

Supporting organizational learning with collaborative annotation

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Abstract: Many research studies have shown that the organizational learning is a key factor that contributes to the well being of the organization. The process of organizational learning is affected by the collaborative annotation which plays an important role in it. However, current collaborative annotation platforms have a common limitation which is the restricted ability to share, index, retrieve annotations as any other information resource (e.g a document). In this paper, we define the annotation and we indicate how it becomes collaborative. We present an original semantic model (MEMORAe-core 2) for collaboration and information sharing and we show how the annotation is modeled as information resource. We present a web platform (MEMORAe) that uses this semantic model. A use case for the use of this platform within small and medium sized enterprise is also detailed. Within this work, our objective is to support the organizational learning by concentrating on the exchange of ideas by means of the collaborative annotation.

1 INTRODUCTION

In this current uncertain economical situation, organizations should do their best to stay competitive. (Alavi et al., 2010) affirms that organizations which learn can have a good competitive situation. (Huber, 1991) argues that organizational learning consists of four points: knowledge acquisition, knowledge sharing, knowledge interpretation and knowledge storage. Facilitating the knowledge sharing is done by organizing the knowledge in order to be communicable and integrable (Duncan, 1979). This means that the knowledge should be represented in a comprehensible and distributable manner and should be saved in an accessible and consistent organizational memory. Many research studies pointed out the usefulness of collaborative annotation for facilitating learning within organizations. Current annotation taking platforms do not take into consideration the aspects of organizational learning. A common limitation of these platforms is the restricted ability to share / retrieve annotations (Su et al., 2010). This is because the annotations in these platforms are disconnected from the information system and they are only accessible in the annotation system. As a result, the annotations could not be indexed as any other information resources (e.g., a document). This means that the annotations are not accessible / visible

like other resources. In order to overcome these limitations, we propose to consider the annotation as being an information resource in its own right. This would facilitate the sharing, indexing, retrieving of the annotations which in turns facilitates the implementing of the collaborative annotation. As a consequence, the collaborative annotation promotes knowledge circulation within organizations. This leads to the applying of the four points presented by (Huber, 1991): knowledge acquisition, sharing, interpretation and storage. As a result, the organizational learning is supported by implementing the collaborative annotation within organizations.

In this paper, we define the collaborative annotation and we justify the role it plays for enhancing organizational learning section 2. Current collaborative annotation tools are presented in section 3. We present MEMORAe-core 2 model and MEMORAe web platform in section 4. A use case example is presented in section 5. We discuss the advantages of this web platform over other collaborative annotation platforms in section 6. Conclusion and future work are in section 7.

2 COLLABORATIVE ANNOTATION

2.1 Annotation Definition

(Oren et al., 2006) defines the annotation as being a relation between the annotated data and the annotating data, this relation has a type and is done in a particular context. (Bringay et al., 2005) defines the annotation as: “A particular note linked to a target. The target can be an other annotation, a collection of documents, a document or a document segment (a paragraph, a phrase, an image, a part of an image, etc.)”. (Slimani, 2013) precises four domains on which the annotation could be applied:

- Document annotation: It is the annotation of documents or part of them. Users can take notes, comments, remarks, etc. and share them with others.
- Wiki annotation: Wikis are collaborative authoring of a particular content. Authors could contribute by adding, modifying or deleting the content. Authors could add annotations to describe the wiki. Annotations are added on page level to describe the whole wiki page.
- Blog annotation: A blog is a website or online journal owned by an individual who regularly writes posts which are presented in reverse chronological order. Contributors to a blog could write comments to a particular post. An annotation in a blog is a statement about a post. For example, posts are classified with simple categories “sport”, “research”, “teaching”, etc. (Slimani, 2013) considers that blog posts are annotated with these categories.
- Tagging: Tags are descriptive terms (e.g., keywords). For example, Flickr allows a tagging to a particular image to describe its content (e.g., “car” for a car image). (Slimani, 2013) considers that tags express some unspecified relation between the resource and whatever the term refers to.

The annotation granularity and form are terms used in the annotation definition. So we need to define these terms

- Annotation granularity (also called “scope”) (Sazedj and Pinto, 2005) indicates if the annotated data is a whole resource (e.g., a document) or part of a it (e.g., a section inside a document, a sentence, etc.). When the granularity is high, the annotation could be done to any part of the resource.

- The form of the annotation (Euzenat, 2002) indicates the type of annotation, a textual object or a structured object. Textual annotation has a plain text form. Structured annotation could be a link to a structured object (e.g., html page, xml, rdf, etc.)

According to us, the annotation is an information resource in its own right. We define an annotation as the “transcription of an idea that have a particular target and a body which is somehow about the target”. We consider that the annotation could have a high granularity (Sazedj and Pinto, 2005). This means that it would be possible to annotate the resource itself or any part of it.

2.2 Collaborative Annotation Definition

Collaborative annotation is the process of annotating a particular resource by several users within a collaborative environment (Petasis, 2012). Within “Palimpsest¹” project, the collaborative annotation is the process of adding a comment to a shared space (e.g., a document), this comment is either a note, an explanation or a criticism attached to a particular text. In collaborative annotation, the users have access to the shared resource on which they could add their annotation. Users also have access to other annotations of the shared resource.

According to us, the collaborative annotation takes place when the annotation itself is shared between individuals who have access to the annotated resource. In this case, the annotations could have an impact on individuals who view it. This annotation could be written by a single author or multi authors. The annotation becomes collaborative when its content is shared between the collaborators. The annotation “Body” could have different forms (Euzenat, 2002): plain text, a document, a chat, etc. When the annotation “Body” is a chat, a wiki or a forum, the annotation is necessarily written by multi authors.

2.3 The Role of Collaborative Annotation in the Organizational Learning Process

As mentioned earlier, the organizational learning is done by supporting knowledge sharing and retrieval within an organization. The fact that collaborative annotations are shared between users promotes the organizational learning. The annotations within a collaborative environment reflects the opinions of the

¹<http://www.programhouse.com/pal/>

annotators about a particular resource. An already annotated resource allows a better understanding of it.

Many research studies illustrated the usefulness of collaborative annotation for facilitating learning within organizations. For example (Nokelainen et al., 2003) affirms that collaborative annotation motivates the individuals ability to learn which in turns enhances the organizational learning process. (Marshall and Brush, 2004) indicates that collaborative annotation provides an opportunity to facilitate making individual knowledge a public one. As a consequence, the annotations' knowledge value is accumulated when these annotations are shared. The experiment of (Su et al., 2010) shows us how a collaborative annotation web platform facilitates knowledge circulation and retrieval between individuals within a collaborative environment. As a result, sharing the annotations by a collaborative annotation platform within an organization plays an important role in the organizational learning process.

3 CURRENT COLLABORATIVE ANNOTATION TOOLS

Most of the collaborative annotation tools are web based applications (e.g PAMS 2.0 (Su et al., 2010)) and few of them are desktop ones (Petasis, 2012) (e.g., SYNC3²). For example, Annotea (Kahan and Koivunen, 2001), Bounce³, Diigo⁴, iComment⁵ and MyStickies⁶ are extensions that could be added to a web browser in order to annotate web resources (e.g., HTML pages, images). These extensions run inside the browser along with a centralized server (to store the annotations). Usually, these annotations are text fields where users can type anything they wish. The user of these tools can be part of one or more groups whose members have access to the annotations of this user (Petasis, 2012). Some tools allow the annotation to collaborative environments (e.g., wikis, blogs). Taking wiki annotations, we can mention WikSAR (Aumueller, 2005), IkeWiki (Schaffert, 2006) and SemperWiki (Oren, 2005). Most of wiki annotations tools allow annotations only to a whole wiki page. This is the same case in blog annotation tools where annotations are done to the blog posts. For blog annotations, we can mention semiBlog (Möller et al.,

²<http://www.sync3.eu>

³<http://www.bounceapp.com/>

⁴<http://www.diigo.com/>

⁵<http://www.icomment.com/>

⁶<http://www.mystickies.com/>

2005), HP Semantic Blogging demonstrator (Cayzer, 2004).

None of the presented annotation tools consider the annotation as an information resource in its own right. The annotation in these tools is an integral part of the annotated resource. As a result, the annotation itself is not indexed and in order to find it is necessary to search the annotated resource. In addition, none of these tools support the annotation that has a structured object like a chat, a forum or a wiki. The only annotation form (Euzenat, 2002) supported is the textual annotation. In order to solve the annotation indexing problem, we consider the annotation as information resource in its own right. So the annotation could itself be indexed, shared, retrieved, etc. the same way we do to index, share, retrieve, etc. a particular resource (e.g., a document). We also offer a new way to create collaborative annotation. This is done by supporting annotations that have structured form like chat, wiki or forum pages.

4 COLLABORATIVE ANNOTATION WITHIN MEMORAE APPROACH

The main objective of MEMORAE approach is to manage heterogeneous information resources within organizations. The approach is comprised of a semantic model (called MEMORAE-core 2) and a web platform (called MEMORAE) which is based on the semantic model. The model and the platform make together a support to enhance the process of organizational learning. The details are in the following sections.

4.1 The Annotation Within MEMORAE-core 2 Model

4.1.1 Describing MEMORAE-core 2 Model

MEMORAE-core 2 semantic model (Fig. 1) contains the concepts that describe "how we collaborate". MEMORAE-core 2 is built using owl (Web Ontology Language). The model focuses on information resources shared between individuals and groups of individuals within an organization. There are two main aspects in MEMORAE-core 2 :

- Modeling the individuals and groups of individuals: The organization in MEMORAE-core 2 model is a set of members. These members are potential users of the MEMORAE web platform.

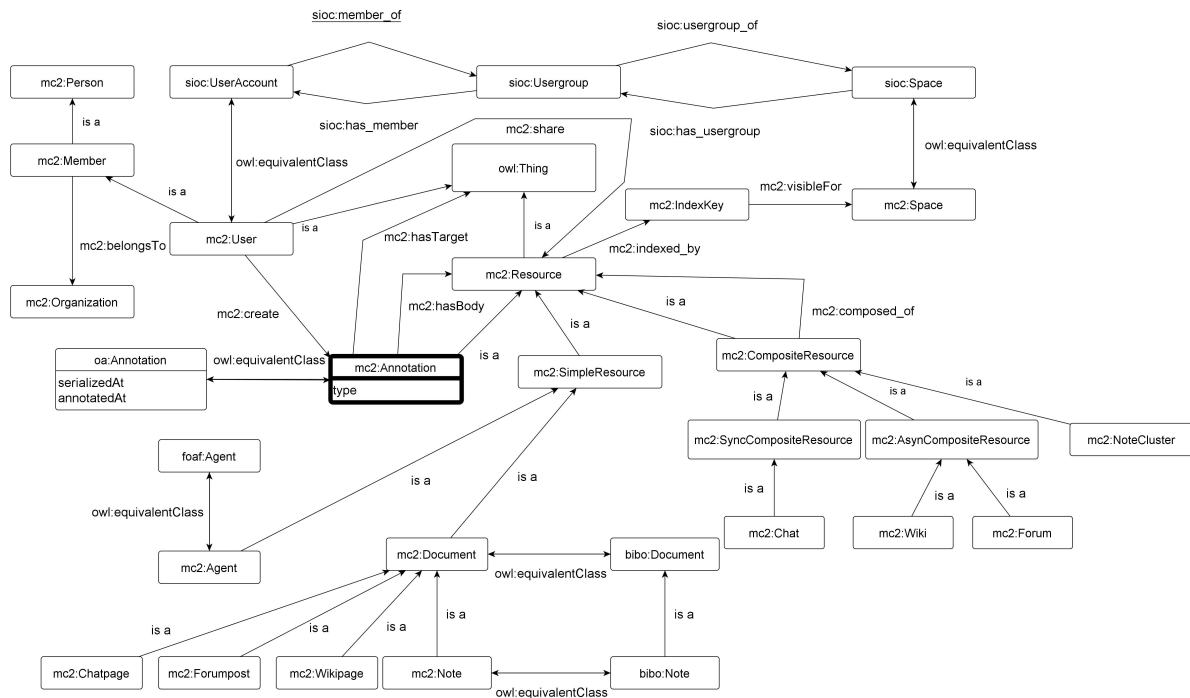


Figure 1: MEMORAe-core 2 model

Each user belongs to one or more groups and each group has its own sharing space in which users can share or access information resources.

- **Modeling the information resources:** The resources in MEMORAe-core 2 are defined as “vectors of information”. The resources are divided into two main categories: simple and composed. A document, an agent, a note can be direct examples of simple resources. Composed resources are composed of other resources (e.g: a note cluster is composed of one or more notes). Each resource is indexed by an index key which is visible for a certain sharing space. The model supports documentary resources and social resources (e.g., chat, forum, wiki).

MEMORAe-core 2 model uses the following semantic web standards (Deparis et al., 2014):

- **SIOC (Semantically-Interlinked Online Communities):** It aims to enable the integration of online community information (Breslin et al., 2009)
- **FOAF (Friend Of A Friend):** It describes persons, their activities and their relations to other people and objects (Brickley and Miller, 2010).
- **BIBO (Bibliographic):** It describes the bibliographic resources (DArcus and Giasson, 2009).

4.1.2 Modeling the Annotation

The modeling of the annotation concept in MEMORAe-core 2 model is based on the Open Annotation⁷ standard of W3C. The annotation concept is added to MEMORAe-core 2 model as an information resource in its own right so it is a subclass of “mc2:Resource” concept. Each annotation has an author, a type, an index, a “Target” and a “Body”. It is the annotation itself that links the annotation “Target” (the annotated data) with the annotation “Body” (the annotating data). The annotation is created by a “mc2:User”. The type of the annotation indicates its nature (a comment, an explanation, a reference, a question, a discussion). The annotation “Target” (filler of the “mc2:hasTarget” object property) could be any concept in the model. This means that the “Target” could be an agent, a document, a forum post, a chat session file, a wiki page or any “Thing” in MEMORAe-core 2 model. The annotation “Body” is somehow “about” the “Target” of the annotation. The “Body” of the annotation could be any resource “mc2:Resource” of the model. The annotation (as any other resource) is indexed by an index key “mc2:IndexKey” which is visible for a sharing space

⁷<http://www.w3.org/ns/oa>

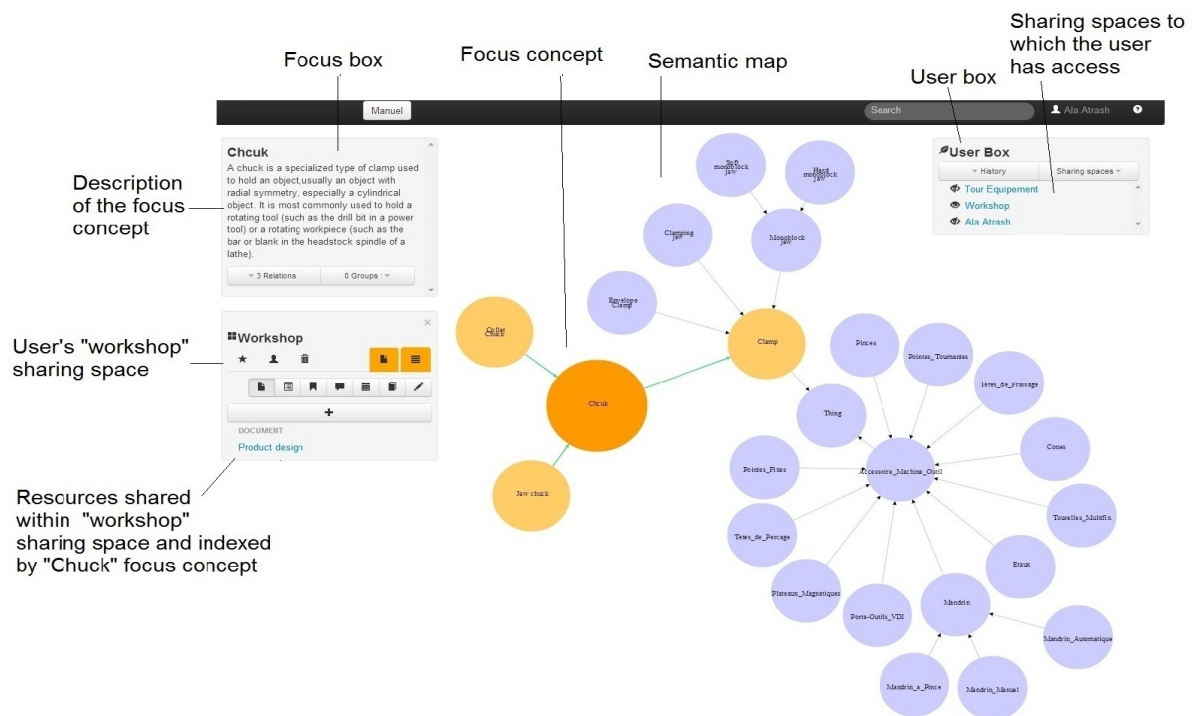


Figure 2: MEMORAE web platform

“mc2:Space”. The annotation becomes collaborative when this space has two or more members who could view it.

4.2 The Annotation within MEMORAE Web Platform

4.2.1 Describing MEMORAE Web Platform

MEMORAE is a prototype web platform which is developed using web 2.0 technologies and based on MEMORAE-core 2 model. The platform aims to facilitate knowledge sharing within organizations. All types of resources are indexed by one or more concepts of a semantic map (Fig. 2) which is shared among all users. The semantic map is the graphical representation of an ontology that represents the specific terms of an organization. This semantic map is built by importing the ontology file (which could be generated by an ontology editor e.g., protégé) into the platform. This ontology describes “about what we collaborate” and it differs from one organization to another. In order to retrieve the resources indexed by a particular concept, the user chooses the desired indexing concept from the semantic map. This concept is then placed in the middle of the screen and its color changes indicating that this is the “focus con-

cept”. If the user shares a particular resource, by default the resource is indexed by the “focus concept”. The users could also add other indexing concepts of the resource. The sharing spaces of the user could be viewed in parallel while navigating through the semantic map. This parallel view of sharing spaces is advantageous because the user can view in parallel the resources shared between different sharing spaces (different groups) but indexed by the same concept (the “focus concept”). This parallel view also permits the user to easily transfer a resource from one sharing space to another by means of “drag and drop”. In this case, the resource is not physically duplicated in the hosting server. It only becomes visible / accessible by both sharing spaces.

4.2.2 Taking Annotation in MEMORAE Web Platform

The user of the platform can annotate information resources including documents, parts of them, notes, other annotations, etc. There are two ways to access the annotations, either when opening the annotated resource or directly through the resources list of the sharing space. An example of the first way to access the annotation is when the user opens a document, he/she could retrieve all the annotations of this doc-

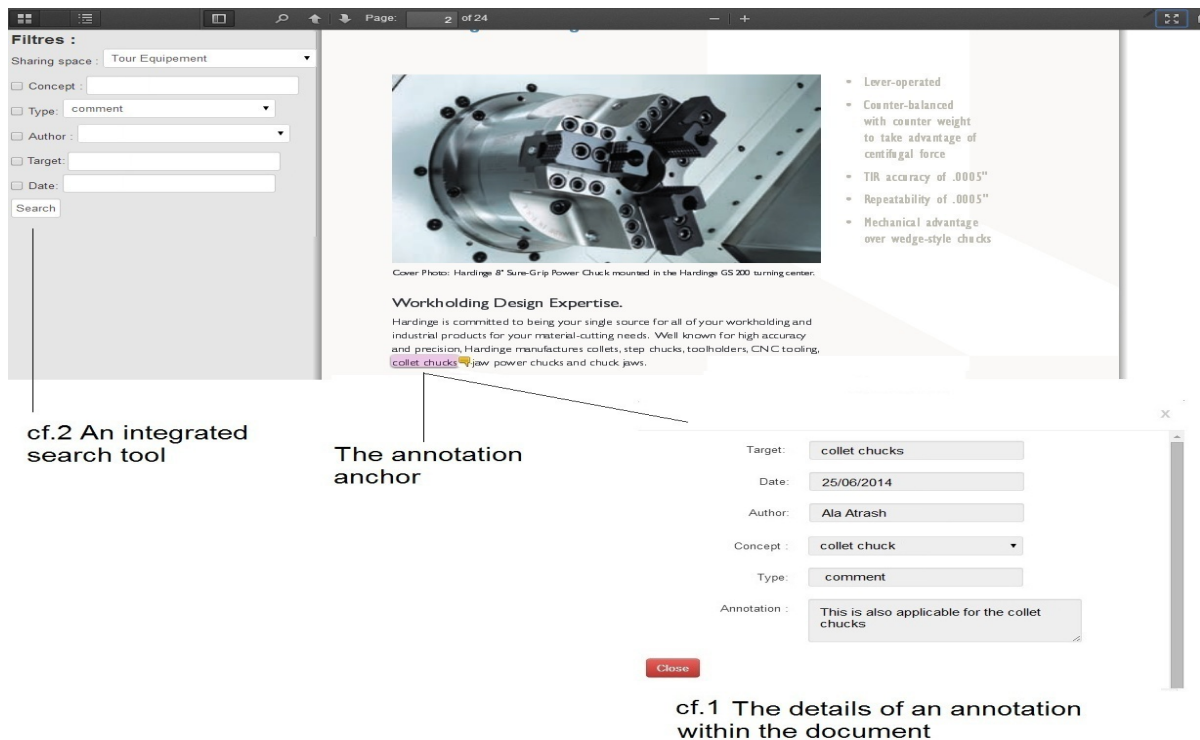


Figure 3: Annotations in a document

ument which are shared in a sharing space to which he/she has access (cf.1 in Fig. 3). In order to create a new annotation, the user chooses the text that he/she wants to annotate, precisely the annotation type, the indexing concept(s) (Fig. 3). The user should also choose a sharing space to which he/she has access and in which the document is shared. The user then writes the content of the annotation and adds it. The selected text is the annotation “Target” and the content of the annotation is its “Body”. The user can not only add annotations, but also filter the annotations of the document thanks to the search tool (cf.2 in Fig. 3) which is integrated to the document viewer. With such a tool, it is possible to filter the annotations of the document by type, date, author, indexing concept, sharing space (to which the user has access), etc. The second way to access the annotation is through its related sharing space. This is because the annotation is modeled as an information resource in its own right so it is accessible in the related sharing spaces when the “focus concept” is the annotation’s indexing concept. When the user clicks on an annotation which is visible in the sharing space, the annotation is opened within its annotated resource. This means that the resource is being accessible by its annotations which are indexed by the concepts of the semantic map.

5 A USE CASE WITHIN “TOUR EQUIPEMENT” ENTERPRISE

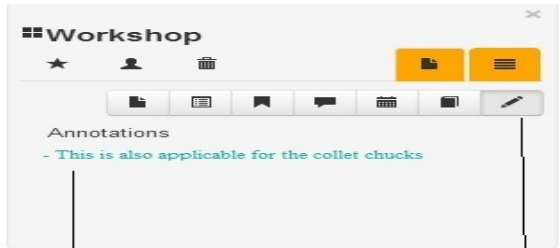
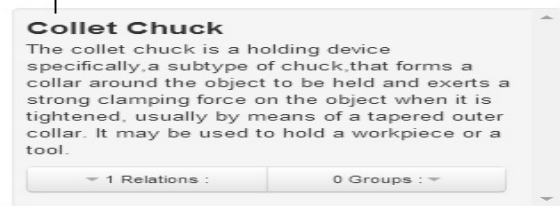
“Tour Equipement” is a small enterprise (14 employed persons) which is specialized in the mechanical production with 50 years of experience. The enterprise is situated in the Picardy region in France. The enterprise hierarchy is composed of: owner-manager, technical manager, production manager, commercial manager and administrative manager. In addition, there are 9 blue-collar workers in the workshop. The process of organizational learning is highly affected by the size of the organization. So this process is specific and needs a none traditional approach in SMEs (Atrash et al., 2013). This is due to the significant relative “weight” of each member in SMEs (Mahe. de Boislandelle, 1996). As a consequence, one member could play multiple roles at the same time. This multitasking is a fundamental aspect that have an impact on the organizational learning in SMEs. In addition, there are very few hierarchical levels with direct supervision and coordination between the members. As a result, employees and the owner-manager have direct interaction and this coordination is usually more made in the action than based on prescriptions and codified rules (Tsai, 2007). Two interview sessions with “Tour Equipement” employees have re-

cently took place in order to identify the special need for managing its knowledge. The first session focused on the main task held by each employee. The second session concentrated to retrieve their daily practices. This field study illustrated that the employees tend to take a lot of annotations during their daily work. As mentioned in section 2.3, sharing the annotations between the members of an organization supports the process of organizational learning within this organization. As a consequence, MEMORAE web platform with its collaborative annotation functionalities and its semantic model seemed an adequate solution which is dedicated to “Tour Equipement” need. MEMORAE web platform allows “Tour Equipement” employees not only to annotate documents (invoices, plans, images of the designed products), but also to share these annotations among each other.

To take a concrete example of using MEMORAE web platform within “Tour Equipement” enterprise, let’s suppose that following scenario:

1. The technical manager belongs to the “workshop” group. He/she shares a document that describes a particular order of a product.
2. The technical manager indexes the document by the “jaw chuck” concept of the semantic map (supposing that the “jaw chuck” is the ordered product).
3. While the production manager (who is also a member of the “workshop” group) is reading the document shared by technical manger, he/she finds a sentence that also corresponds to another type of chucks called “collet chuck”.
4. The production manager decides to annotate the document by a commentary saying “This is also applicable for the collet chucks”.
5. The production manager choses the sentence and adds his/her annotation. By considering this annotation as an information resource, the production manager could share his annotation with others. The annotation could be shared only in the sharing space of the containing document (“workshop” group in this case).
6. The production manager choses to index his annotation by the “collet chuck” concept of the semantic map.
7. Now this annotation is visible / accessible by the members of “workshop” group when the “focus concept” is “collet chucks” (Fig. 4). The members of the “workshop” group could see the sentence chosen by the production manager with his/her commentary (“This is also applicable for the collet chucks”). The members could also open the containing document if they want.

The focus box indicating that the focus concept is "collet chuck"



The annotation visible in "workshop" sharing space and indexed by "collet chuck" focus concept

Annotation resource tab

Figure 4: The annotation visible as an information resource in its sharing space.

6 DISCUSSION

Taking back the “Tour Equipement” use case, we recognize that considering the annotation as an information resource enabled the production manager to share and index his/her annotation in order to be accessible by others. The members of “workshop” sharing space were able to access the document by the annotation of the production manager. With other collaborative learning platforms, the annotation of the production manager is considered to be as an integral or complementary part of the document. As a result, the indexing and sharing of the annotation is not possible and the only way to access the annotations is to open the annotated document itself. Our platform has overcome this limitation of annotation sharing by modeling this latter as an information resource in its own right. The annotation itself is accessible as being an information resource in the sharing space.

7 CONCLUSION AND FUTURE WORK

This paper presented an original semantic model that models the annotation as an information resource in

its own right. This enables to share and index the annotation separately from the annotated resource. The model allows to create annotations that have a chat, a forum or a wiki “Body”. We presented MEMORAE web platform for collaboration that uses MEMORAE-core 2 model as a base. We illustrated how this platform implements and facilitates the collaborative annotation. This would support the circulation of ideas which in turns enhances the process of organizational learning. Future work could be done by applying the work of (Li et al., 2012) to capitalize the traces of annotation-taking activities that took place within the enterprise.

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