Exploiting Geospatial Markers to Explore and Resocialize Localized Documents

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Abstract. Corpus resocialization can be achieved through digital revitalizing, i.e., making a corpus available for new users with new uses. We propose a semi-automatic identification of spatial and temporal markers that make up metadata for localized documents. Metadata is then exploited by concrete applications in environments for tourism and teaching.

1 Introduction

In all Western European countries, national institutions take initiatives to emphasize their cultural heritage by relying on digital and web technologies. However, the valorization of resource collections with less notoriety is much more difficult because it applies to corpuses of more restricted interest or more geographically localized. Nevertheless, this field requires to be developed because the heritage available in these spaces is as rich as varied and potential for its valorization remains undeniable.

The wealth of localized documents we focus on suffers not to be sufficiently shared because of its inaccessibility. These document collections generally rest in the depth of archives, museums and libraries and live only for a small number of specialists who know of their existence.

Our research work focuses on the specificities of localized documents and the ways to re-socialize them for an increased number of people. This does not "simply" consists in digitizing and redistributing our document collections. Resocializing consists not only of putting these inaccessible documents at the users' disposal but also of thinking the way to facilitate their content appropriation for specific users, with new usages.

Problems tackled in this paper are of two kinds. From one hand, we focus on the investigation and the classification of a massive and varied document set, on the other hand, the methods of transmission of their contents towards new users.

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We will first present the characteristics of localized documents (paragraph 2), and will focus on the methods to make them available. Because the re-socialization of these documents is achieved through their suiting to new public and new uses [1], we discuss the means of exploiting a set of spatial and temporal metadata to express the documentary contents in a relevant way (paragraph 3). After presenting the principles for locating spatial segments (paragraph 3.1), we explain the way to exploit them. A first research work enabled us to identify three publics (scientists, tourists, teachers/learners) to which we associate particular uses of the corpus. Then, we present a specific way of using our spatial and temporal metadata to use and revitalize localized documents in tourist (paragraph 3.2) and academic contexts (paragraph 3.3).

Then, in order to illustrate this work, we describe the practical aspects and the technical tools used to validate each one of our proposals: a tool for generating spatial and temporal metadata (paragraph 4.1), a possible use of the metadata to revitalize localized documents thanks to applications for tourism (paragraph 4.2) and teaching (paragraph 4.3).

We conclude this contribution by presenting the limits of our proposals and the further research envisaged.

2 Localized Documents

Our interest is related to localized documents left out at the bottom of archives, museums and libraries. Our work aims at defining tools allowing to re-socialize these lost treasures to make them accessible to a larger public again [1].

We think that "rough and massive" digitalization and broadcasting of these document collections do not constitute in itself a satisfactory solution to facilitate access to their contents. It must be coupled with some thinking on the means of transmitting the contents of the documents to the potentially interested users [2]. This "adapted" transmission of the contents presupposes a structured organization of the document collections in order to be able to locate within the bulk of documents (or extracts of documents) those considered to be relevant for the user. However the variety and the quantity of the considered document collections stresses the issue of document exploration and classification.

Therefore, we first focus on the design of tools allowing to improve the study, the characterization and classification of the document collections to revitalize. Our localized documents are characterized by contents strongly attached to a territory and its history. This property manifests itself in the omnipresence of place names and of historical events defining the concerned territory. Whether they are newspapers, popular or erudite literature and so on, documents abound of notations and spatial and temporal references.

This assumption leads us to consider the criteria of time and space as significant entrance points to explore localized document collections [3]. Therefore, the constant presence of space and time markers leads us to imagine tools able to consider a corpus and to automatically or semi-automatically outline all the places and historical events mentioned within each document [4].

3 Document Revitalization: Defining and Using Spatial and Temporal Markers

As specified in the preceding paragraph, we focus on spatial and temporal references within the concerned documents. We then define tools allowing a non-expert user (teacher/learner, tourist, general public) to access to digitized corpus. Moreover, these tools must be not only easy to use and available in familiar digital environments (web sites, interactive terminals, virtual museums, etc.) but also associated with the usual activities of these publics. We will expose hereafter the method employed to detect spatial segments and then define the corresponding markers. The way of exploiting these spatial markers is then explained within two scopes related, on the one hand, to general public (tourist-oriented) and, on the other hand, to the educational environment (teaching-oriented).

3.1 Semantic Treatment of the Document Contents

Considering a restricted corpus allows one to implement more sensitive scans that take into account the document contents. Our contribution is a non exclusive alternative to traditional search methods used in libraries and based on descriptive forms (metadata). We aim at considering in a more accurately way the user request and at increasing the results relevance, returning for example a document extract instead of a whole document.

The document contents are taken into account by a specific semantic process which exploits the localized property of the corpus and focuses on spatial and temporal entities. The data processing sequence used to highlight spatial and temporal markers is composed of four main steps [5]:

- the lemmatization carries out a segmentation of the words,
- the lexical and morphological analysis proceeds to a word recognition,
- the syntactic analysis, based on grammars, allows to find the bonds between words,
- the "semantic" analysis carries out a more specific analysis allowing the extracted syntagms to be interpreted.

More precisely, the data processing sequence used to detect spatial entities is implemented as follows:

1. currently, the text "tokenisation" corresponds to a simple lemmatization phase. It would be nevertheless interesting, in a further work, to retrieve the document structure, i.e. paragraphs, titles, etc.
2. the detection of spatial entities that are potentially georeferencables (words with capital letters, words belonging to a lexicon) is carried out at the same time than a morphosyntactical analysis which allows to retrieve words type.
3. a grammar-based analysis, allowing the interpretation of the extracted syntagms (adjacency, distance to another spatial entity, etc.), is then carried out at the same time of a georeferencing process applied on the spatial entities previously detected. This georeferencing process is based on services close to the gazetteers (services available on the web and allowing named entities to be georeferenced).

This data processing sequence allows each spatial entity, previously extracted, to be interpreted. Figure 1 highlights an indirect entity “la lisière du bois de Zouhoure” (“the edge of the Zouhoure wood”) defined by a direct entity (Zouhoure) and a topological relation of “adjacency” type (“the edge of ”).

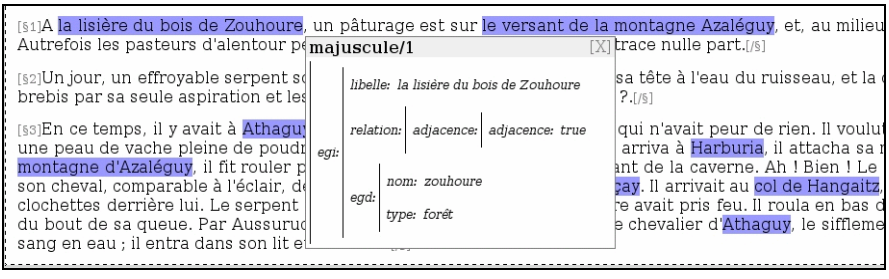

Fig. 1. Interpretation of the spatial segment « la lisière du bois de Zouhoure » (“the edge of the Zouhoure wood”)

From a technical point of view, the marking tool architecture relies on web services which re-use and adapt modules of the Linguastream platform[1] developed to solve similar problems in the field of the text analysis. Using the XML technology, we produce an intra-documentary marking: the initial document is enriched with markers highlighting spatial and temporal text segments.

Developed by the GREYC research group[2] since 2001, LinguaStream is a generic platform used for automatic natural language processing. LinguaStream is based on the concept of data processing sequence. In a data processing sequence the results produced by an upstream chain link are exploited by a downstream link.

LinguaStream allows the design and the evaluation of complex data processing sequences, by assembling various analysis modules: morphological, syntactic, semantic, discursive or statistics. Thus, each stage of the data processing sequence results in the discovery and the marking of new information, which subsequent analyzers will be able to base upon. At the end of the chain, various tools allow to display the analyzed documents and their associated marks. The advantage of this platform lies in the fact that all the modules of the data processing sequence accept an XML flow as entry and produce an output XML flow.

Thanks to a simple and powerful GUI (Figure 2), the user builds his/her specific processing link while linking the different modules that he/she deems necessary for his/her analysis. It is also possible to shunt the XML flow into a file in order to trace the output of a given module.

In order to detect geographical entities in our document collections with the Linguastream platform, we have built a specific language processing link which is made up of several macro phases [6]. This detection system is not based on a fixed model or

[1] www.linguastream.org
[2] www.greyc.unicaen.fr

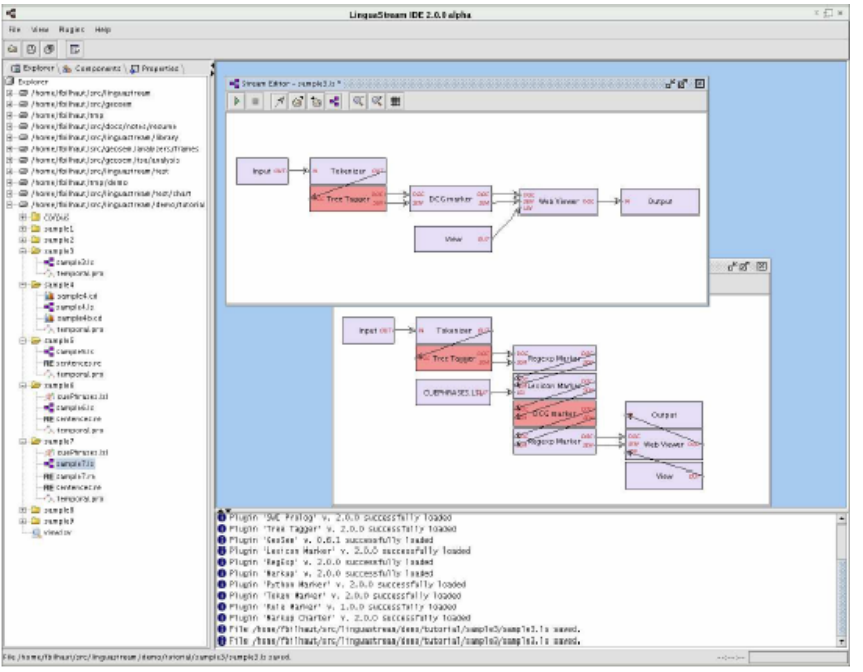

Fig. 2. The Linguastream platform

an ontology but on a set of heuristic rules. Here is an example of Prolog rules integrated in our prototype, allowing to detect adjacent relations between geographical entities.

```
root (X) --> ega (X).

ega ( entite_geo : X ) -->eg (X).

eg ( egi : X ) --> egi (X).

eg ( egd : X) --> egd (X).

egi ( libelle : libelle .. relation : X .. egi : EGI ) -
-> relation (X) , egi (EGI).

egi ( libelle : libelle .. relation : X .. egd : EGD) --
> relation (X) , egd (EGD).

relation ( adjacence : X ) --> adjacence (X).

adjacence ( type_adj : proche ) --> ls_token ( 'proche' ).

adjacence ( type_adj : proche ) --> ls_token ( 'près' ).

adjacence ( type_adj : proche ) --> ls_token ( 'à' ) ,
ls_token ( 'de' ).
```

```
egd (X) --> prep , lexique (X) .
%Preposition
prep --> ls_token ( 'de' ).
prep --> ls_token ( 'd\'' ).
% Candidate : Direct Entity
lexique ( libelle : N .. type : commune ) --> N @ eg :
egd .. egn : oui.
```

More precise details concerning this marking technique are available in [6] and [7].

3.2 Revitalizing Documents in a Tourist Context : Principles

In a tourist context, the user mainly needs to explore, discover and be oriented in a territory. Our contribution consists in proposing the discovery of a territory via a navigation based on spatial (and temporal) markers identified as metadata within the corpus. The territory visit is built through an itinerary among all the available marked documents.

Spatial and temporal markers available in the corpus will then be exploited by the navigation system in a transparent way for the tourist. For example, the selection of the documents relevant to himself is realized according to the route defined on a map. Markers (place names, house names, position, date, times, etc.) defining the route become the selection criteria of significant documents in our corpus.

Thus, the territory discovery is performed according to a spatio-documentary navigation which consists in defining the possible interactions and dependences between two interdependent spaces:

- the navigation in a geographical space is achieved by (re)defining the route on the map and thus updating the corresponding consultable documents that deal with the route,
- the navigation in a document space is not only carried out by consulting the proposed documents but also by following the intra-documentary hyperlinks which can possibly refer to new places. This may entail the wish of a change of itinerary.

The success of tools based on these principles depends more on their interactional qualities, on their ease of appropriation and on their adequacy to a target public expectations than on the exhaustiveness of the markers located inside the corpus. These tools can then be described like scenarized environments exploring the marked resources. “A scenario describes and organizes the communicational structures that take part in an activity, in accordance with an intention. The scenario describes the activities that support interactions.” [8]

Within this scope, we are developing, in partnership with a local inter-district media library (MIDR in Pau - Médiathèque Intercommunale à Dimension Régionale) a project called “*Virtual Routes in the Pyrenean heritage”* (« *Itinéraires virtuels dans le patrimoine Pyrénéen* »). This project focuses the needs from both a cultural and tourist point of view. It appears as a cartographic visualization of a route (determined by the user) allowing to structurally display the result of the information retrieval. Our

prototype uses a loosely coupled architecture based on web services [7]. It notably supports the execution of geographical requests on georeferenced data, information retrieval, result representation; some web services are already available on the web. The next paragraph presents the principles related to the utilization by and for the educational environment.

3.3 Revitalizing Documents in a Teaching/Learning Context: Principles

In the current technological and economic context, the issue of educational resources acquires an ever increasing importance. This remains true with regard to their development, their indexing and standardization. [9] defines some guidelines of relevant concern in his research in Human Learning Interactive Environments. Documents should be considered as very significant elements in Problem-Based Learning Situation (PBLS) because the learner faces problems in which the documents can be seen as suggestions for potential solutions and thus constituting *a cognitive resource, a vector or a proof of learning* [10].

However, according to [11], the current state of Information and Communication Technologies does not seem to be able to provide simple computing tools for processing, indexing and capturing the information contained in the documents. Therefore, to overcome these difficulties, we have chosen to limit our research work to documents including spatial and temporal information. For such documents, we wish to provide the pedagogues-designers data-processing tools allowing them to semantically mark the contents of documents used for modeling PBLS.

From spatial and temporal markers arranged in a semi-automatic way in documents in relation to a given PBLS, our research work [12][3] consists in developing cognitive tools for various users. Therefore, the pedagogues-designers need to critically examine and specialize existing tools dedicated for production, coordination and co-operation. Actually, in the utilization phase, these tools will be used by the learners during their activities for which they handle extracts of the documents provided by the designers. The interaction processes between the available documents and the learning activities (and conversely) will lead the pedagogues-designers to both prototype and finalize the documents to didactize, and the activities suggested by the PBLS.

SMASH [13] is a co-operative PBLS designed [14] to check and to implement our research projects. This case is designed for 10-12 years children and the underlying learning objectives relate to road safety. We have chosen this specific co-operative PBLS because it implies documents including both spatial and temporal information. In texts resulting from witnesses' accounts, we used spatial and temporal information for teaching purposes. In the next paragraph, you will find screenshots relating to the work in progress.

4 First Results

We hereafter present the technique and the result of spatial and temporal documents marking. We then detail the use of the marked documents within two contexts for two different uses.

[3] This work is developed in our IDEE research group – http://idee.iutbayonne.univ-pau.fr.

4.1 Marking of Spatial References

The text below is an extract of a legend described in [15] and is used as support in an article published in Pays Basque Magazine, a tourist magazine intended to promote the Basque Country [16]. Figure 3 highlights a manual spatial marking:

- we bolded place's names, house's names and people's names belonging to a real territory,
- we underlined the spatial references in the considered document.

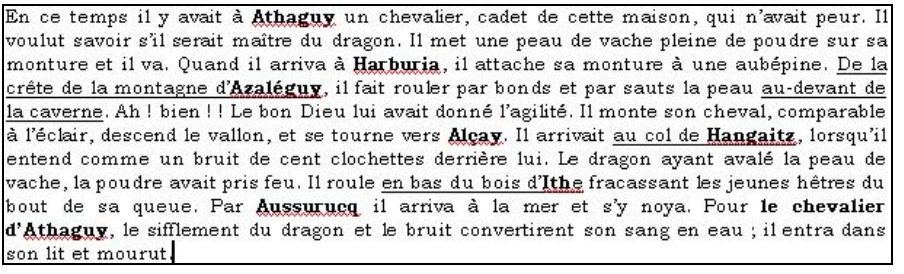
En ce temps il y avait à **Athaguy** un chevalier, cadet de cette maison, qui n'avait peur. Il voulut savoir s'il serait maître du dragon. Il met une peau de vache pleine de poudre sur sa monture et il va. Quand il arriva à **Harburia**, il attache sa monture à une aubépine. De la crête de la montagne d'**Azaléguy**, il fait rouler par bonds et par sauts la peau au-devant de la caverne. Ah ! bien ! ! Le bon Dieu lui avait donné l'agilité. Il monte son cheval, comparable à l'éclair, descend le vallon, et se tourne vers **Alçay**. Il arrivait au col de **Hangaitz**, lorsqu'il entend comme un bruit de cent clochettes derrière lui. Le dragon ayant avalé la peau de vache, la poudre avait pris feu. Il roule en bas du bois d'**Ithe** fracassant les jeunes hêtres du bout de sa queue. Par **Aussurucq** il arriva à la mer et s'y noya. Pour **le chevalier d'Athaguy**, le sifflement du dragon et le bruit convertirent son sang en eau ; il entra dans son lit et mourut.

Fig. 3. Manual spatial marking

To compare, Figure 4 presents an automatic spatial marking on the preceding text (almost equivalent) carried out by our tool [7].

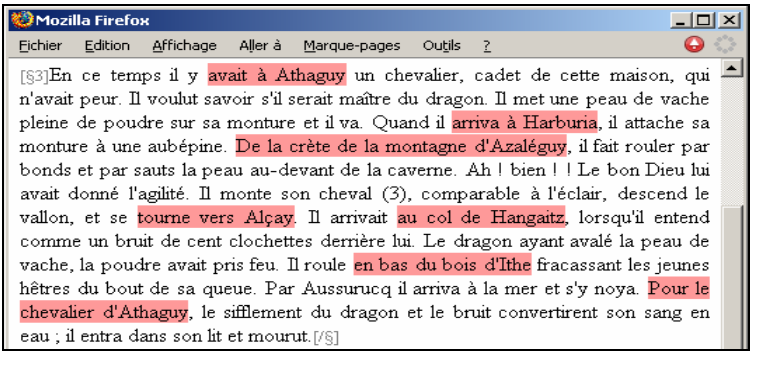

Fig. 4. Automatic spatial marking

The automatic text marking techniques for segments related to space are not of the same complexity level. A first set of tools allows to automatically locate the terms in bold representing toponyms and house names, such as "Athaguy" or "Azaléguy". Spotting them is based on typographical scanning (here all the words with a capital letter) and morphological (here, all the names). This locating phase is only based on knowledge rules. Results could be improved by using for example a geographical and linguistic atlas [17].

This first phase of recognition is then supplemented by the use of tools able to identify, by extension, the terms or expressions such as "coming to the pass of" ("*au col de*") or "down the wood of" ("*en bas du bois de*"), or to interpret more complex segments such as "the peak of the mountain of Azaléguy" ("*la crète de la montagne Azaléguy*").

However we observe, a difference with manual marking if we consider spatial references (like "in front of", "nowhere", etc). Work remains to be done in order to integrate rules able to process this type of spatial references.

Temporal analysis is carried out according to the same principles. The "stopover points" are then dates, operators defining intervals ("from X to Y", "between X and Y", "years X") and new classes of operators, such as ("the beginning of X", "around X", etc).

Spatial and temporal documents marking constitutes a first step aiming at facilitating the following phase because these marks are exploited to re-socialize the document collections by conveying relevant extracts to the users. The two following paragraphs present two projects using the tool for spatial and temporal marking on document collections related to the Basque Country.

4.2 Revitalizing Documents in a Tourist Context: Application

We have imagined a first case study that consists of proposing a tourist to discover the Basque Country through a virtual visit. The user defines a route on a map and the system then proposes a set of documents in which the places on the itinerary are mentioned. Figure 5 illustrates the discovery of the area where the Cerquand tale presented in paragraph 4.1. is located.

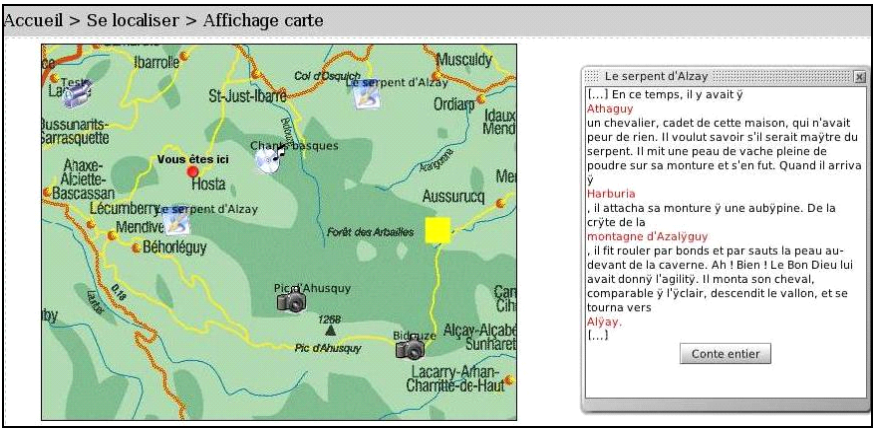

Fig. 5. Re-socialization of localized documents for a tourist use

In the current prototype, the route is simply defined by a starting point and a point of arrival (or a displacement range) that the user selects by pointing on the map. Using a graph representing the possible ways to go from a place to another, the system

calculates a possible route. During this process, it indexes the names of the places defining the stages on the route and queries the pre-marked documentation base in order to extract the documents likely to interest the tourist. The map displays, next to each stage place, icons that refer to the documents in which the place name appears. The possibilities of spatio-document navigation are then implemented according to principles described in paragraph 3.2.

4.3 Revitalizing Documents in a Learning/Teaching Context: Application

This paragraph stresses the importance of the concepts of space and time in the scope of teaching activities. We can easily highlight the interest of spatially and temporally marked documents to teach disciplines such as geography or history. However, we remain convinced that the exploitation of spatial and temporal markers may extend to other subject areas.

The first example we will mention relates to the Smash case presented in paragraph 3.3. This example does not envisage the problems of localized documents revitalization but illustrates a way of exploiting the spatial and temporal references in a teaching activity which is not related to the teaching of history or geography. In the Smash situation, learners have to an accident scene from witnesses' accounts in order to understand what occurred (and thus detect/learn the associated road safety requirements). The accident reconstitution phase consists in positioning the various protagonists of the history (cyclist, witnesses, and traffic signs) on the map representing the place of the accident. Learners carry out this work while reading and interpreting the various accounts available. To help them in this activity, we used our spatial marking tool to provide them (if they face learning obstacles), a second version of accounts where the spatial references were highlighted. Figure 6 presents an extract of spatial marking for a testimony ("*I had just left the store and was ready to cross the pedestrian walkway situated on my way to go to the Brasier road*.").

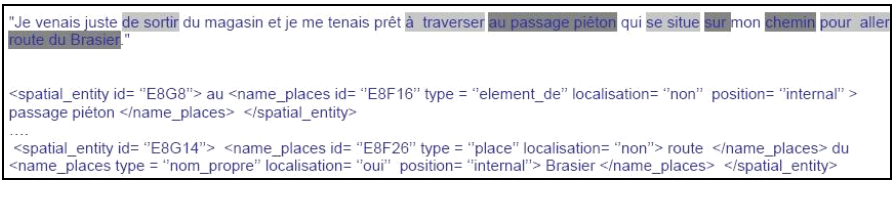

Fig. 6. Spatial marking in the Smash application

Our second example focuses on the revitalization of localized documents in educational applications. This project, still in progress, aims at exploiting our local document collections (*cf.* paragraph 4.2) in order to familiarize learners with the signs allowing to estimate the potential evolution of a village from different point of views (demographic, economic, spatial). This PBL teaching application, will consist in studying shared documents (population registers, land property record, demographic evolution tables, etc.) describing two villages that have evolved differently throughout

time (expansion, disappearance). From this study, learners will have to deduce some indicators (population, trading activity, etc.) allowing to estimate if a given village is about to extend or, on the contrary, to decay and for which reasons.

From a technical point of view, the application will also be based on the Smash architecture in order to establish the tools underlying a PBL: generic whiteboard implemented on Lazlo application server[4] coupled to an Open Distance Learning platform such as OpenUss[5], capable of using the information system. Spatial and temporal marking tools will be available for:

- the pedagogue, to extract from the documentary collections a set of documents considered as relevant for learning,
- the learners, to search for document extracts, mentioning the relevant indicators at various times and/or on various places, relying on spatial and temporal criteria.

This project is only at a design stage and aims to validate the assumption that the concepts of space and time are omnipresent in many learning/teaching situations.

5 Conclusions and Perspectives

In this paper, we presented a research work focused on the revitalization of localized documents. In a first stage, we proposed to use the specificity of these documents in order to develop tools allowing a set of spatial and temporal metadata to be generated. This metadata can be considered as criteria which can be used to propose a first classification of all the documents.

In a second step we stated the principles exploiting this metadata in order to socialize these documents according to various uses: socialization for a tourist purpose and socialization for a teaching purpose, each one being illustrated by concrete projects.

These research tasks are currently in progress and thus require further investigations and many more experiments. Indeed, the results obtained at this stage entail us to support the assumption that spatial and temporal markers represent a significant entrance point for the exploration of localized documents. However, we keep in mind the underlying difficulties of the marking stage and therefore the effort that remain to be done to approach the quality of manual marking. Subsequent work on this aspect will consist to enrich the current marking rules on the one hand and, on the other hand, to find new ways to exploit these marks in order to favor the broadcasting of the document contents for new users.

Currently, our tools concern only text resources. However, localized document collections consist of extremely varied documents: postcards, photographs, video and sound extracts, etc. These other kinds of documents must also be taken into account, in a long-term project whose aim is to revitalize a cultural heritage.

In the same way, the proposed tools were only tested on space/time markers. In the longer term, research tasks will consist in developing a reflection on the feasibility to find and exploit new kinds of markers.

[4] www.openlaszlo.org
[5] http://openuss.sourceforge.net/openuss/index.html

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