Cultures of Participation in Community Informatics: A Case Study

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Abstract. This paper describes a participatory design project aimed at developing FirstAidMap, a collaborative web mapping application to be used by an Italian non-profit association for public assistance and first aid. Volunteers of this association, and specifically ambulance drivers, need to know the characteristics of the territory where the association ensures its assistance, in order to reach a given place quickly and in a safe manner. Despite the new opportunities offered by Web 2.0 technologies, paper-based maps are the only means used by volunteers to spread and share knowledge within the association, while training sessions through Powerpoint™ presentations are regularly held to train novice drivers about the dangers existing in the territory and possible changes to traffic and road signals. The two design cycles carried out to develop FirstAidMap, which are described in this paper, gave the chance to observe how a culture of participation may progressively emerge in a community informatics domain and how the related issues may be addressed.

Keywords: collaborative web mapping, meta-design, cultures of participation, community informatics.

1 Introduction

In many application domains, managing and sharing knowledge is a fundamental activity that needs to be sustained by favoring a culture of participation [3-4], namely by providing all actors in the application environment with the proper means to participate in activities of their interest. Creating and exchanging up-to-date knowledge about the territory is a crucial need at COSP (Centro Operativo Soccorso Pubblico), a non-profit association that provides first aid and public assistance in a wide area near Brescia, in Italy, to a population of more than 20000 inhabitants. The association has grown over the years from 10 to 220 volunteers, providing today about 5000 first aid interventions a year. At COSP, volunteers play different roles, from driving ambulances to acting as rescuers, to coordinating the activities of other volunteers at the switchboard. COSP volunteers actually constitute a 'community of practice' [27], and share a high motivation and a strong desire to participate in the achievement of an important goal, namely saving human lives.

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The activities at the non-profit association could be naturally sustained by Web 2.0 technologies, and especially by collaborative web mapping systems, which may help COSP volunteers obtain detailed and up-to-date information about the territory. Nevertheless, members of COSP still prefer keeping on using traditional paper-based maps to plan their interventions, as well as going on taking training sessions through PowerPoint™ presentations to transfer knowledge about the territory from senior to novice drivers. The reasons underlying this situation are manifold. First of all, most volunteers come from different professional fields, have different cultural background, and are generally not so confident in computer-based systems. Lack of trust in new technologies is often the main problem for this type of user communities. As reported in [22], with reference to the fire response domain, firefighters still keep on using printed A5 cards representing parts of the city map, instead of using GPS navigators. Similarly, COSP volunteers do not rely on navigator satellite systems the ambulances are equipped with, because they do not generally suggest optimum routes for emergency vehicles. Some COSP volunteers currently use Google Maps, but they would not use it for COSP activities since it is considered too general and not well-suited to their domain and needs: they would fear making mistakes while using it or loosing precious time while preparing an intervention, if they do not find quickly the necessary indications to reach the target place.

Consolidated paper-based practices, lack of trust in information technologies, inexperienced and heterogeneous users, need for self-sufficiency, and limited budget are some of the typical problems that one usually finds in 'community informatics', intended as the design and management of computer-based systems for non-profit communities, non-governmental social service providers and local government agencies [1].

A first goal of our design project was thus to develop, with the collaboration of COSP volunteers, a web mapping application, which, on one hand could exploit existing web mapping services (including Google Maps), but, on the other, encapsulate relevant knowledge of COSP domain, being customized to the first aid domain and the skills of COSP volunteers. During the design of the first version of the application, volunteers' expectations on the system under design increase. In particular, a more collaborative application was required: volunteers asked for a virtual space they could directly shape and enrich to actively build their knowledge about the territory and share it within the COSP community. In other terms, volunteers felt the natural need of transforming themselves from mere consumers to producers of knowledge useful to their domain, namely, with Fisher's words, they required "a shift from consumer cultures to cultures of participation" [4, p. 42]. A second design cycle was thus carried out to obtain a collaborative web mapping system satisfying these new demands.

The paper presents the experience concerning the design and development of this system, called FirstAidMap. It illustrates how the components of the culture-of-participation framework discussed in [4] – meta-design, social creativity, and richer ecologies of participation – progressively emerged in the project. The considered case study shows that, in community informatics more than in other domains, users must be directly involved in system design, and called to be active participants at use time.

The paper is organized as follows: Section 2 discusses related work. Section 3 presents the first design cycle of the application. Section 4 illustrates the second design cycle, carried out to integrate functionality for knowledge creation and system adaptation in FirstAidMap. Section 5 aims to draw the main lessons learnt from this experience and delineate future research directions.

2 Related Work

Geographic maps are one of the most ancient and useful tools for displaying and creating knowledge about the places where we live [17]. This characteristic is emphasized in the digital era, where maps become dynamic and interactive. They are dynamic since they usually display data from a database and, if these data change, map visualization changes accordingly. Maps are also interactive in that different users working on the displayed map can add, reorganize or change the information to be displayed, thus creating new knowledge about a territory.

Geographic information systems (GIS) are the early software systems introducing digital maps as displays for information located in databases. They allow one to perform sophisticated operations on geographic information organized in map layers. However, GISs are usually designed for communities of geographers or expert in geographic information generally, whilst inexperienced users are often unable to use them [26], [12]. Even though GIS usability has been considered in some studies (e.g., [20]) and methods have been proposed for user-centered design of GISs [14], [24], the research in this area is mainly focused on effective knowledge visualization and retrieval, also called 'geovisualization' [18], rather than on the design of easy-to-use GISs. Particularly, geovisualization is playing an important role in the emergency domain (see for example: [18], [25], [2], [11]). In this context, geovisualization tools are aimed at representing cartographic content about the occurrence of certain events (e.g. a fire, a chemical disaster, a flu epidemic) and their evolution. Less emphasis is given to the representation of territory knowledge necessary to reach a given place with an emergency vehicle, with the exception of the study presented by Nadal-Serrano [22] for the design of web cards that resemble the printed cards used by firefighters for incident response preplanning.

As an alternative to GISs and geovisualization systems, collaborative web mapping systems can be used for free by a vast population of users, because they do not require particular competencies and they are generally usable. Collaborative web mapping systems allow users to visually define spaces by enabling them to choose what to map according to their own goals, knowledge and practices [10]. Furthermore, web maps can be regarded as virtual spaces created by end users and totally evolved at their hands and thus become social media [19]: while accessing and managing the information associated with the map, users interact directly or indirectly with other people, by sharing and exchanging knowledge related to the territory.

Among collaborative web mapping systems, Google Maps is certainly the most famous and used worldwide. It enables users to create personalized maps and share them with relatives and friends. Particularly, users can create their own maps by using

place markers, shapes, and lines to define a location, an entire area, or a path. However, the interaction with tools for map personalization is still too much programmer-oriented, with terminology and interaction style that often intimidate some users. Furthermore, working on a shared map, possibly with different roles, is not supported adequately. Last but not least, Google Maps is not domain-oriented, being general enough to address the needs of different user communities, and enabling a wide range of activities and different kinds of knowledge to be represented on the map.

Other systems, like WikiMapia (www.wikimapia.org), allow map sharing, even though their main goal seems the creation of social networks rather than virtual places where to accumulate and share knowledge for specific and common purposes. User-generated street maps are supported in OpenStreetMap as well, an extensive and effective project involving a user community that is increasing exponentially [13]. Anyway, in these applications, users constitute informal groups, characterized by common interests in a same place. In other terms, they are aimed at supporting communities of interest; whilst, according to the characterization presented in [15], in our case, there is a need for a system to be used by a community of practice that has to share knowledge about territory for faster first aid [9]. Furthermore, it must be regarded as a system that belongs to the community informatics tradition.

Community informatics is characterized by an increasing need of participation on behalf of community members, due both to the continuing growth in the request for services by the community and to limited budget flexibility reserved in such organizations to information technology. Therefore, in a community informatics domain, an interactive system must be inexpensive, easy to use, and customizable by the community members; moreover, its configuration, management and enhancement must be carried out within the community, by limiting as much as possible the intervention of software professionals. However, as observed in several projects [1], [7-8], community members do not usually have high competencies and expertise in information technologies; in addition, their motivation to learn a new work practice or technical skills strongly depends on the goal value with respect to the individual effort.

To cope with these problems, a culture of participation [3-4] should be adopted, in order to provide users "with the means to participate and to contribute actively in personally meaningful problems" [4, p. 42]. Particularly, three major components constitute the theoretical framework for cultures of participation [4]: 1) *meta-design*, that is the creation of a socio-technical infrastructure in which new forms of collaboration can come alive by allowing systems to be modified at use time [5]; 2) *social creativity*, which allows all voices being heard to frame and solve a complex problem and to support people interacting each other and through shared artefacts; 3) *richer ecologies of participation*, which foresee the creation of different levels of participation on the basis of the different roles that community members can play or would like to play.

In the following, we illustrate how these three components progressively emerged in the FirstAidMap project as a consequence of an iterative design work carried out with representative end users.

3 Supporting Driver Training: First Design Cycle

In the FirstAidMap project, two participatory design cycles have been carried out: the former to build a first version of the application to support ambulance drivers and driver instructors in training activities; the latter to cope with the new emerged requirements and collaboration needs. In both design cycles, three volunteers of the COSP association participated in the design process. They have a deep knowledge of the non-profit association and its needs. Two out of them are experienced ambulance drivers, also playing the role of instructors of new drivers. The last volunteer is an ambulance driver who has been collaborating with the association for more than 5 years. In this section we present the main results of the first design cycle.

3.1 User Profile and Task Analysis

Interviews and brainstorming sessions with the three COSP volunteers allowed exploring the characteristics of the COSP association, identify the profiles of the intended users, analyze their tasks, and define the requirements for the new system.

At the beginning of the project, FirstAidMap was intended for ambulance driver instructors who possess deep knowledge of the territory and have a long experience in driving ambulances as volunteers. It was also intended for all ambulance drivers and driver assistants interested in keeping themselves up-to-date. These volunteers share a common motivation in helping others, offering their time to COSP activities, but their primary job ranges among a variety of possibilities. Most of them are not young people and have no specific competence in information technology. Usually, they are able to browse the web and use web mapping applications, such as Google Maps. Furthermore, driver instructors are able to use office applications as novice users, especially PowerPoint™.

As emerged from the interviews, navigator satellite systems are not considered sufficient and satisfactory to carefully assist ambulance drivers and the whole emergency crews in bringing medical care to serious patients timely. Navigator systems, indeed, do not take into account critical issues when suggesting quickest paths to a place, such as roads with humps or uneven road surfaces (really dangerous in case of patients on board), road yards in progress or weekly open-air markets causing detours that can irreparably delay the provision of first aid. Due to these limitations, COSP volunteers do not rely on navigator systems, but they rather prefer trusting in their knowledge and expertise of the territory to decide how to reach a given place quickly and in a safe manner. For this reason, driver instructors regularly carry out training sessions for the other volunteers. During a training session, instructors describe the most important characteristics of the territory where COSP operates (including about fifteen different villages), and show possible changes occurred since the last training session. Driver instructors carry out training sessions by preparing PowerPoint™ slides with annotated maps of the different villages that they comment and illustrate in detail.

3.2 Data and Functional Analysis

Representative volunteers participating in the domain and task analysis revealed soon their interest in a system for map navigation similar to Google Maps, but customized to the specific needs and characteristics of their community.

Therefore, the first requirement was to develop a web application based on existing mapping services, which could be specifically suited to the training of new ambulance drivers.

The digital map should have been the main component of the application; its interactive nature obviously should have increased the ability of instructors to explore the map with respect to the static versions.

Furthermore, the map should have been easy to explore by users with limited experience and competencies in information technology. Particularly, map zooming and panning activities should have been facilitated. In this respect, a 'direct zoom' function to a selected set of villages was explicitly required, because instructors, during training sessions, are used to present and describe all the characteristics of a single village simultaneously.

Finally, the map should have contained all the information the specific community requires about the territory. Three types of information were recognized as crucial for COSP work: *zones*, *points of interests* and *notifications*. Such information are all necessary to guide ambulance drivers to the place where a medical assistance is needed. A *zone* is an area on the map with common characteristics; it groups together several points of the map satisfying some condition, namely a set of roads or neighborhoods reachable through a same ambulance route from the COSP offices. A *point of interest*, or briefly POI, is a place on the map, more precisely a fixed and stable element on the territory that acts as a reference point for ambulance drivers and can help drivers to find their way to a place. As in navigator satellite systems, a POI can be a church, a sports ground, a square and so forth. However, it can also be a more specific reference point for an ambulance driver such as a bridge, a dangerous road or a traffic light. Finally, a *notification* provides alert information about a critical situation that can interfere with first aid interventions. It describes a critical condition occurring in a given place and for a period of time that may hamper the attainment of a certain place, e.g. the work in progress in a specific area of interest or the temporary modification of the road network of a neighborhood due to a demonstration. Differently from zones and POIs, notifications:

1. Often convey critical information about the territory;
2. May have a limited validity, e.g. the closing of a motorway tollbooth due to work in progress that may last one week;
3. May refer to events occurring with a certain frequency, e.g. the open-air market that takes place in a square each Wednesday morning.

All these types of information should enrich the map with semantics relevant for the COSP domain. However, they can constitute a lot of information, which altogether may confuse the map user. Therefore, to avoid information overload, such information should

have been organized in different levels to be enabled/disabled, according to users' needs and preferences.

3.3 Design

After the requirements analysis, a set of static mock-ups have been prepared and used during the meetings with representative COSP volunteers to discuss whether the needs they had previously expressed have been satisfied, to obtain their suggestions for improving the system look-and-feel and possibly to collect new requirements.

An interactive prototype was then designed and developed. Figure 1 shows a screenshot of this first version of FirstAidMap.

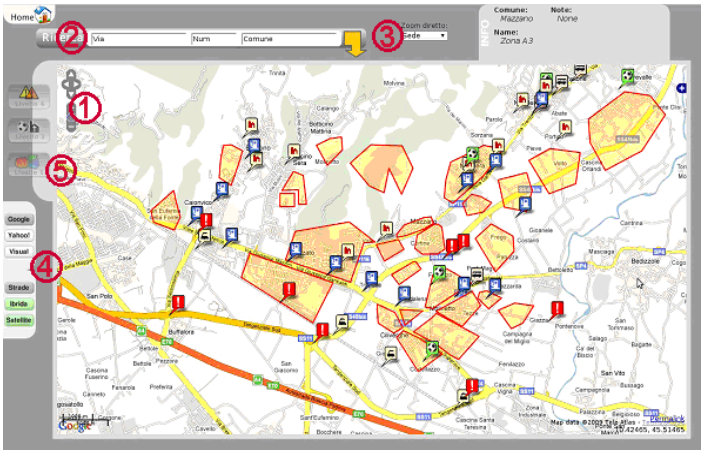

Fig. 1. The first version of FirstAidMap

As the reader can notice, the screen space is almost totally filled with the map. Different types of map (road, satellite, or hybrid) can be selected and retrieved on the fly through different web mapping services (Google Maps, Yahoo! or Visual Maps). The information relevant for the COSP domain is included within proper information levels: zones are represented as interactive semi-transparent orange polygons; POIs are represented through icons that resemble POI meaning (a church, a soccer balloon to indicate a soccer field, a train to indicate the railway, etc.); notifications are represented by square red icons with an exclamation mark inside.

The map is surrounded by a variety of widgets to carry out the following activities:

- Navigate the map through the common tools for panning and zooming in/out (widget no. 1 in Figure 1), or by using the mouse left button and wheel;
- Search for a place, by inserting an address in the search bar (widgets no. 2) or selecting a village from the combo box through the 'direct zoom' component (widget no. 3);
- Personalize the visualization (through the selector widgets no. 4) to choose the type of map to be displayed or the web mapping service;

- Enable/disable the information levels for zones, POIs and notifications (selector widgets no. 5);
- Select an element (zone, POI, or notification) by a mouse click on the element itself, in order to access a pop-up presenting some detailed information about the selected element.

3.4 Evaluation

To gather preliminary user feedback and assess to which extent this first prototype satisfied COSP needs and expectations, an experiment has been conducted with a group of seven COSP volunteers (five males and two females). Their ages ranged from 24 to 49 years. They held different education degrees, from middle to high school, till laurea degree, and represented various professional backgrounds: the sample included two civil servants, an artisan, a housewife, a student and a software developer. They all had at least two years of experience at COSP by playing the role of ambulance driver and/or driver instructor. Five of them were using the computer daily and had already accessed online maps, using Google Maps mainly. Two volunteers declared to use the computer only a few times in a week.

Participants were asked to carry out two tasks for evaluating the searching and exploration functionality offered by the system. The test was performed at the COSP office at the end of participant shifts. An introduction session was carried out before the experiment to show test participants the main functionality of the application. During task execution, qualitative data about FirstAidMap usability have been collected through direct observation. Then, an anonymous post-questionnaire was submitted to participants to investigate their opinions about the easiness of the interaction with the application, the effectiveness and efficiency of its components, and the application aesthetics. Further questions have been also included in the questionnaire to gather additional user comments and ideas for improving the application.

In the experiment, all participants were able to interact soon with the map and the tools offered by the system. They successfully completed both the assigned tasks. The most significant problems experienced by test participants were related to the identification of a target point within the map (its marker was hardly distinguishable from POIs), and the map dragging when information levels were active.

User opinions gathered through the post-questionnaire provided the design team with important feedback. Participants expressed their desire to contribute to content insertions, with the aim of sharing their knowledge of the territory with other volunteers and thus contributing to improve the COSP service. They also recognized, in some cases, the need of defining new types of POIs and notifications.

4 Fostering Cultures of Participation: Second Design Cycle

After the evaluation of the first prototype, the design team, including the three representative volunteers, met again to discuss the results of the test with users. In that

meeting, the design team reflected on the emerging motivation of users to participate in content creation and system evolution.

As a consequence, representative volunteers realized that a system where users could apply their knowledge of the territory in a more extensive and collaborative way would have better supported their daily practice. They realized that what they need was not simply a training system through which they could learn and teach the characteristics and the dangers of the territory, but also an interactive space that all volunteers could shape to build and share their knowledge on the territory, and thus collaborating to bring first aid to patients timely.

The emerging idea, which subsequently permeated the second phase of the project, was therefore considering all COSP volunteers as a fundamental source of knowledge related to the management and provision of first aid in a given territory.

This opened up a different perspective on system design where the components of the framework for cultures of participation described in [4] naturally emerged.

4.1 Meta-design

Sustaining and encouraging COSP volunteers to participate in shaping the map according to their needs and preferences became the new goal to be pursued, and thus led to the adoption of a meta-design approach.

Indeed, it was necessary to provide users with proper tools for enriching the map with significant and up-to-date information, along with functionality for customizing map visualization and monitoring users' activities. Moreover, this should have been achieved without forcing COSP volunteers to become expert neither in information technology nor in cartography, as many commercial geographic information systems require [26], [12]. The aim was to create a community able to manage and evolve the system without the intervention of software professionals.

A new usage scenario has been identified, beyond driver training: using FirstAidMap as a support tool while preparing an emergency intervention, in order to identify the characteristics of the area around the ambulance destination place. Indeed, to carry out this task, ambulance drivers still use traditional paper-based maps available at COSP offices and annotated with their comments and notes.

Thus, the design team started to study how 'to transform' COSP volunteers from passive users into co-designers of map content. The aim was to design and develop a new version of FirstAidMap enriched with end-user development (EUD) [16] features that, not only could support users in creating and sharing knowledge on the territory in an easy and natural way [9], but also that could encourage and motivate them to participate. To this end, the level of complexity of activities should have been appropriate to the COSP volunteers' individual skills and situations, and possibly allow them to easily move up from less complex to more complex activities. In this way, advanced functionalities should have been made available to users progressively, without forcing them to learn such functionalities soon. Advanced functionalities should not have been intrusive and distract users from their primary task; at the same time, they should have encouraged users in experimenting system adaptation and modification. Moreover, some form of acknowledgement should have been foreseen, such as a clear association between contents and their creators.

4.2 Towards a Rich Ecology of Participation

For the new version of FirstAidMap different user roles have been identified, which correspond to the different roles that volunteers may play in contributing content.

All COSP volunteers should be able to access the system easily, without any authentication mechanism[1], as *visitor* users, just to explore the map-based content, visualize the map based on their needs and interests, and eventually point out a danger or a real-time update (e.g. a detour, an hazard), which can interfere with first aid interventions, by adding a new notification.

Like visitor users, ambulance *drivers* can access the map and the associated information, visualize active notifications, and possibly insert new ones. However, they are required to log in FirstAidMap and consult the map before each emergency intervention, in order to check possible alert situations in the route to the emergency site. This organization rule suggested by volunteers that participated in design was a consequence of the new usage scenario of FirstAidMap.

A volunteer logged in the system as *contributor* user is provided with advanced tools and functionality to create and modify zones, POIs and notifications in addition to access and explore the knowledge base as visitors or drivers.

Finally, more active and experienced COSP volunteers should be able to perform activities to let both the content and the whole system evolve according to the COSP community's needs, thus acting as *administrator* users. An administrator is a power user who manages user profiles, system accesses and all the information associated with the map (POIs, zones and notifications). Furthermore s/he is responsible for configuring the system according to the COSP volunteers' needs.

This classification of end-user roles (see Figure 2) is characterized by a gradual increase in the complexity of the activities assigned to them, according to the principle of "gentle slope of complexity" [21]. The usage of the application should motivate and encourage COSP volunteers to become more active in their collaboration to map enrichment. It is worth noticing that a migration path of users [3] is foreseen in this classification: after a first period of basic interaction with the system as visitor or driver users, COSP volunteers may wish to become contributors to add and manage zones and POIs, beyond inserting notifications only. In a similar way, a contributor could wish to become an administrator, possibly collaborating with other administrators in the definition of new kinds of POIs and notifications.

The different participation mechanisms may foster a mutual support for knowledge accumulation and sharing. Volunteers that are more knowledgeable of some particular area, or that occasionally discover some new information, may make their knowledge available to the community as soon as possible, even accessing the system just as visitors to add notifications. Each volunteer's contribution may stimulate reciprocity, especially when information is regarded as crucial to find the best path for an intervention. The idea of associating zones and POIs with the authors' name allows recognizing not only each volunteer's contribution, but also the relationships that the different volunteers have with specific places. In this way, knowledge on the map may stimulate interactions among volunteers, beyond the use of the system for first aid interventions, and re-enforce the sense of belonging to the community.

[1] The underlying assumption is that the system is accessible only on the COSP intranet.

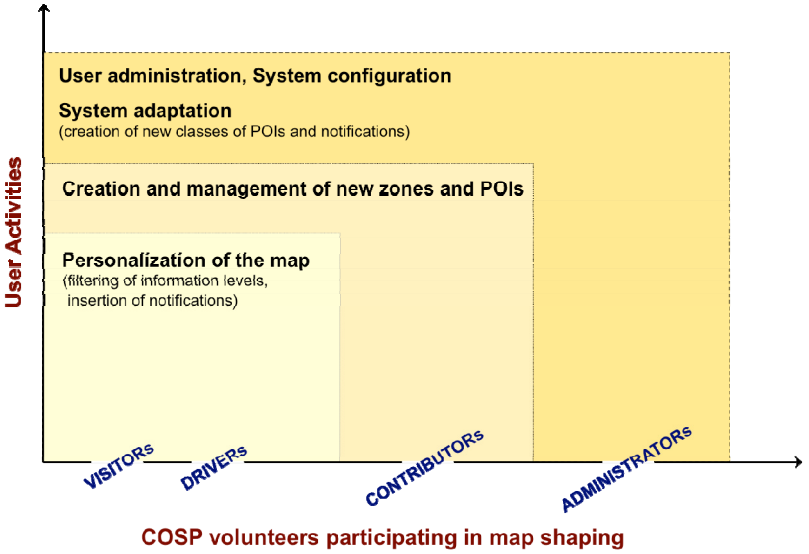

Fig. 2. The rich ecology of participation of FirstAidMap

4.3 Encouraging Social Creativity

To include functions concerned with insertion of new content and system administration, it was necessary redesigning the layout of FirstAidMap and enriching its interaction experience. The three representative COSP volunteers have been involved again in the participatory design of the new version of FirstAidMap. In this way, system appropriation by volunteers further increased, while considering their perspective helped designing the EUD mechanisms to be made available to the different user roles.

In this second version of the application, after selecting the map consultation button in the home page, a visitor or a driver user accesses the map view page shown in Figure 3[2]. Here, the user can interact with the map by clicking on the zoom in/out and pan widgets or using the mouse wheel and left button. S/he can also select an icon on the map, so as a pop-up window appears to display its textual details (in the example, it is a notification informing about traffic deviation due to the construction of a new roundabout). On the right of the map there is a navigation panel where the user can: i) customize the map visualization by selecting its type (road, hybrid or satellite map) and the web mapping service (Google, Yahoo!, Visual Maps); ii) filter the map-related information to be displayed (zones, POIs, notifications); iii) search a specific place by specifying its address or selecting a village from a list.

[2] The figure refers to a driver user authenticated in the system. A driver is allowed to perform the same activities of visitor users, but FirstAidMap logs his/her activities. This feature allows checking a posteriori if drivers consulted the map before starting their interventions.

Fig. 3. The map view page of FirstAidMap

Under the navigation panel in Figure 3, there is a notification manager panel allowing the user to insert notifications by characterizing them with a name, a description, a validity period, a frequency and a severity degree. This feature is a result of the social creativity in design: indeed, it was an explicit request of representative end users, because every COSP volunteer should have the possibility to notify to the community new dangerous situations. This also allows volunteers to become confident with content creation, according to the idea that providing everyone with (few) tools for participating encourages changes in human behavior and social organization, and thus social creativity at use time.

Obviously, social creativity increases if a consistent number of volunteers log in the system as contributor users. To this end, these users find in the interface three more panels to manage zones, POIs and notifications respectively (Figure 4). Each item in these panels can be selected by the user to perform a specific action, namely *insertion, modification* or *deletion* of zones, POIs and notifications respectively; the corresponding sub-panel is thus expanded to show all the information necessary to carry out the selected action. Only a sub-panel, and thus only one functionality, can be active at any time. This allows reducing errors and increasing user performance while updating content. For example, to insert a new zone (Figure 4), the user should select the 'manage zones' panel, and within this panel, open a sub-panel for zone insertion. In this state of the application, the interaction with the map allows drawing a new zone, and a simple form allows completing the data about the zone being drawn.

Finally, most experienced and skilled COSP volunteers can log in the system as administrator users. As a member of the COSP staff, an administrator user will not necessarily be an expert in system administration, but just a power user, with some deeper knowledge in information technology with respect to the other volunteers. Therefore, s/he must be supported by easy-to-use tools and user-oriented terminology. To this end, a separate section of the application has been created to carry out monitoring activities, manage user profiles, configure and adapt the application.

Figure 5 shows the page devoted to system adaptation. At the top, the user can select the base map to be loaded when the application starts. Then, s/he can manage the types of POIs and notifications by changing the existing ones or defining new types. In this way, the visual aspect of POIs and notifications can change at use time. The administrator can define a new type of POI or notification by inserting a name and selecting an icon from those available in a group of radio buttons. If the user does not find a suitable icon, s/he can load a new image on the system (Figure 5).

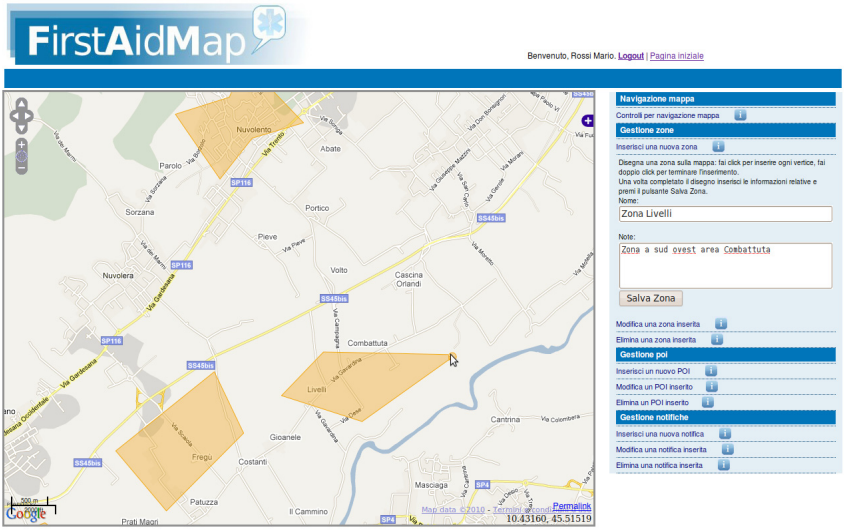

Fig. 4. Adding a zone to FirstAidMap

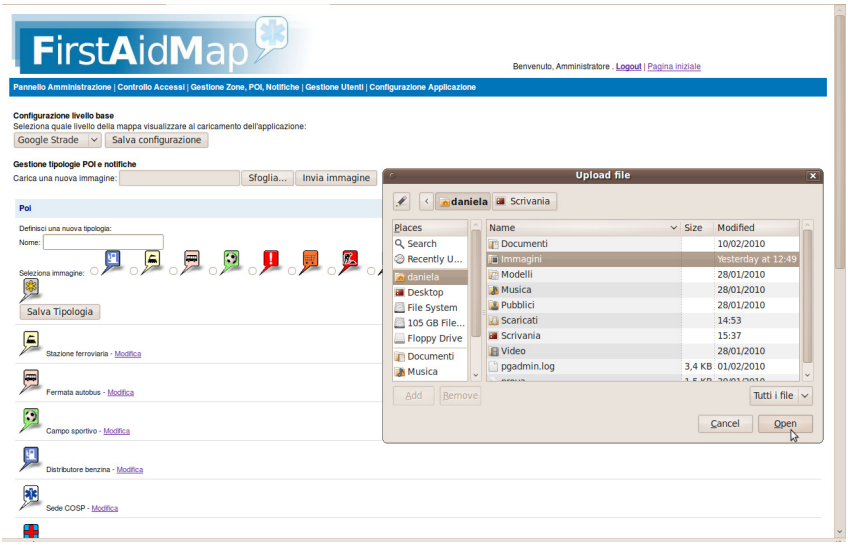

Fig. 5. The page for managing POI and notification types

4.4 Evaluation

Two outside evaluators have carried out a heuristic evaluation [23] of the second version of FirstAidMap. They identified 60 usability problems, which were then discussed with the design team, in order to identify possible solutions and their priorities. During this meeting, four usability problems were judged false positives. More precisely, evaluators classified as usability problems the appearance and behavior of some widgets that were explicitly discussed and decided during the requirements analysis and design phases. Finally, designers considered five problems as technical bugs and not as actual usability issues.

Designers have then fixed the problems and installed the system at COSP, in order to allow the representative users that participated in the design to test the system. Even though these users declared their appreciation for the new version of FirstAidMap, they reported us a list of problems, most of them related to code bugs emerging under some specific conditions, which need to be solved before performing an extensive experimentation with a significant number of COSP volunteers.

Users took also the chance to suggest further features to be added to the application. Particularly, users asked for the possibility i) to visualize the path from the COSP offices to the target point, ii) to print the map and all selected information levels, iii) to filter POIs and notifications according to their type, and, last but not least, iv) to enjoy the application on a portable device in the ambulance, with real-time data updating based on GPS.

Unfortunately, the development of these additional features requires a third design cycle pushing further on meta-design. This confirms once again the need of creating systems that are flexible enough to cope with the requirements emerging at use time.

5 Discussion and Conclusion

The experience gathered in this case study has been useful to deepen the concept of culture of participation in community informatics. Meta-design contributed to create FirstAidMap as a living entity [6], composed by a software system (the technical component) and its users (the social component). A rich ecology of participation has been established, giving rise to different responsibilities and collaboration possibilities for COSP volunteers. Moreover, social creativity has been sustained at design and use time. Indeed, a participatory design activity with COSP volunteers led to create EUD features that may engage, encourage and motivate users in contributing and sharing their knowledge on the territory. In particular, usability aspects and social issues have been carefully considered in the design of such features.

On the technical side, all the functionalities for inserting new data and modifying the existing ones on behalf of each kind of user (visitor, driver, contributor, administrator) have been designed to be simple and intuitive, in order to foster the participation of as much volunteers as possible. At the same time, users are not forced to become contributors when they are not willing to: for example, they can first approach the system as simple visitors, then try to add notifications and finally ask for the possibility to access more sophisticated functionalities. Moreover, in FirstAidMap, objects and tools are properly grouped and presented to the users only when needed, thus limiting error possibilities and supporting a more efficient interaction.

On the social side, it is crucial to let each user contribute her/his knowledge as in the traditional paper-based practice. The main motivation for this activity - underlying also the traditional practice - is that it is carried out for an important cause, namely saving lives. However, FirstAidMap creates further opportunities for social rewards: for example, the contributor's name is associated with zones, points of interests and notifications, and this can be recognized by all volunteers using that information. Participation may yield personal, social and professional benefits: personal benefit is achieved when "I feel better" by realizing the importance of my participation; social benefit can emerge from the fact that "colleagues may use and appreciate my contribution" or, more importantly, that "lives are saved also thanks to myself"; professional benefit could be a consequence of approaching a software system as a non-expert in information technology, who progressively migrates from the role of visitor to that of administrator ("I can learn some more IT").

For the future, we plan to integrate the system with further mechanisms for the evolution of its technical and social components. Thus, on the one hand, EUD tools must be implemented to extend the system with advanced functionalities, such as the possibility for users to create new information levels or develop content filters; on the other hand, different forms of rewarding must be studied to encourage user migration path towards co-developing roles. Personal, social and professional benefits must be understood better and sustained by studying further EUD mechanisms, by going beyond the mere technological aspects. Finally, we would like to test the system in other application domains where knowledge about territory is a fundamental source for problem solving, e.g. logistics, transport by courier, and so on.

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