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Social Interaction through Map-based Wikis

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ABSTRACT

This paper introduces the notion of map-based wiki, a wiki that allows users to interact with each other and with information through a digital map. The map, either geographic or conceptual, becomes a medium for creating knowledge through digital annotations. Annotations may be multimodal. Audio or icon notes set the mood for perceiving map space, while text or graphic notes create information space. We analyze examples to gauge map-based wikis' potential, then focus on Banco Territorio, a map-based wiki designed for information and emotional spaces, which localizes both spaces to overcome cultural misunderstanding in social interaction through digital maps.

Keywords: *map-based wiki, digital annotation, social interaction and communication, knowledge sharing, emotional mood.*

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1. Introduction

Maps are one of the most ancient and useful tools for organizing and displaying knowledge, starting with their primary use as a medium for geographic information. For this purpose, maps depict areas of the Earth's surface that involve *generalization* (pictorial representations show only some of the features that matter to a cartographer) and *symbolization* (certain features are represented by symbols: a town may be shown as a dot, for example (Freeman, 2007)). Maps have been used both as information-storage medium and as information-display medium. Reading a map generally yields information beyond geography *per se*. Of course it tells distance, latitude, longitude, elevation or borders, but also gives ancillary information, which may include advertisements, notes on tourist attractions and so forth. Furthermore, maps can be

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used to represent historical data, not only as data related to a specific geographic area (the map of a certain country at a certain time) but also as historical events represented spatially (i.e. a timeline). In any event, all these kinds of information are static, expressed once for all. When information changes a new map is needed.

In the electronic era, maps become *dynamic* and *interactive*. They are *dynamic* in that maps display data from a database. If these data change, map visualization changes accordingly. Maps are *interactive* in that different users working on the displayed map can add to, reorganize or change the information to be displayed. This feature makes the map, on the one hand, a common knowledge base for a community of interest and, on the other hand, a social medium for human interaction.

These characteristics are not independent from one another. The ability to modify a knowledge base is the necessary premise for a social medium. Maps act as common knowledge bases because they are the virtual space where data and information can be easily collected, organized, and displayed. When maps are accessible to others and available online, many people can jointly manage the information associated with a map and, by interacting with it, interact with other users of the map. The map thus becomes the perceptible part of a social medium, the boundary object through which different users interact (Giaccardi, 2007).

This social aspect is conveyed not only by geographic maps, but also by concept or mind maps. By ‘concept maps’, we mean diagrams that show the relationships among concepts, with concepts connected by labeled arrows in a downward-branching hierarchical structure. Mind maps are diagrams used to represent words, ideas, tasks or other items linked to and arranged around a central keyword or idea without any formal restriction on the kinds of link to be employed.

In this work, a digital map is considered a social medium if it meets the following conditions:

1. It displays information stored in a related knowledge-management system;
2. Users can access and modify the information associated with the map;
3. Users can share additional information related to the map;
4. Users can act on the information added by other users;
5. Interaction among users and interaction between users and information is enabled through the map.

These features define a *map-based wiki*.

This paper is organized as follows. Section 2 presents some examples of social interaction among users through map-based wikis available online or recently proposed

in literature. Section 3 starts from the preceding examples to discuss the different kinds – or 'flavors' – of knowledge that are created or shared through map-based wikis. Observation of these examples shows digital annotation to be the main tool that supports creating and sharing knowledge. Section 4 describes the Banco Territorio system, a map-based wiki that capitalizes on the features analyzed in section 3. Banco Territorio allows users to express and share both cognitive and emotional knowledge, which is localized to user culture, language and system of signs. Finally, Section 5 draws some conclusions and directions for future work.

2. Social Interaction through Digital Maps

Google Maps has dramatically changed the way we use and see digital maps. Geographic information systems (GIS) first introduced virtual maps as displays for information located in databases and managed by complex systems. They allow complex operations to be performed on the information in the map's layers. The problem is that these systems are designed for communities of geoinformatics experts. Generic users are often unable to interact usefully with such systems. Moreover, these systems were not originally designed for the web.

Google Maps gives generic web users the chance to interact with a map through simple operations for planning a trip or searching for a place, for example. The 'MyMap' functionality allows a user to annotate a map by adding text, images or video and then share the map with other users s/he chooses by sending them the map's URL (the map is thus private). If the private map's creator allows the users s/he shares the map with, this community of users can modify the annotations on the map. Google's 'MyMap' feature has been used as a basic operation in many systems that exploit Google Maps' API, which can be considered map-based wikis in that they are wikis (Leuf & Cunningham, 2001) for collaborating to create and develop knowledge related to digital maps.

The WikiMapia project allows registered users to select interesting places by drawing polygons: then a user can add a text note about the place, as well as images. Other users can see that the place has been selected and they can read the note and see the images by clicking on the polygon that identifies the area. Registered users can add new information or edit the annotation that refers to the place. Information is thus transformed by editing or addition. Registered users can also vote for an annotation. If

the annotation has more than one vote against it, it is deleted. This parameter, which WikiMapia uses to control the correctness of annotations, is a typical feature in a social network, where peers who belong to the network (in WikiMapia they are the registered users) approve or reject information. In Figure 1, the open window in the middle of the map displays a description of the place written by a registered user. The menu items display the operations that the user can perform on the map.

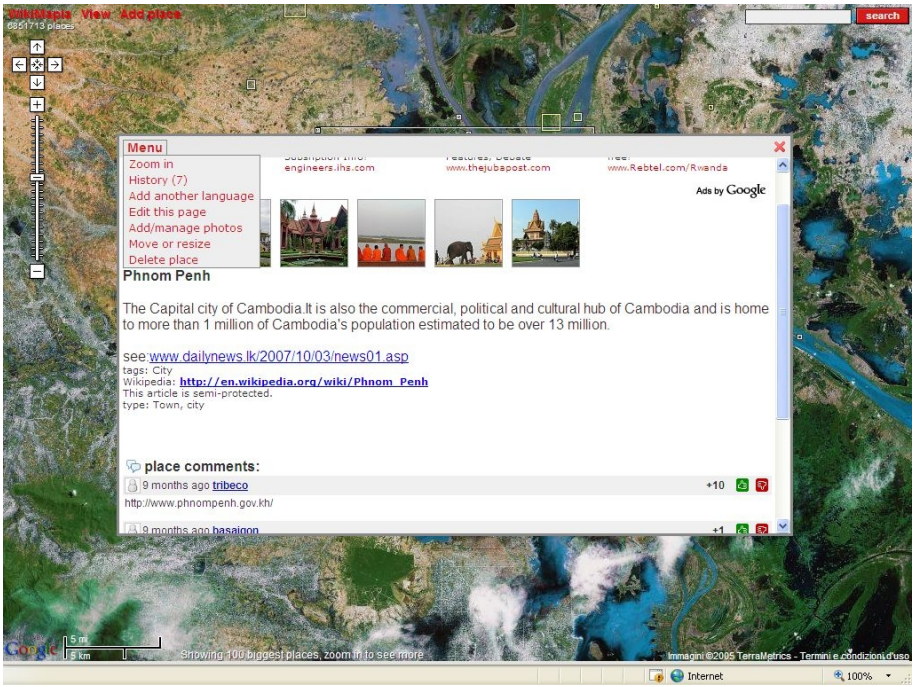

Figure 1. *WikiMapia*: an annotation on the digital map of Phnom Penh, Cambodia. In the upper left corner, menu items show the operations that may be performed on the map and on the current annotation. The box at bottom center displays comments.

YourHistoryHere and PlaceOpedia are two other interesting map-based wikis based on the Google Maps API. They were developed by mySociety, a charitable organization aimed at building websites to support civic and community aspects of people's lives. YourHistoryHere is similar to WikiMapia: it enables users to mark a place with a flag and to add, at the flag, a textual annotation telling the history of the specific and, in the developers view, 'unusual' place. Other logged users can comment on the history. PlaceOpedia links places to related articles in Wikipedia by adding notes, again by exploiting the Google Maps API. What is interesting is that the aim of both these wiki sites is to create an *"underlying system for collecting and sharing geographic annotations in an open syndicated format"* (as in the home page of both sites). There are no registered users. When a user writes a history or a response, s/he simply has to leave her/his name and email address. A specific response requires

users to state if they consider the history 'abusive'. If so, they have to give reasons for their opinion. Unlike WikiMapia, no voting mechanism is used, but the conversation among users determines the reliability of the information displayed. In all these examples, users who comment on or edit annotations constitute informal groups, characterized by common interests or common knowledge, e.g. about a same place. In this case, their common ground is a geographic map.

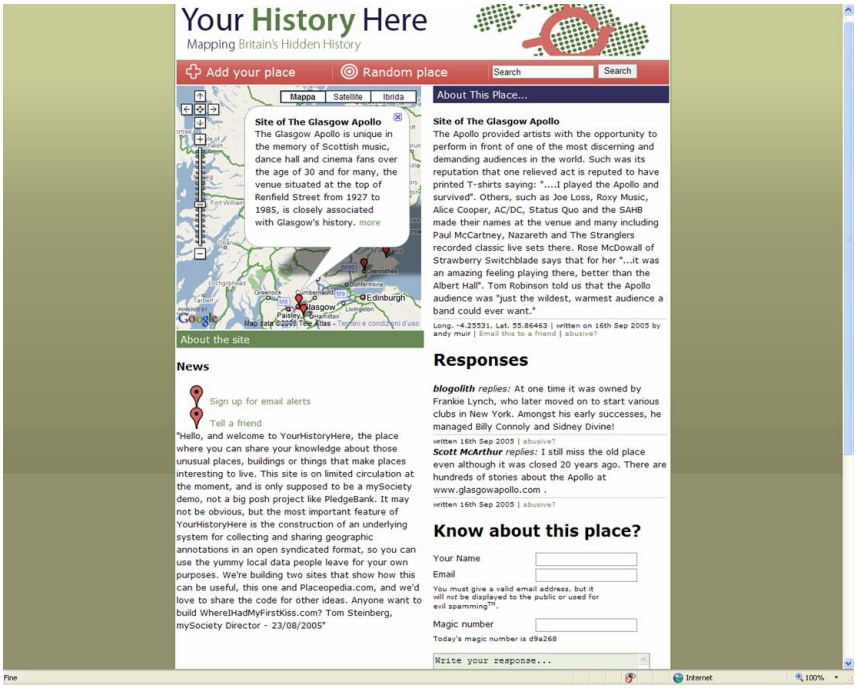

Figure 2. In YourHistoryHere, the map is displayed at the upper left of the page. Clicking on a flag in the map displays part of the history. Clicking again loads the full history on the right. Below the history, comments and a form to add comments or history are shown.

Other map-based wikis employ a mind-map representation to define the relationships among members of an interest group. An example is FOAFnaut, which is based on a graph that defines the closeness of the users signed in on the FOAFnaut tool, a sort of mind map of people involved in one of the FOAF projects (FOAF). Relationships among people are displayed through arrows that link interactive icons and through pictures: each icon represents a person and pictures show the two connected persons. Two persons are linked if they know each other and, in this case, they are co-depicted in the same picture (as in Figure 3). The annotation box on the screen displays metadata about the person represented by the selected icon and shown in the photo. By signing in, a member can add some pictures and information about her/himself and build relationships that specify who s/he knows in the network.

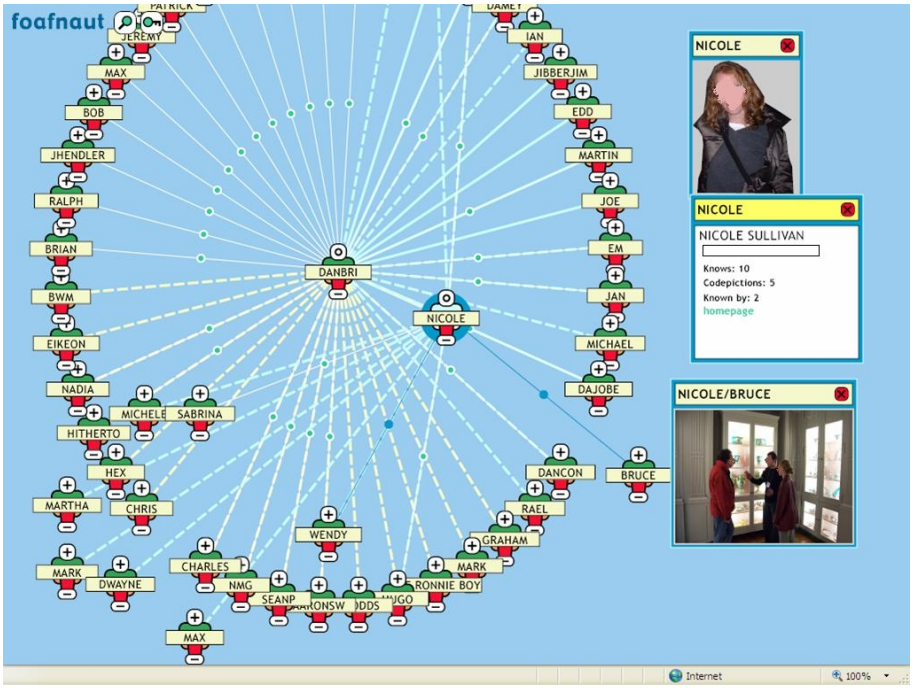

Figure 3. FOAFnaut shows relationships among its members. The blue line shows the co-depiction of two persons. Clicking on the blue circle on the line displays a picture of the related persons (Nicole and Bruce). An annotation box containing information about Nicole is also displayed because Nicole is the original selected person on the map.

Regardless of its specific use, the FOAFnaut experiment is interesting because the mind map displayed is the result of the application of metrics such as centrality, closeness, density, and cohesion, characteristics taken from social-network analysis (Martino & Spoto, 2006; Moody & White, 2003).

Several map-based wikis have been proposed in the literature to collectively create and manage new knowledge related to a digital map (Teranishi, Kamahara & Shimojo, 2006; Chen, Lee & Chang, 2006; Priedhorsky, Jordan & Terveen, 2007). GMapWiki is an example of a map-based wiki proposed by Teranishi, Kamahara and Shimojo (2006) as a ubiquitous collaboration environment where users in virtual environments and in the real field can collaboratively create new knowledge related to digital maps. Remote users in the real field – through portable devices, such as PDAs and mobile phones – can easily add links and images of objects in the ubiquitous environment or edit existing ones, and collaborate with other users to manage and enrich the knowledge related to digital maps. Fotowiki is a further example of a map-based wiki designed to collaboratively enrich a geographic area with up-to-date visual and textual information (street-level photos of the surrounding sub-areas and related descriptions, along with 360-degree virtual tours) (Chen, Lee & Chang, 2006).

A further example of a map-based wiki is the 'Silence of the Lands' project (Giaccardi, 2007). Silence of the Lands is a virtual museum of natural quiet where geographic maps are enriched with sound annotations. Sound annotations express in a more emotional way than textual annotations the experience of the natural heritage through the sounds directly captured from nature.

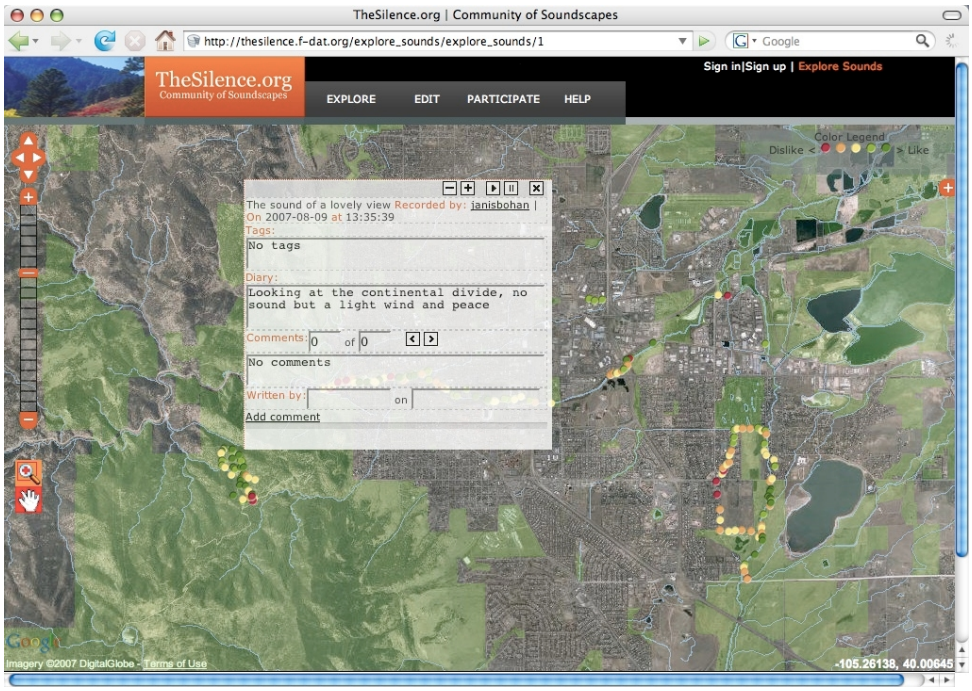

Figure 4. A screenshot of the Silence of the Lands website.
In the center, a written annotation describes a sound captured on the field that can be heard by clicking on the related dot on the digital map.

Members of and stakeholders in the Boulder, Colorado, local community – indeed people from anywhere in the world – can collect sounds from the natural environment and automatically associate them, through PDAs, with a precise time and place for display on a GIS or Google map. They can then access their own sound annotations through the Silence of the Lands website (see Figure 4) and describe the recorded sounds through various descriptors. An interesting descriptor is a colored dot that marks on the map the place where a sound was recorded, as well as visually conveys the user's mood related to the sound in that place, where dot colors are chosen according to a scale of liking. It is also possible to add a written note. A 'soundscape' is thus produced by adding descriptors and sounds, accessible through the web. Participants and occasional visitors can access the interactive soundscapes and compose their own soundscape in the public space through a computational table or through the website.

3. Wiki Knowledge through Digital Annotations

In this section, we focus our attention on the different kinds – 'flavors' – of knowledge managed by the map-based wikis analyzed so far and on their use of digital annotation as the basic tool for knowledge pooling and social interaction.

3.1 Flavors of Knowledge

In a map-based wiki, maps are the 'doors' through which users access existing knowledge; they are also the framework for creating new knowledge. Different kinds of knowledge can be identified on the basis of content, of the physical support used to convey the knowledge, and of how users perceive and interpret such knowledge. The combination of these three features in different ways leads to different flavors of knowledge, which we discuss in the following with respect to the systems presented so far.

In a map-based wiki, a map depicting a geographic area may provide several informative contents – as in the case of Wikimapia or YourHistoryHere – from geographical data or notes to historical narrations, to folk tales created by wiki users and so forth. This information is mostly conveyed by written signals and can be backed up by pictures illustrating the places related to the knowledge content. This information primarily involves human cognitive capacity, thus setting up an information space associated with the map. Humans read and write textual information about the place and, if necessary, cognition is supported by exemplifying pictures.

A concept or mind map depicting an abstract or metaphorical concept allows us to detach from real spaces. The case of FOAFnaut focuses on the cognitive level of knowledge by proposing a mind map of the relationships among FOAF members. Stressing (and perhaps shifting) the notion of 'conceptual metaphor' (Lakoff & Johnson, 1980) a map can be considered a visual metaphor where distances are built according to sociological metrics: places denoted by nodes represent human members, distances visualize the relationships among members and indicate common interests occurring among the members, while pictures exemplify these occurrences. In FOAFnaut, as in Wikimapia and YourHistoryHere, users perceive the content by visual signals and interpret it by associating written notes with geographical or metaphorical spaces.

The knowledge represented in the Silence of the Lands project has a different flavor: the aim of this project is to build emotional paths that describe a real environment.

Knowledge is no longer cognitive but emotional and the signals to support this kind of knowledge can no longer be written: sounds and colors are the evocative bits of information that allow users to explore a real environment.

The sounds a visitor collects from the natural environment indeed represent an intimate aspect of visitor's perception and experience of the environment. While the map identifies the boundaries of the area where sounds have been caught, sounds permit to expand the map's perception (and knowledge) beyond their natural boundaries. A further spatial dimension is thus introduced beyond the 2-D map, and the sound duration also permits to create a time-sited experience. Geographic maps enriched with such a flavor of knowledge can thus be conceived as 'affective geographies' (Giaccardi & Fogli, 2008), that is maps that elicit and visualize the affective meaning users ascribe to places in the maps. Written texts are minor additions, captions that do not change the emotional knowledge of the places. Colored dots associated with the places where sounds have been caught permit to represent visually the positive or negative feelings inspired by the sounds. Sounds and colors enable building a map that is not understood but rather experienced according to different emotional moods.

3.2 Digital Annotation as a Tool for Social Interaction

Written texts, pictures, sounds and colored flags or dots are all elements that make up a digital note. Digital annotation is the tool that enables social interaction in the map-based wikis under consideration. In different ways, a digital annotation allows users to start a 'dialog' by sharing information and feelings. Digital annotations can be shared by the members of a community of interest and may evolve to create new knowledge.

Annotations associated with a map can be multimodal in order to support different kinds of interaction and knowledge. Textual and graphical annotations set up an information space, which is dynamic in that it may be enriched or evolve through new annotations. The use of sound and icon annotations, on the other hand, sets up an emotional space in that they represent different emotional moods in perceiving the map space.

However, both the information space and the emotional space are local to the user culture, language, and system of signs (De Souza & Barbosa, 2006). Languages and symbols are culture-oriented. In different cultures a same color or graphic sign may represent different emotions or moods. Cultural hurdles and misunderstandings can

thus arise. In creating a network to support social interaction through digital maps, one challenge and opportunity is to overcome such cultural boundaries.

One solution, currently adopted by several systems, is to use a single language (both textual and visual) to express shared knowledge, in some cases defining a sort of universal icon language; Google itself seems to prefer this approach. As Google, big web brands usually design or try to impose their language as universal (a sort of globalization effect). However, this solution requires too much effort for a non-native user who has to interpret and manipulate information represented through textual and icon signs that are alien to her/his culture and language. This may lead to ambiguity and misunderstanding when users of different cultures and languages collaborate to build new knowledge. WikiMapia supports many national languages; however the icon language is the same.

A different strategy to overcome cultural hurdles is to localize the whole language, not only the spoken (or written) language but also the icon language, with respect to the user culture and system of signs, by translating colors and symbols as well. In this way, not only cognitive information but also feelings and emotional moods can be easily interpreted by each wiki user.

4. Localizing Cognitive Knowledge and Emotional Moods in Banco Territorio

The Banco Territorio is introduced here to illustrate a solution for localizing cognitive and emotional knowledge. Banco Territorio is a wiki based on tourist maps that allows generic users to collaboratively build and associate with digital maps not only cognitive but also emotional knowledge through colored emoticons, i.e. stylized facial expressions that visually denote human emotions and attitudes (Costabile, Piccinno, Mussio & Parasiliti Provenza, 2007). Banco Territorio also allows users that are experts in different disciplines (e.g. as geology, history etc.) to jointly enrich the knowledge base with certified information in the form of specialized annotations, which illustrate relevant topics referring to the maps.

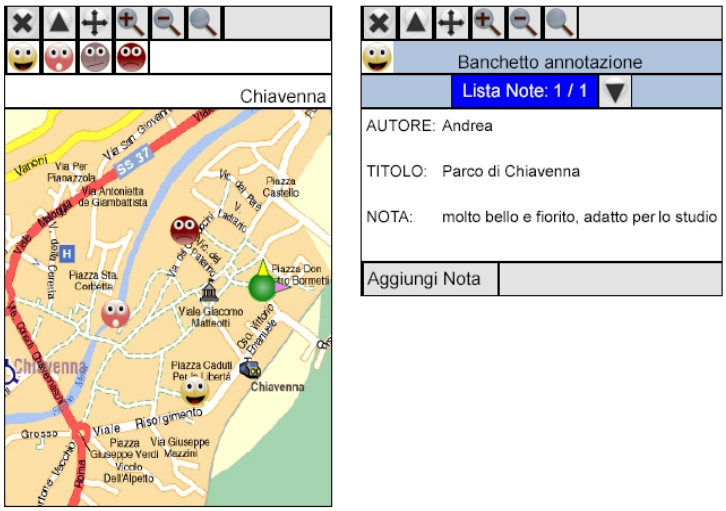

Figure 5. A map and an annotation produced by a tourist: the emoticon expresses the tourist's feeling and leads to the written note.

Figure 5 shows a map in Banco Territorio, along with an annotation manager, the tool through which a generic user, e.g. a tourist who is visiting a place in the map, inserts a text annotation expressing suggestions or comments on her/his visit, so as to enrich the information space associated with that map. The user is required to establish her/his feelings about the place by choosing an emoticon to visually summarize the content of the note being created. The map is annotated with three emoticons. A fourth visual link – the star operator – permits to access specialized annotations created by expert users and associated with that point of the map (see Figure 6).

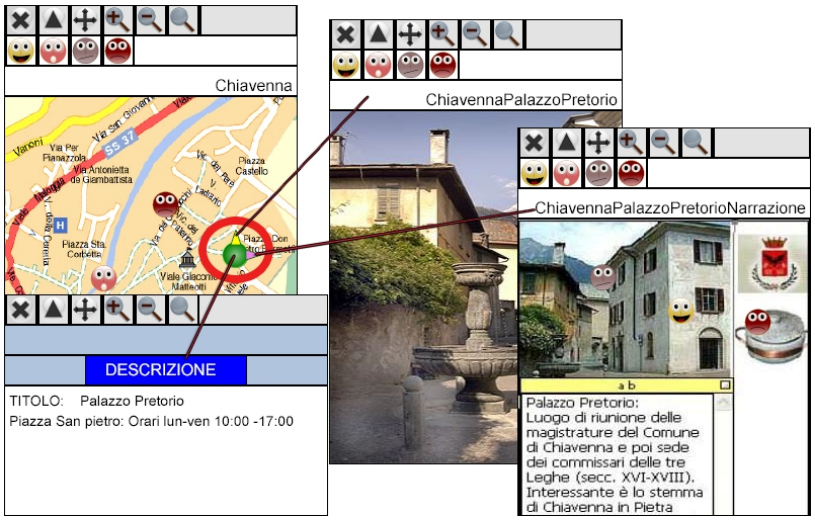

Figure 6. Examples of expert annotations as multimedia documents on a major monument in the map. The star operator, circled in the figure, signals the annotations and allows access to them.

4.1 Cognitive Knowledge Arising from Interactive Annotation

In Banco Territorio, generic users can annotate their suggestions, comments or useful remarks with regard to a specific point on the map, by creating, as WikiMapia, text or multimedia annotations to share with other users. Banco Territorio users can also associate annotations with paths they depict on the map. In Figure 7, a user, 'Giovanna', has annotated her opinions on the different legs of her trip through Milano (the selected path in red from Duomo to Policlinico). Annotated paths enrich the information space related to the map with knowledge paths on different topics. Figure 7 also shows that an annotation associated with a map can become a starting point for a discussion. Users can recursively annotate an existing annotation entered by another user, providing their points of view on the annotation's content. A thread of annotations is thus created recursively. The thread leads to knowledge enrichment through discussion, which could completely change the original point of view. Specifically, new points of view can be identified as well as new ways to approach an interesting topic related to the environment shown on the map.

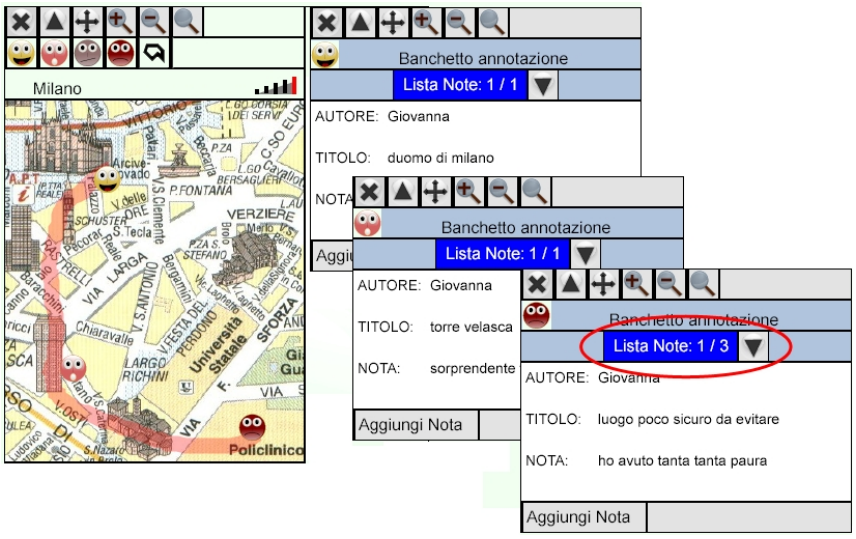

Figure 7. A path on the map of 'Milano' and its related annotations. The note on the right is the first in a thread of notes.

Social interaction among users also permits to add 'certified' knowledge when users are experts on the topic being discussed. Expert users feed the existing knowledge base with specialized content that is discussed and approved among them. They enhance the informative material and give users new material to comment on. An expert user can define two different types of specialized annotations: i) *descriptions*, i.e. textual and multimedia annotations; ii) *narrations*, i.e. multimedia annotations

enriched with sets of metadata. The set of metadata in the narration (the 'context' of the narration) is used to dynamically obtain links to related (even external) resources, with the aim of describing different aspects of the situation, activity or general subject under consideration, e.g. wine production, the history of the place, etc. (Valtolina, Mazzoleni, Franzoni, & Bertino, 2006). The context is described by a query, unwittingly and easily defined by expert users, on a set of distributed databases: the result of the context query is a set of documents, such as images, that refer to the annotation content written by the expert. In Figure 8, an annotation added by an expert user is shown.

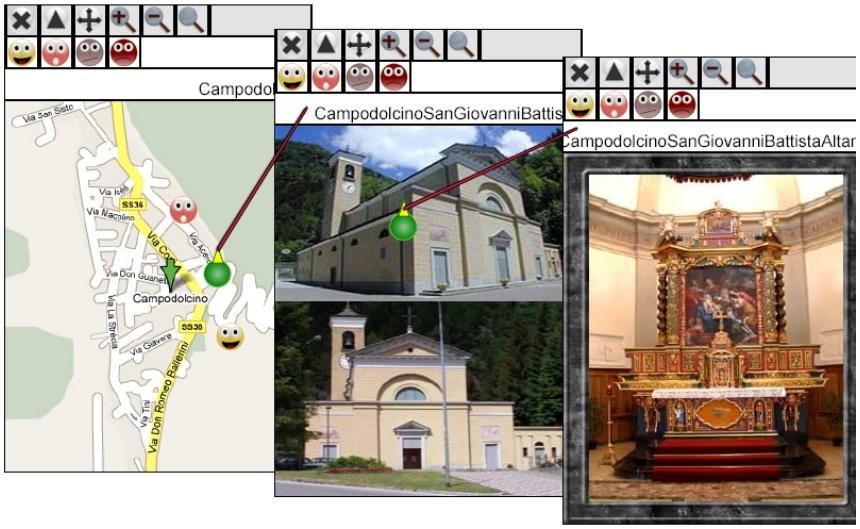

Figure 8. A recursively expert annotation: the annotation includes pictures of relevant monuments in the country.

4.2 Sharing Emotional Moods through Digital Annotation

Unlike the purely document nature of text and graphic annotations, icon and sound annotations allow the user of a map-based wiki to enrich perception of the map space with an emotional layer, thus associating the map with an emotional space.

In Banco Territorio, the emotional space is set up through particular visual markers – i.e. colored emoticons – that immediately evoke the notes' emotional nature, each emoticon referring to a particular place and summarizing, for example, the experience of a visitor in that place at a specific time. As shown in Figure 7, Banco Territorio provides users with four emoticon types, which visually express four different emotions: appreciation, surprise, disappointment, and sense of danger. The path on the map depicted in Figure 7 is annotated with three emoticons. Each emoticon

provides users with an immediate visual indicator of the particular mood the entity being annotated inspired in the author of the note. The first emoticon above, near Duomo, denotes a positive feeling related to that leg of the path. The subsequent emoticons denote different feelings, from surprise to completely dissatisfaction. If interested, readers can select a specific emoticon and access the correspondent annotation content, which clarifies the reasons for the emotional state visualized on the map. The use of colored emoticons, along with the possibility to attach a sound to them, makes the annotations multimodal and provides a sort of synesthetic method for sharing information about places on a map.

Whenever different users associate different emotional states with a same point on the map, the resulting emotional state will be displayed as a synthesis of them all. In this way, a common emotional level is achieved from a plurality of different users' emotional states.

4.3 Facing Cultural Challenge

Banco Territorio has been designed and developed according to current internationalization and localization techniques (Esselink, 2000) so as to be easily adapted to different cultures and conventions – by taking into account the different materialization properties (localization components) of each culture (Barricelli, 2007; Barber & Badre, 1998; O'Hagan & Ashworth, 2002).

The Banco Territorio depicted so far is localized to Italian culture: behind the Italian texts, the emoticon buttons – which express appreciation, surprise, disappointment, and sense of danger – are displayed according to the colors and facial expressions of Italian culture and conventions. Figure 9 shows the Banco Territorio presented in Figure 5 localized for a Japanese male user, where both textual and visual signs are displayed differently according to the Japanese language and system of signs. Specifically, behind text translations, the icon language, and in this case, the emoticon buttons are translated by using colors and graphic signs typically adopted in the community of Japanese male people. This is indeed an example where representing a same emotion also depends on the user gender (O'Hagan & Ashworth, 2002). As shown in Table 1 the four emoticons for Japanese female users should be stylized by graphical signs that are different from the Japanese male ones, while colors are the same since they convey the same information – colors an shapes in Table 1 are derived by current literature (Barber & Badre, 1998; O'Hagan & Ashworth, 2002).

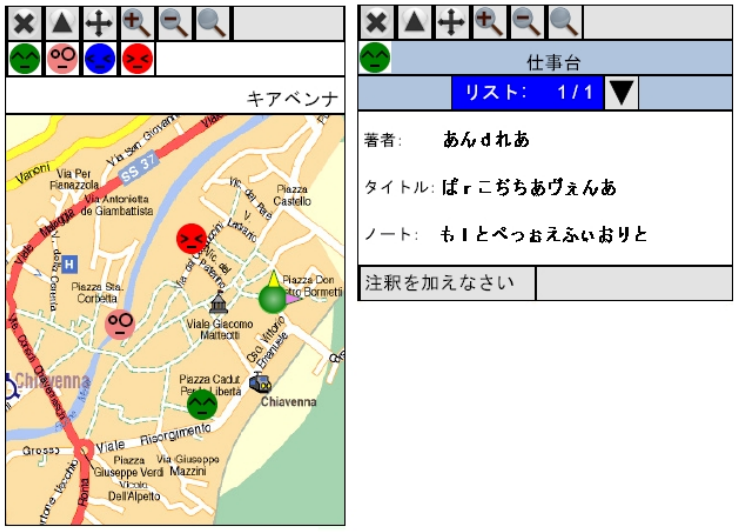

Figure 9. Banco Territorio localized for Japanese male users. Compare this to how the same information appears in Figure 5.

By adopting this approach, a same emotional state is correctly visualized by taking into account the culture and, in the case at hand, also the gender of the specific user. This solution pays special attention to the affordance and firstness of icons, which must be the right ones for the particular user to avoid misunderstanding and ambiguities.

To conclude, localization allows cultural hurdles to be overcome very broadly: the interactive system – internationalized and subsequently localized to different cultures – enables users of different nationalities to interact with the map-based wiki and with one another, each of them through her/his own language and system of signs.

SCALE OF LIKING					
Emotion	**Italian colors**	**Italian Shape**	**Japanese colors**	**Japanese male shape**	**Japanese female shape**
Appreciation	Yellow		Green		
Surprise	Lightcoral		Lightcoral		
Disappointment	Gray		Blue		
Sense of danger	Red		Red		

Table 1. Shape and color localization in the emoticon case (Barricelli, 2007)

4.4 Implementation Issues

In this section, we provide an overview on the different specifications of a Banco Territorio system and then we briefly discuss the Banco Territorio architecture.

Banco Territorio specification. Banco Territorio is characterized by four-specification levels, one for each different aspect of an interactive system: (i) content and organization; (ii) localization; (iii) materialization; (iv) interaction dynamics (Fogli, Fresta, Marcante, & Mussio, 2004).

The functional components – entities – of Banco Territorio, together with their logical structure, are specified through an XML-complaint language, the *interaction multimodal markup language* (IM^{2}L). IM^{2}L has been introduced in (Fogli et al., 2004) to describe interactive systems and its schema has been recently refined to provide an internationalized specification of the abstract entities that make up an interactive system independently from its materialization. These entities define the goals, scope, operational structures and functionalities of the system under construction apart from their materialization and consequently from their localization components. As an example, the row of emoticon buttons visible in all the Banco Territorio shown in previous figures, are described as an *operatorSet* entity that contains four *operator* entities, the emoticons – one for each different emotion to be associated with a note. Generally, the *operator* entity denotes a widget through which the user can interact to activate a function. According to IM^{2}L each *operator* is characterized by a name, a type, an identifier, the other entities it is related to, as well as its current state, the function associated, together with – as in the case of emoticon operators – the emotion the entity has to convey. This abstract and internationalized specification of an interactive system permits to describe the system without taking into account how it will be materialized based on the user's culture. As an example, the Banco Territorio in Figure 5 and 9 are different materializations of the same Banco Territorio, whose abstract and internationalized content is described by the same IM^{2}L document. For more details we refer the interested reader to (Barricelli, Fresta, Marcante , Mussio & Parasiliti Provenza, 2008).

When materializing the abstract entities of an interactive system, some materialization properties (also called localization components) strictly depend on users' culture, language and system of signs [1] . Geometry, topology, color representation, shapes and text are some example of these components. To specify

[1] They also depend on the activity to be performed and on the work context as well as user physical capabilities.

the localization aspects of Banco Territorio, we have defined a second XML-complaint language, the *localization markup language* (LML), which permits to specify for each IM^{2}L entity its localization components (e.g. shape, color, orientation, order, thickness) given a specific locale (e.g. culture, gender). In the case of emoticon *operator*s, the LML Banco specification for a given locale (e.g. the Italian one) sets the shapes and colors adopted, as reported in Table 1, based on the emotions that characterize the different *operator*s.

To describe the materialization aspect of Banco Territorio (independently from its localization aspect) a *template language* (TL) is specified. TL is built upon the specific language chosen for system materialization (e.g. XHTML and SVG). The current prototype of Banco Territorio is materialized according to the W3C scalable vector graphics (SVG) to strengthen a window-icon-menu-pointer interaction and direct manipulation on the web. Consequently, the current TL consists of SVG documents that specify the materialization templates of the entity types to be localized during the instantiation process based on the LML Banco specification at hand.

Finally, the interaction dynamics of Banco Territorio is specified through the ECMAscript language and PHP scripting documents.

The different levels of system specification permits to easily localize the abstract and internationalized description of the Banco Territorio according to user culture, language and system of signs.

Banco Territorio architecture. Banco Territorio is realized according to an AJAX-like architecture (Garrett, 2005) as shown in Figure 10. The user accesses the system through a Banco log-in web page, which loads from the Banco specification database: (i) the ECMAScript engine specification; (ii) the IM^{2}L content description; (iii) the current SVG templates; (iv) and, on the basis of the user profile (her/his culture, the activity and work context), the correspondent LML specification of the system. These specifications are thus interpreted by the browser, which coordinates the activities of its XML processor, the ECMAscript interpreter and the SVG viewer – the Adobe SVG Viewer plug-in, in our case. Given the IM^{2}L Banco specification, the Banco engine thus localizes the SVG templates according to the LML document. It then produces the initial state of the Banco Territorio system localized to the specific user and manages, on the client side, the interaction between the user and the system. On the server side, a PHP module is responsible to enrich the knowledge base with the new knowledge (i.e. annotations and narrations) associated with the maps. More details can be found

in Barracelli (2007), and Barricelli, Fresta, Marcante , Mussio & Parasiliti Provenza (2008).

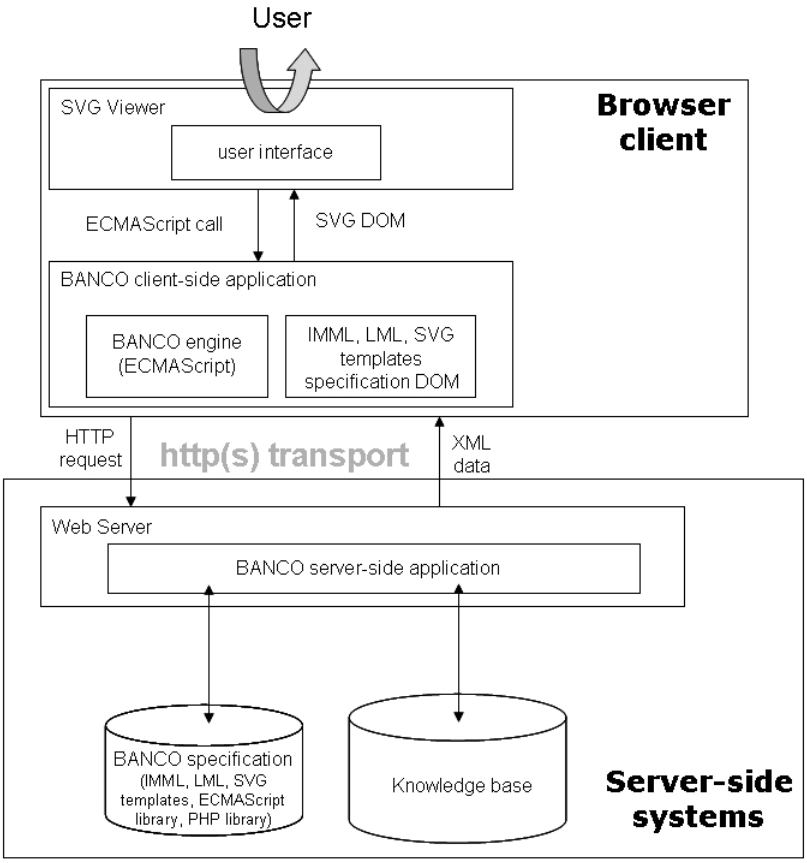

Figure 10. The Banco Territorio Architecture.

5. Conclusions

The ability to map space for cognitive knowledge and emotional moods, directly or metaphorically, and to localize this representation in such a way as to create a multicultural social network are interesting topics that merit further and deeper exploration.

The notion of map-based wiki introduced in this paper aims at defining tools to 'materialize' these efforts as emerging from virtual interaction. In map-based wikis, a map is the perceptible part of a social medium. Operations on the map allow users to interact with one another to create a social network.

Multimodal digital annotation appears, from the examples discussed, to be a powerful functionality of map-based wikis for conveying cognitive and emotional knowledge

(cognition and feeling) in a sharable shape, the external form of the knowledge. This external form can be described by adopting internationalization techniques, such as in the Banco Territorio, so as to be localized for specific cultural domains.

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