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Collaborative Multi-Perspective Urban Knowledge and Civic Media

A Never-Ending Design Challenge

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***Abstract*—Developing a civic social network requires to consider users meeting in real life, collaborating on digital entries related to real urban entities. This makes necessary to think about collaboration tools in a new perspective: ensuring the participation of users with different levels and forms of legitimacy to represent complex relations among entities, and ensuring the accountability of each contributor. We present a set of technical solutions allowing the collaboration on complex entities, keeping interactions simple, and representing multiple perspectives about shared entities.**

Keywords-urban informatics; civic media; collaborative network; urban entities; participatory design.

I. INTRODUCTION

The knowledge about the city can be seen as a coherent system of social and geographical information about urban entities, ranging from street furniture to buildings, from the neighbourhood life to city services systems. Each entity and each place is defined by perception and uses of a multitude of local players involved in ongoing activities and projects in those spaces at the same time.

Nowadays, new challenges arise from social media and map-based applications where the focus is not just on mapping a place indicating its position, but on sharing social information aimed to support new forms of citizen engagement. This kind of information is not only about physical components, but also about intangible and un-representable elements that define the corpus of the urban knowledge. In this scenario, spatial attribution of contents is a mandatory requirement because digital entities correspond to real places, actual events, and active groups. In general, real life dynamics occurring in real environments can be potentially expressed and documented in a virtual space.

Finding new intuitive solutions to gather and visualise multiple contributions about same urban entities from heterogeneous sources and different perspectives is a challenging task: it is crucial to represent the operational context acting in the city by representing the coexistence of networks, flows, initiatives, minimizing conflict situations, and without forcing a simplification of reality.

We are working on designing a Civic Social Network (CSN) [2][3][4], intended to address this issue by establishing a collaborative framework based on citizenship and public engagement at local and urban level.

In our opinion, a CSN aimed to represent urban and local reality avoiding the fragmentation of information should not host multiple parallel-unconnected entities, but it should rebuild the social context integrating different contributions, without discriminating in favour of one of many parties' position. This is the premise to design a collaborative platform to promote collaboration in real life among different players (with concurrent perspectives and goals) interacting in the same physical space. User legitimacy and responsibility over contents are the key problems to be addressed in this kind of platform.

During a participatory design process involving 1500 people in 70 meetings, workshops and living labs, we engaged potential users in a first cycle about assessing the requisite for collaboration on digital platforms in their real context. Considering their inputs, we designed and developed a set of solutions [13] oriented to the following goals:

a) Providing a mechanism to contribute in contents creation regardless their initiators, in order to taking into account different forms and levels of legitimacy of local players, and let various sources coexist without forcing a common position or a unilateral perspective;
b) Providing a mechanism to share the responsibility of moderation over contents about the same urban entity;
c) Ensuring a clear accountability of users even in case of multiple contributors, relying on non-anonymity of users, and on identification of collective users such as organizations, local authorities or businesses.

The result is a system capable to represent a network of digital entities corresponding to real urban and local objects.

New issues are related to the fact that relationships among users in a CSN are based on spatial proximity and on collaboration on the same urban entities, both in real world and virtual space. The main interaction is about and through contents describing places, activities, projects and groups. Define clear policies to enhance all contributions and preventing abuses is the precondition to create a positive virtual work environment for civic engagement.

In this contribution, we present the extension of this design process, proposing the solutions we implemented to answer to the following questions:

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1. Can we define a category system able to classify places and other urban entities in an objective way?
2. Which policies are socially acceptable to extend moderation mechanisms over contents on the same entity from the first author (initiator) to multiple contributors?
3. How to support a daily use of a platform and common sense interactions?

The structure of the paper is the following: Section II includes a brief analysis about the main approaches used by the most successful digital platforms based on users' collaboration for the content production. In Section III, we describe the general approach we followed in relation to the issues regarding legitimacy and responsibilities. We describe the technical solutions we implemented in Section IV. Then, we present the evaluation and the open issues. Lastly, we synthesize our conclusions and the future developments of our CSN.

II. STATE OF THE ART

We introduce an emblematic real use case emerged during our workshops with potential users in order to compare the approaches used in collaborative digital platforms and the related outputs for the example.

We need to map a school in a neighbourhood. Who is legitimate to describe the school? The dean, the school board, school employees, teachers, students' parents, former or current students? The school board and the dean can describe the school in term of educational vision and methods, or syllabus and training paths; employees are qualified to write about the public services offered by the school; students and parents can share their experience lived in the school environment.

What if the school is hosted in an historical building? What is more prominent? The historical or the educational aspects? Therefore, who is legitimated to describe the historical aspects? Historians, architects, local experts, students, neighbourhood inhabitants, cultural heritage authorities, or local administrations? The local administration can motivate the change of destination of a monumental place to a public facility in order to revitalize the local area. Historians can describe the significance of that building in the city history. Architects and local experts can describe stylistic and technical characteristics and why the building is worth to be preserved. The cultural heritage authority can place the building into the local cultural assets. For neighbours, a public building as a school is an important focal point in the place where they live over time.

The example can become even more complex. What if the school gym is used by sport organizations for their activities? What if the school is managed by a religious organization?

The school is a complex urban entity that lends itself to be represented by a multiplicity of descriptions, all fitting a specific aspect of the reality, with different forms and levels of legitimacy.

We consider this scenario in order to study the problem of defining a suitable category system for complex urban entities and the solution implemented so far as moderation mechanisms.

A. *Category systems*

A platform category system can be addressed by top down or bottom up design approaches.

An example of a bottom up approach can be found in OpenStreetMap (OSM) [17]: the community of users raise proposals and decide the category system, which is a folksonomy supported by a wiki documentation [18] collecting motivations, examples, pictures about the interpretation and correct use of categories. In this case, there are well-known issues regarding the locality-based semantic of categories, the small number of active contributors engaged in category definition, and the resulting low quality of data. In a bottom-up project such as OSM, the school in our example would be flattened into a physical Point of Interest on a map defined by shape, name, address and function. Activities, social relations and uses of spaces will not be represented.

Following, GeoKey [19] enables the definition of categories at "community level": each group can setup a project with their own data types and features. This bottom-up approach presents interoperability issues and hardship in interpreting and reasoning with data. On this platform, the same urban entity could be included in several different community maps with their own categorization, without fostering for a mutual exchange of information among groups working on the same place.

On the other hand, the stability given by top-down approaches have as counterpart the loss of flexibility in terms of representation of heterogeneous point of views. For instance, Pinterest as world ideas catalogue defined 34 categories [20] for all possible ideas; Foursquare provides a category tree for all possible places [21]; Twitter defined recently ten categories of streams to cluster all tweets, such as "music" [22]. In these social network, the school in our example would be fragmented in multiple unconnected entities and entry points, making impossible to merge several contents actually related to the same complex entity. Each content, even if related to the same real place or object, would fit in one of the categories set by the system.

B. *Moderation policies: common goal and owership*

If we consider to use Wikipedia in our scenario, the result will be two interlinked pages addressing the school and the historical building. Homogenous groups of experts, with the supervision on Wikipedia editors [6], will develop each one of them [5]. Personal experience will not be allowed and contingent activities will not be documented.

Considering Facebook groups [9], the result will be a parents group about sharing personal experiences as students' parents or former students. The dean or other authorities will not be included in this kind of group or they may participate as individuals and not as in charge of institutional authority.

In both cases, the problem of plurality is simplified involving users in something of very specific where it is possible to assume the collaboration of users toward a common goal. Indeed, contents in an encyclopaedia page are general and acceptable for a large majority of people without representing multiple perspectives. In a parents group on Facebook, users share a set of characteristics and interests, and

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their involvement is limited. Potential conflicts about attribution and legitimacy are solved addressing the compliance of each contribution to the common goal. This overall guide is done by editors in the case of Wikipedia, and group owners or moderators in Facebook, but in a working environment where interactions among users are strictly regulated by explicit and implicit rules.

When expressing the identity is more prominent than other goals, the legitimacy issue is solved in an ownership assessment. In other words, if the goal is to represent an entity in an official way the problem is to identify who has the rights on this entity. Collaboration on defining the entity can be done, but under the owner's supervision and permission. In some cases, owners may allow contrasting opinions if the draw-back of censuring is bigger than the contrast itself, but contributors have no rights to demand a fair acknowledgement of their positions. This is the approach of Facebook and Google+ pages, of Google maps about places and of websites integrating social media features. The collaboration mechanisms are meant to mediate the asymmetric relation between one owner and many contributors with no rights.

Considering Facebook applied to our example, the dean will open an official Facebook page [8] of the school, giving the responsibility of managing contents to an employee that will publish only general information and official announcements. If the dean wants, the page can collect comments, which will be moderated by the same employee, or simply ignored. It will result in parents and students opening their own groups about specific topics or even fake or unofficial pages about the school in order to express other positions than the official one.

Considering Wikipedia, a contrast of opinions will be resolved asking for sources such as the official school website or the school board documents. The hierarchy of sources leads to the users' hierarchy.

Anyone can add information on Google maps, but in order to claim the ownership of a place [7], a postal card is sent to the declared address in order to verify the owner identity. But then, once a place is mapped, also anonymous users can indiscriminately post comments, ratings and pictures which the owner has to keep in check in order to avoid attacks from rivals.

In any case, the perspective is unique and limited by the tool. The result is the multiplication of entry points, which is not a problem for Google and Facebook but it is for users that must know where to search information. In these systems, interactions among users are simple and clear but mostly left to the good will of the owner, which has actually no obligations toward others. The acceptability is very low for the excluded users that are the large majority.

Self-regulating communities such as tech forum are basing the moderation system on users' reputation gained by contributing to the system. These approaches have many limitations based on the implicit assumption that users are experts of the whole domain which can be more or less true in domain forums but definitely it is not true on a generalist platform. In other words, a user may spend his/her reputation outside their expertise field. Furthermore, voting system leads to a result which can be right or wrong, more or less favourite by the community, but in general a result which is quite difficult to overrule in the future. This is not a problem in tech forums because a new question can always be open (in particular regarding a new version of a problem) but in our scenario the goal is to keep an entity dynamic and alive preventing the definitive establishment of a position.

III. General Approach

In this Section, we address the issues we identified as key points in building the civic platform as a trustworthy environment.

A. Legitimacy

The evaluation of legitimacy is left to users that can make their own evaluation about the relevance of the contribution shared on the platform w.r.t. to their authors, their context and their area or theme of interest. On the platform, users can be registered as single citizen or as collective bodies like organizations, associations, institutions, local authorities, business, etc. Non-anonymity is one of the principle assumed as prerequisite to model and design interactions and functionalities.

While a citizen could be not entitled to provide an official representation of an urban entity, his/her experience could be valuable for other users. Following our running example, the experience expressed by former students may be much more relevant than a dean statement about how the school experience will be for your children.

On the contrary, the level of accountability of information shared by local administrative offices about services or public programmes is stronger than a general contribution shared by citizens.

In real life, people perform this kind of evaluation all the time making assumptions based on their goal and perspective, and on the official role and competences of other subjects they interact with. In our platform, we let users decide the relevance of contents in relation to their experience without relying on recommendation systems based on popularity or user profile, since a CSN is oriented only to the public dimension and exclude any form of user profiling [13].

B. Sharing responsibilities over contents

Non-anonymity is the first step to take responsibility about contents. The relation between the platform and shared urban spaces, or the connection between virtual space and real space, reinforces the awareness of consequences related to personal actions and statement in the public sphere, containing incorrect and uncooperative behaviours. Experimental evidences we collected during our participatory workshops confirmed that associating identity and actions at local scale discourage inappropriate conduct.

In addition, the responsibility over contents should be shared among the interested parties in order to ensure plurality and cooperation on building common urban entities. We can define users investing enough energy as those recognized worth of responsibility as proactive contributors. Proactiveness is not related to the production of digital contents in general, but is related to the documentation of real

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actions having an effect at local level using the platform functionalities to enhance processes and outcomes. On the contrary, sharing opinions does not mean be proactive, because not necessarily an opinion is related to an active involvement in local initiatives and projects.

We decided to structure entities (places, events, groups, insights, news) as complex objects. Each of them have a single evident entry point giving access to all point of views and sub entities, rather than multiplying the entity for each point of view. Structuring entities can still enable the chance of having different responsible groups for different purposes. In other terms, we propose content driven solutions to represent shared responsibilities among players acting on the same places.

IV. TECHNICAL SOLUTIONS

In this Section, we introduce the solutions we developed to build entities as shared workplace for heterogeneous local actors.

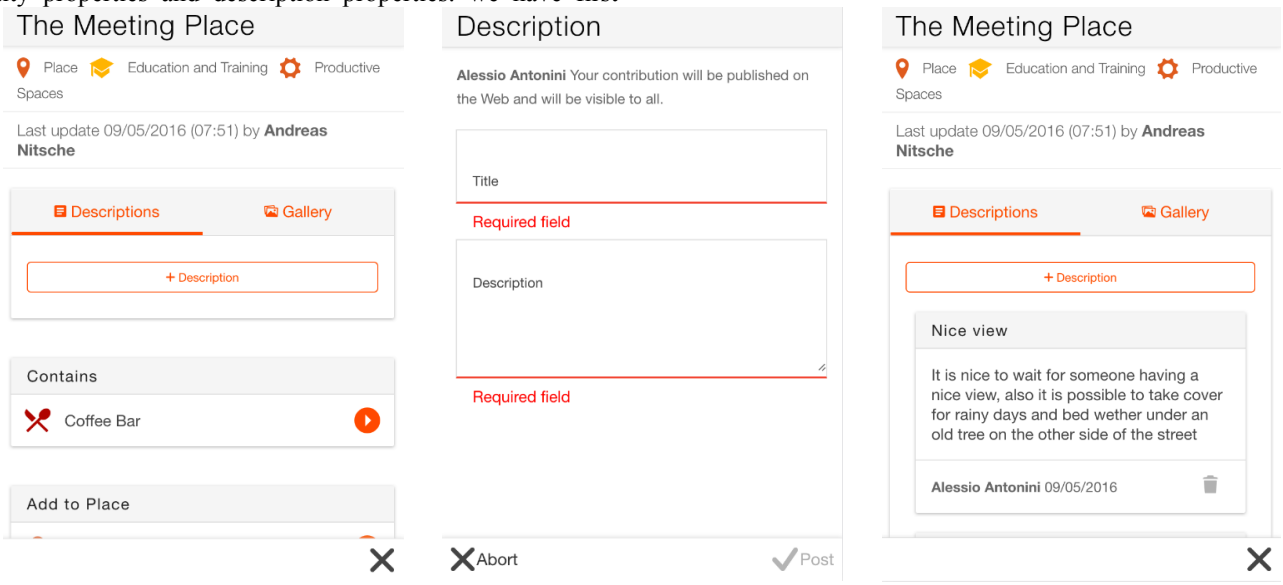
A. First-order Entities and Second-order Entities

Our platform has a map-based main interface. In other words, we separate the mapping activity from the interpretation of a place and the documentation of activities and project carried out from users, because we are interested in collecting social information rather than geographical entities.

Technically speaking, we make a distinction between entity properties and description properties: we have first order entities working as shared entry points and second order entities. We define a shared set of primary properties belonging to the entity and that must be defined in the creation process (sandbox [15]): title, valid time interval, categories, tags, external URL, coordinates (latitude and longitude). Each primary entity may have specific primary properties, for instance: events have door time, duration, organizer, attendees and performer (The entity properties are mostly inspired to entities of schema.org specifications [16]). Primary properties should be more or less objective in order to avoid the proliferation of homonymous entities. Following the example, we want to avoid many parallel entries about the same school letting the first one defining a "place" school without having the concern of making a general or official description.

Then, we defined a set of second order entities describing a primary entity. The second order entities are available for any primary order entity as its complement and to any user, except into groups where the content creation is reserved only to the group members. The second order entities are meant to be fast to create. As today, we implemented: descriptions requiring a title and a text (Figure 1 (b)), comments requiring just text and images.

Light-weighted entities enriched with secondary-order entities as properties result in sharable entry points for collecting different perspectives by different users, as second-order entities Figure 1 (c).



(a) (b) (c)

Figure 1. A place containing an event (a). The description for (b), and a description added to a place created by a different author (c).

B. Relations Among Entities

Managing typed single entry points is not enough to catch the complexity of real life entities. In general, we consider part of relations among entities of the same type:

1. A place can contain sub-places, such as office rooms
2. An event can be composed by several sub events
3. Articles can have sub-topics
4. Groups can be spliced in operative or thematic sub-groups.

Moreover, we introduced additional relations:

1. *"location"*, from an event to a place
2. *"news of"* from news to an entity that is not a news *"group of"* from a group toward an entity
3. *"group from"* an entity to a group

Adding relations among entities results in enabling the possibility to build complex structures from a single entry point from different users' contributions.

For instance, following the running example, the "place" school can host events, organized in many sub-events, and groups, structured around a class or a type of activity. An event organized by a sport organization can be independent from the school context, but it can be hosted in the school and the same for the news related to this event (registration, updates, etc.)

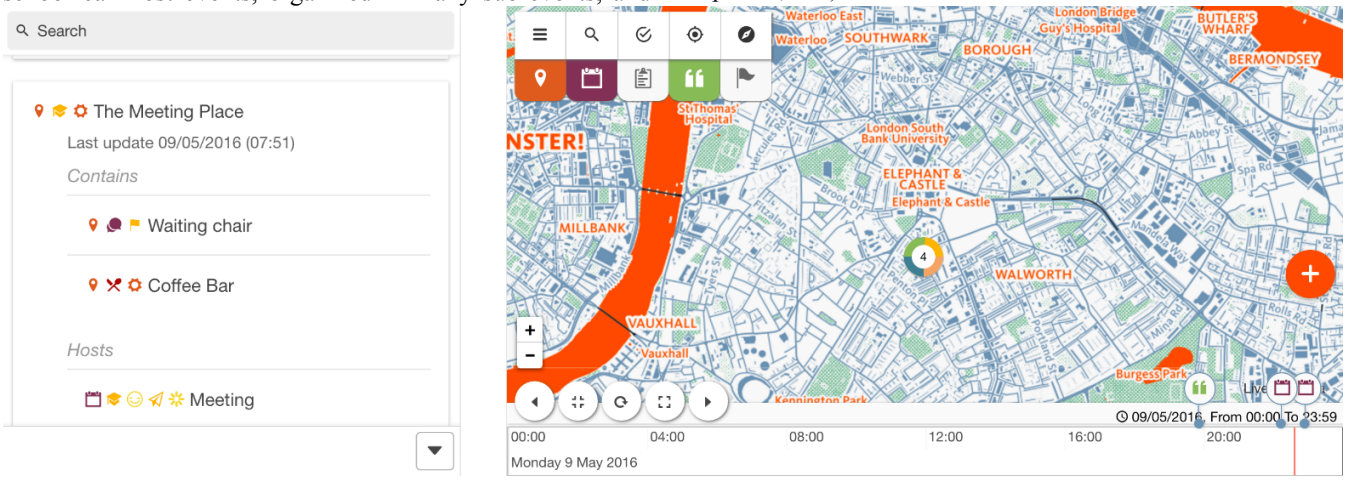


Figure 2. A place two sub places and an event in FirstLife wall (a). A map view with the first version of the timeline (b).

C. *Relations Among Authors, Moderators and Contributors*

An entry point is the result of one user action but one user, even if legitimate, cannot cover all points of view about an urban entity. Moreover, one user should not have the monopoly of an entity for many reasons:

1. Lack of perspective, as we just stated he/she cannot pretend to express everything can be said about an entity;
2. Dynamic reality: things change and so users' commitments toward taking care of a piece of information can change;
3. Excess of responsibility: the burden is too heavy from the user perspective, and the risk of missing an important and vital piece of the puzzle is too high from the community perspective;
4. Coproduction of social reality: nothing social is made by one person but everything requires others, and thus their representation.

We do not recognize the role of owner, but the greatest importance is referred to contributors. Each first level entity has one initiator (the first contributor) and a set of contributors. Starting from an entry point, in parallel with the graph of entities, we defined a network of collaborations replacing the standard friendship/following-relations of social networks. Users are connected through contents and so they share the responsibility of taking care of contents, by acting at content level.

The initiators still play an important role at the beginning, but on the contrary of other web 2.0 and social network mechanisms, the burden is released as the entities becomes more complex relying on collective moderation. Contributors are engaged in self moderating themselves, being notified about activities and comments added to the entity they contribute to create, and they can comment, report abuses or eventually delete a contribution.

A user can always be identified by playing the contributor or the moderator role resulting in exposing yourself and your own reputation. Contributor and moderators conduct must be compliant with the guidelines included in the ethical code of the platform. Moreover, they can always report abuses to the platform administrators.

V. EVALUATION AND OPEN ISSUES

In this section we present results of the first design- phase where we tested the considering scenario. In particular, we held a specific series of workshops involving local stakeholders such as organised citizens, organisations, local authorities, local institutions, universities, schools, traders associations, etc. (about 70 meetings with a total of 1500 participants) to collect and testing scenarios, which where formalized as object diagrams and user stories. Moreover, we involved a full class of prospective geographers from the University of Turin in order to test the mechanisms we designed and implemented from a domain-expert point of view.

As result, some open issues have arisen:

1. Categorization fallacy: the first user still has a huge impact in defining an entity category;
2. Events stickiness: events and other timed entities tend to stick together; the timeline is not used in its extend
3. Unused comments: comments at entity level are not used as expected, on the other hand comments can be used to notify issues at description level. The right level of comments is too bounded to the type of entity but, in general, enabling comments for second level entities is a need

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4. Balancing moderator power: the problem in finding a suitable policy to extend the moderator role from author to contributors is due the power of moderator itself. In order to establish a policy, we need to balance the moderator power with a double check from the crowd.

In the following, we analyse those four open issues using user stories and use cases in order to revise the solutions we implemented.

A. Categorization Fallacy

Extracting descriptions from entities was a solution to limit the authors' responsibility in defining entities and make the creation process faster. In particular, we decided to open entities to different contributors and to enable the creation of multi-facet entities. Considering the categorization fallacy, we did not accomplish the latter objective completely. Considering the lesson learned from experimentations with university students, we found that the categorization task is strongly influenced by the current user goal, even when there is no room for misunderstandings.

An emblematic example is the supermarket categorization. Since university students do not go to supermarkets for common shopping like anyone else, but for lunch, we found many grocery stores categorized as "restaurants" rather than "market".

This issue can be addressed through many strategies, but we may revise the constraints collected so far:

1. We want to avoid conflicts
2. We wish to avoid multiple categorization, without a proper justification
3. We do not want to take sides

The solution we came to require to relax a "wish to have" constraint, or in other words, we need multiple categories to be defined by different users. On the other hand, losing a crisp classification of entities may result in a foggy definition of entities, it would be nice to bind categories to proper justifications.

For this reason, we decided to split categories in functional categories and properties. We found that the most objective categories can be considered as entity properties (i.e. the event cost). Moreover, we also moved functional categories to second-order entities in order to bound a categorization to a visual or textual context.

Revising the previous example: now a student can classify a grocery store as supermarket because connecting the category to a description about having lunch there.

B. Events stickiness

In a first prototype, we introduced a timeline as time filtering control and as an exploration tool for timed entities [14]. The timeline was continuous ranging from centuries to seconds, giving to users total control in defining the period of interest. What we did not realize was that most of daily activities take place at the same time. For instance, we sleep 1/3 of day hours and the work activities are mostly condensed from 8 a.m. to 8 p.m. The result was having few spots of the timeline condensed with events and most of the timeline useless.

Furthermore, the "freedom" of the previous timeline resulted in scaring users: they did not get what they were doing and which was the connection between map and timeline.

Since the timeline goal was to give an idea of the presence or not of timed entities on the map, we decided to rebuild the timeline from scratch following few principles:

1. It is not possible to access to entity through the timeline
2. The timeline need to provide a qualitative (entity type) and qualitative (ratio) evaluation of what is currently visualized on the map;
3. The timeline should be support human interpretation.

In order to support user interpretation, we first split the timeline in time steps: months, weeks, days, night, morning, afternoon and evening. Each step was enriched with a qualitative and quantitative bar displaying the ratio of timed entities for each entity type, avoiding any direct reference to the single entities (Figure 3 , Figure 2 (b)).

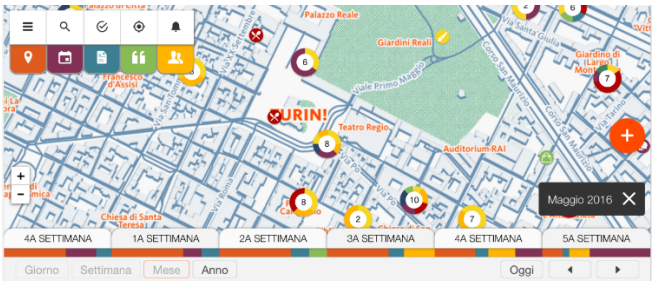

Figure 3. The timeline is slit in steps easy making it easier to read for users, i.e. weeks in a month. Each step shows the ratio of timed entity types.

With this new setup, users can consider much more intuitive the interaction with the time-line clicking on a step to zoom in and focus the map on the timeframe they wanted.

C. Unused comments

The general platform setup should engage users in be useful to others leaving the "guts" to other social networks. It worked so well that users ignored the comment feature completely. We thought deep about providing or not comments but in the end, we integrated comments because we knew we were missing a method to ask questions or pointing errors. The transformation of description and pictures from simple properties to second-order entities had the drawback of making comments mostly unused.

Starting from the original goal, we extended comments to pictures and descriptions, restoring their original purpose.

D. Balancing moderator power

We spent a large amount of time trying to define a policy to extend moderator privileges from authors to moderators. Despite our effort, we did not come up to any general solution, which can consider different lifecycles of entities. The problem lies on the definition of "contributor": what a user should do and how long we need to wait until promoting a user from the role of contributor to the moderator level?

Each policy required an assumption about the original author will to check contributors in an objective way, or

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having contributes being checked by the crowd fast enough to rise eventual complains in time. Are those strategies general enough?

We found plenty of counterexamples based on different lifecycles of information. For instance, there are entities, which are mostly used in very short time and others that are not used much. In this second case, how long should we wait? Furthermore, an author can leave FirstLife without checking contribution or prevent any contribution at all deleting systematically everything. This is a wicked problem [24].

After evaluating social and technical constraints, we decided to bind content moderation in a double check mechanism: a moderator can delete or modify a content if there is a "report" from a different user. This solution reduces the impact of the policy we are trying to define, lowering users' expectations and concerns about it.

We found the moderation mechanism be the main problem. The common pattern gives the power to delete or modify contents without control or justification. This is not compatible with the multi perspective collaborative environment we are trying to build. Moreover, it was forcing the introduction of a mechanism to require the intervention of an external editor, which is something we really wish to avoid.

We still need to define in detail a suitable policy, but nevertheless we reduced expectations and make the impact of this policy less critical since we expect the policy definition process a never-ending challenge.

VI. CONCLUSIONS AND FUTURE WORKS

Designing a collaborative civic social network is a huge challenge itself, stressing common solutions in scenario where users are engaged both online and offline, and in which different point of view need to coexist. In this contribution, we revised the solutions we developed during one year of participatory design. In particular, we focused on three specific aspects related to the construction of a model:

1. Supporting interactions on shared use of entities,
2. Supporting common sense interpretation about urban entities,
3. Defining a mechanism to share responsibilities over contents among multiple contributors.

Categorization was one of the few top-down features we had in order to support the map-based visualization system. Moving the category attribution from first order to second order entities, we managed to build a richer description system avoiding the introduction of moderation mechanisms. Finally, we enabled comments for second order entities, in order to support users' self-moderation and self-aid in maintaining entities correctness.

Having a shared environment with contributions of different types and for different purposes makes the CSN quite complex. We found very important to simplify the mechanisms where possible, and in particular we designed a hybrid timeline based on the classical calendar views: year, month, week, day.

The most challenging task was to tackle an impossible problem such as making contributors trust each other on a web platform sharing the moderator role. Studying the problem, we found that we needed a less powerful role of "moderator". A light moderation requiring a double check from a second user resulted to be much more acceptable and easy to understand rather than sophisticate policies based on time intervals and users' visualizations.

As partial conclusion, this process did not end yet and it will most likely not end because, as society changes, technology needs to follow and be updated, in particular in term of addressing new needs and facing new requirements and expectations.

Currently, we are developing a new set of features for supporting group coordination and process patterns. The new solutions will be tested in the next months in three trial sites within the H2020 project "WeGovNow!" [23].

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