an independent channel, just featuring limited interaction, but it's more an exception than the normal situation.

Such interactive process leads to different outcomes. Mostly, items posted by others triggered individual reactions based on previous experience, leading to specific processing of the reference. Interestingly, participants more likely relied on snaps uploaded by themselves when it comes to events or items that are available in multiple forms (pictures of the same airport for instance). In some cases the whole experience was processed on the basis of integrated references that are hardly interactive with previous similar ones experienced by other members of the community. Typically, stuff uploaded by others, both snaps or textual posts, became interesting when it counted as a relevant term of comparison referring to some analogue event directly experienced by the active members of the community.

Pattern and Themes appearing in hybrid ecosystem of narratives may be roughly divided into individual storytelling aspects and collaborative storytelling.

Personal stories are most frequently evoked by places, personal memories, urban design, impressions from nature phenomena, contrast between the objects and their environment, graffiti and brand wallpapers.

The evidence of popular perspectives taken by individuals is presented in figures 3-6. Usually participants of an experiment did not start their stories from themes or topics that were planned beforehand. Many of them explained in the interview during last face-to-face meeting that the first impression to start the story came from the environment. This impression initiated the deeper interest towards certain perspectives in the Hybrid Environment and triggered them to continue the story. Personal stories were most frequently formed extracting and documenting perspectives of the locations, and urban design of the city (see Figure 3). Personal memories and impressions were used to find perspectives. Perspectives towards the nature phenomena were taken. Contrasting between the objects and their environment also created perspectives (see Figure 4).

Figure 3. The 'pain' perspective is attributed to the geographical location in town (left)

Figure 4. Contrasting artifact with its surrounding opens a new perspective (right)

In several cases emotional triggers were used as perspectives for extracting certain content. For example, one participant searched for the "happiness" images from the Flickr database to understand if this feeling is same for different nations in different locations. Another student focused on the impressions of red color in the environment (see Figure 5).

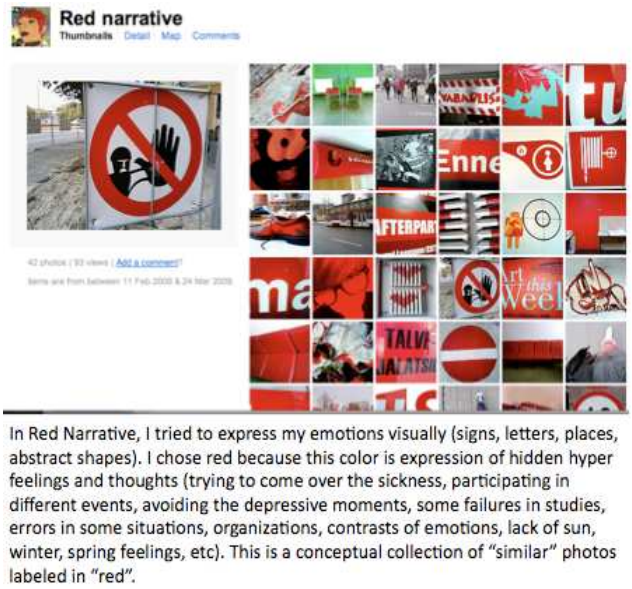

Figure 5. The 'red' perspective as a trigger of the story.

Loading places and buildings with emotions and personifying them was one of the ways of integrating images to the stories. Another way was to relate existing stories that the narrators had read previously, to the new objects and places found in town. Thus, the perspective was selected because of previous memory of other stories (see Figure 6).

Figure 6. Literary references as triggers which prime the environmental experience and make it possible to find and adopt new perspectives

It was notable that some participants tried to embed action triggers to the hybrid ecosystem to trigger collaboration. Some participants assumed that storytelling triggers in hybrid environment might be embedded into the town as graffiti. In several cases, hybrid graffiti appeared that connected real locations and digital artifacts in social software.

Figure 7. Hybrid graffiti as a narrative

The graffiti locations were commented in the computer-based system. Figure 7 demonstrates that the storyteller reused the digital graffiti image from another storyteller's Flickr account and elaborated the context in his blog, creating a hybrid graffiti that interpreted contents situated in the geographical location.

As we have mentioned above, monitoring others by friendfeeds, and the formation of ontological semantic space in digital environment by means of tags appeared to be the triggers for individual storytelling and swarm-like collaborating on writing narratives. On top of such social surveillance, one participant in the experiment got an idea of initiating social surveillance activities as part of her narrative (Figure 8). In her blog she wrote the following:

> I came up with the idea of new narrative using parts of bodies in urban environment and trace the dimension of urban hybrid being, thus research how different participants perceive and participate. For this experiment common tag besides #narrativeecology is mixedbodies and then for particular images - head, foot, torso, arm. In flickr you can easily organise photos in a batch (rotate, add tags, geo location to all needed pictures at once and send them to the group sets ;).

Figure 8. Illustration of the 'hybrid being' created by collaborative narrative activity

One example, the illustration of storytelling as reminiscent of ants' foraging behavior was documented with the "hat" graffiti in Tallinn (Figure 9). One participant noticed the signal trail of "hats" and started to follow it documenting such graffiti in his microblog. Another participant noticed the trail of "hats" in the microblog feed, and started collaborating and finding and collecting the "hats" as well. Other strong collaboration magnets were food, buildings, emotional scenes, scenes that triggered curiosity.

Figure 9. The signal trail of "hats" in Hybrid Ecosystem

Collaboration always appeared without planning suggesting that indeed a swarm behavior was a relevant model for describing it. The main forms of collaboration on narratives were:

I. Becoming triggered by content collected by others and reusing content uploaded by others as part of your stories, giving new interpretations to the content (Figure 10). Such activity indicates that some perspectives in Hybrid Ecosystem may lead narrators to discover new perspectives that may be related with the initial perspective by few tags. This develops various possible trajectories in Hybrid Ecosystem that may lead each reader to find and combine new stories using the available story parts.

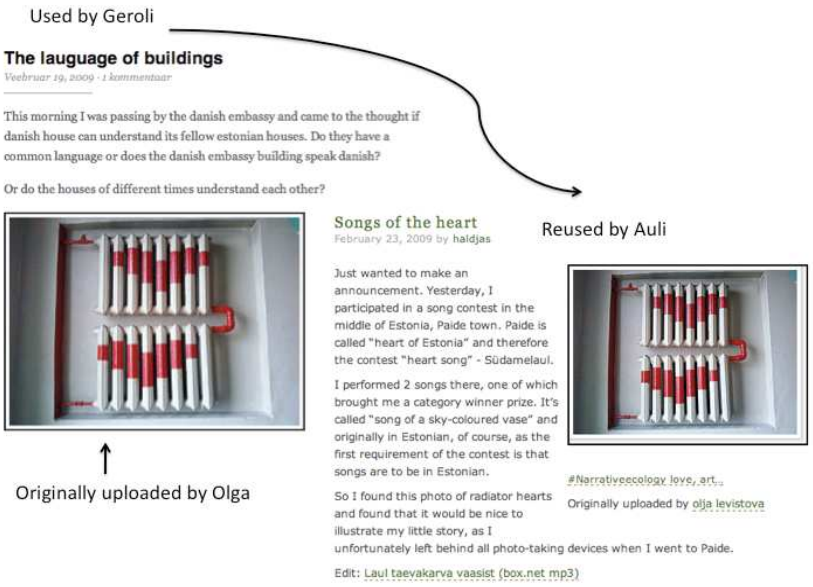

Figure 10. Reusing content in stories as a form of collaboration.

II. Dedicating the content to other storytellers to be used in their stories (Figure 11) appeared to be one ways of accumulating content related to certain perspectives. This behavior is similar to the swarming behavior of termites, while constructing the nest without initial agreement of actions.

Figure 11. contents of stories which are dedicated to other stories

III. Adding content to another story (Figure 12) was another behavior indicating that accumulation of stories may appear without predetermination of collaboration.

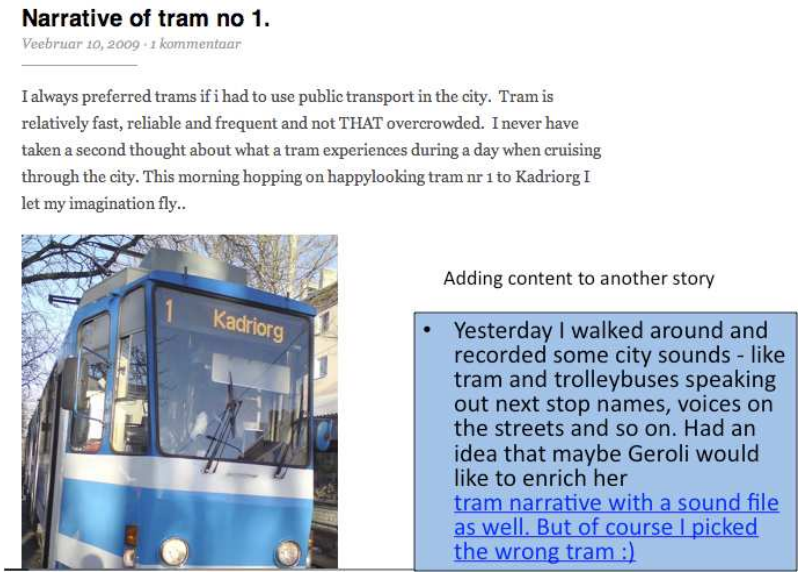

Figure 12. content added to another story

IV. Picking up stories, acting them, and documenting this action in a story (Figure 13) was an interesting behavior, which indicated that a result of reading narratives in hybrid ecosystem enaction may also be the real physical action.

Figure 13. Enacted story is captured as a new artifact in the story

V. Commenting on others' stories was one of the more traditional forms of the collaboration on narratives (Figure 14), that usually appears often in blogs and microblogs. However, such collaboration indicated to what perspectives participants might react emotionally in the hybrid environment.

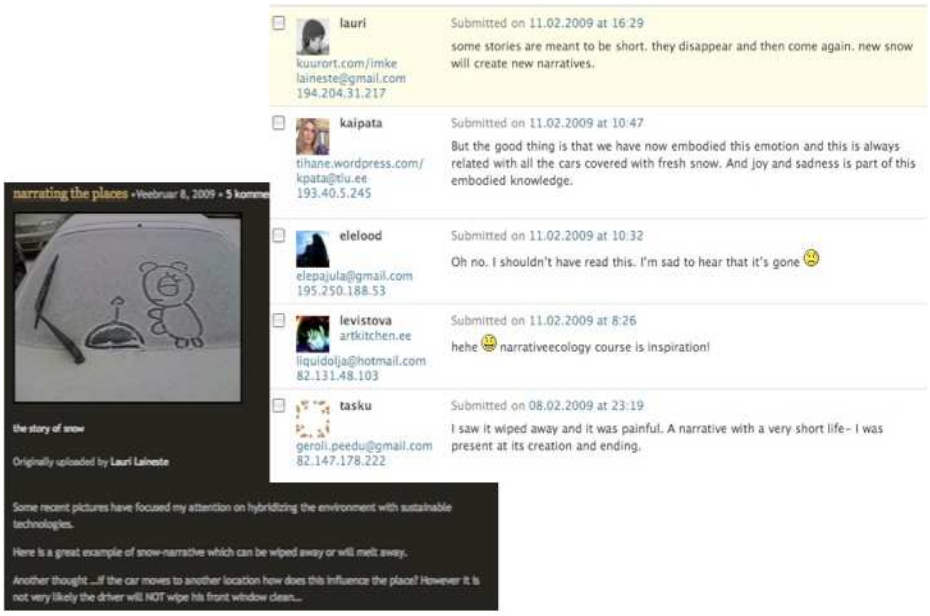

Figure 14. Commenting on stories as a form of collaboration

As a general conclusion we essentially found that some topics and themes seem to emerge, to be narrated and spread on the basis of unplanned, not concerted, polygenetic activity, as in the case of food experiences, whereas other ones seem to be virally transmitted from one source to

the whole community, say birds or geometric patterns. So, interaction basically leads to emergence of behavioral patterns that immediately develop into mutated forms. That is, as soon that a theme seems to be spreading among the community, the individual participants start differentiating their unique point of view on it, eventually comparing it with the one of some peers, so as to team up on the basis of affinity.

Moreover, some of our predictions concerned the involvement of metaphoric filters when processing streamed items. A more careful assessment of data is very likely needed, but we may conclude that literal outscores metaphorical by far. Comparison is definitely very active as a processing strategy whereas proper metaphors and generalizations emerge on a very limited basis. It looks like individuals evaluate the collective narrative streaming as a source of peculiar, particular events, meaningful in themselves, not just because they can combine snaps and text so as to grasp a general meaning.

When starting the narrative swarming experiment in Hybrid Ecosystem, one of our assumptions was that new storytelling formats might emerge. Table 1 presents the differences between traditional narratives and the ones emerging from a storytelling strategy based on swarming in hybrid ecosystems.

Table 1. Comparison between traditional stories and swarm-like narratives in hybrid ecosystems

Traditional stories	Swarm-like narratives in hybrid ecosystems
are created purposefully according to the plotline	plot and themes emerge as the result of individual or collaborative interaction with the environment
are integrated uniquely into a single whole story	are integrated on the basis of individual or collaborative navigation of hybrid ecosystems
are understandable as a whole	are partially understood as far as perceived or described elements fall in the individual experience of the hybrid ecosystem: portions can be noticed and integrated differently depending on the adoption of individual perspectives
follow linear formats and can be segmented in sub-units	define a cluster of close-bye and interrelated perspectives, whereas individuals who experience the hybrid ecosystem embody the story differently depending on the sequence of perceived items and events and their peculiar selection of available perspectives
describe actions which are situated in space which refers to actual or made-up environments	suggest affordances in the hybrid ecosystem
describe affective responses which lead to the emotional decisions that trigger purposeful goal-oriented actions	point out affordances of environmental features to participants involved in the immersive experience of the hybrid ecosystem
are typically written by an author	emerge as the result of collaborative storytelling
The author in active role in the story as a character or as narrator	Each author strengthens particular personally preferred perspectives, thus, changing the hybrid ecosystem and adjusting it for himself and participants alike, allowing community formation and functioning

We could also detect some interesting mutation of traditional storytelling features in the new environment. For instance, participants agreed that embedding the storyteller's into narratives, for example adding shadow signatures as digital watermarks on images, works as a signature (see Figure 15).

Figure 15. Storyteller embedded into a digital reference

More in general, collected evidence shows that swarm-like stories are not traceable as linear patterns, simply by following a linear plot. Indeed, they emerge as agglomerations of references which entails given perspectives and allow different readers to retrieve different stories. The retrieval of stories, or parts of them, provides individual who are experiencing the hybrid ecosystem with various potential interactive reactions, such as commenting, adding new elements to the story or carrying it along after taking the lead as a storyteller, retrieving parts of the story in peculiar locations. In such terms, narratives what emerge in hybrid ecosystems supported by locative technologies and Social Networking Services, define the borders of new participatory and collaborative story formats that reshapes human presence in the environment while redefining the very concept of storytelling.

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