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Palette

Pedagogically sustained Adaptive LEarning Through the exploitation of Tacit and Explicit knowledge

Integrated Project

Technology-enhanced learning

D.MED.04 – First version of the awareness-support tool

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Summary

This document reports on the awareness services offered through the two tools that are being developed in the context of WP4: Collaboration Services, namely eLogbook and CoPe_it!. We first present the awareness types that need to be supported and we proceed by describing in detail how these are conceived and implemented in the abovementioned tools. Moreover, we briefly report on the integration of these tools, focusing on the additional awareness services resulting from this integration.

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1. Introduction

1.1.   Awareness in Palette's Mediation Services.

Defined by Dourish and Belloti [3] as "an understanding of the activities of others, which provides a context for one's own activity", *awareness* is one of the most crucial needs expressed by communities of practice. [1]. Awareness of past and current actions in shared environments and over shared artefacts influences and guides the members' decisions and course of actions.

Awareness services are particularly important in the context of mediation services, in that they allow participants to have a general perception of the community's activities, progress, and problems, as well as to have a perception about their progress compared to the others. Awareness is also necessary for participants to find potential collaborators for exchanging documents and ideas, or to ask for help. In a web-based CoP, the artefacts can serve as an instrument to generate and sustain awareness.

Acknowledging the crucial factor that awareness plays in the Palette project, explicit support for awareness has been foreseen. Initially (as described in Implementation Plan 1), the Palette consortium had foreseen the development of a dedicated tool for awareness services. However, the standalone nature of awareness tools has been criticised in literature [15], as their de-contextualisation decreases significantly their effectiveness. Taking the above into account, together with outcomes of the participatory design process followed throughout the evolution of the project, the above plan has been amended. The decision made at the end of the first year is to view awareness as an integral part of collaboration services, so that each individual tool being developed in the context of WP4 should provide customised awareness services in a way to further enhance each tool specific objectives and goals.

With respect to which types of awareness to support, looking at the literature of Computer Supported Collaborative Work (CSCW) reveals that various sets of awareness types have already been proposed [2, 10, 11, 13]. These different sets attempt to address different concerns of the collaboration. However, in the context of Palette's collaboration services, no single set of awareness types was able to address all required collaboration aspects. Instead, a synthesis of relevant awareness types found in the aforementioned literature has been adopted. This set of awareness types permits addressing awareness issues at the level of the group as well as at the individual one, something that is critical for collaboration services, in general, and the project overall goals, in particular. Thus, the adopted awareness types include:

Informal awareness: this form of awareness of a work community is the general knowledge of who is around and what he/she is doing. It has been pointed out as enabling spontaneous interaction [8].

Presence awareness: involves information about the status of users. This information indicates each user's availability, aptitude and willingness to collaborate with others.

Task awareness: involves information about the aim of a task, its requirements and how it fits within a bigger plan.

Social awareness: concerns the information that a person maintains about others in a social or conversational level. It includes issues like the degree of attention and the level of interest of a person.

Group-structural awareness: involves information about participants' roles and responsibilities, their positions on an issue and the overall group processes.

Historical awareness: concerns the knowledge of how artefacts resulting from collaboration have evolved in the course of their development.

Workspace awareness: concerns the up-to-the-minute knowledge about others' interaction within a shared workspace [9]. This includes knowledge about the workspace in general, information about other participants' interactions with the shared space and the artefacts it contains. The difference from informal awareness described previously is that workspace awareness is relevant only within the context of single, shared collaboration environments. Informal awareness does not make such assumption and considers a broader, system-wide context. Several elements are relevant to this type of awareness: *presence* (is anyone in the workspace?), *identity* (who is participating?), *authorship* (who is doing what?), *action* (what are the participants doing?), *action history* (how did that operation happen?), *artefact history* (how did this artefact reach this state?), etc. (for a more complete list see [8]).

It is important to notice that the adopted awareness types are not considered as independent but rather that they overlap in a collaborative environment [9]. Hence, some awareness functionalities that have been implemented may be related to more than one awareness type.

In the next sections, we outline the awareness mechanisms available in Palette's collaboration services, and in particular in the eLogbook and CoPe_it! tools. We describe what information is delivered to users, how preferences with respect to desired awareness information can be expressed and what cues are used to facilitate transparent delivery of this information. For each tool, we relate the available awareness functionality to the awareness type it contributes.

1.2. Motivation

The awareness mechanisms introduced by eLogbook and CoPe_it! attempt to address concerns that are related to two issues: 1) the disruptive effect of notifications and 2) the highly dynamic nature of their collaboration environments. While eLogbook concentrates its efforts in addressing the former CoPe_it! focuses on addressing the later. Both issues have harmful consequences on the collaboration as they decrease the groups' productivity and effectiveness

Awareness mechanisms are essential in cooperative and collaborative environments where people interact through task sharing and assets exchange [5]. However, and as previous research has proven, not all notifications are welcomed by users and they might end up having an adverse effect. As a matter of fact, many studies have shown that excessive unnecessary notifications might lead to adverse effects such as a decrease in productivity [16, 17]. For instance, in a learning community of educators, teaching assistants and a considerable number of students, if every time a student comments on a document or an educator decides to change the rights assigned for a role in a specific activity everyone is notified then overload of information will occur. Consequently, community members will tend to ignore all received notifications some of which might be relatively important and might require an immediate action. The situation becomes more critical when students are receiving information on mobile devices. As a matter of fact, these devices have intrinsic constraints such as limited screen size, short battery life and limited storage capabilities. Consequently, they impose a bigger need for information selectivity.

A way to avoid these adverse effects and successfully sustain collaboration is to provide context-sensitive, user-centred awareness services. In order to achieve such services, three fundamental issues have to be addressed [9]:

- What information should be delivered?

- When should it be delivered?

- And how should it rendered?

In other words, the relative relevancy and importance of a notification to a specific user, its delivery and display means, and its time of delivery are the three intrinsic notification parameters that should be adapted based on target user's interests, notification preferences on style and context.

Although most users of CoPs are more or less acquainted with Web-based collaboration environments, the collaboration environments in Palette bring in new ways of interacting with knowledge items in shared workspaces by introducing a new set of operations that go beyond "traditional" operations found in contemporary collaboration environments such as Web-based forums. These operations include amongst others changing the spatial position of knowledge items on the workspace, relating knowledge items using explicit relationships, aggregating knowledge items, changing the visual appearance of knowledge items or relationships, and changing the view of a workspace. These operations -although a natural extension of the collaboration space - do not make the tools more complicated but rather turn it into a much more dynamic environments than traditional collaboration environments. For example modifications initiated by anyone in the CoP and at any time can occur. The semi-synchronous features introduced by the tools contributes decisively to these issues.

In a similar vein, the notion of CoP in these tools refers to a highly dynamic entity that evolves and changes during collaboration sessions and its lifetime: new users can be added to a CoP or disappear from it, some users may be online and others not, different roles can be assigned to CoP members that might even change during a collaboration session,   the status of individual users evolves in terms of participation and - at a higher level – their expertise. In addition users may be members of different CoPs or working on multiple workspaces where they may have different roles, be assigned to different tasks and pursue different goals.

Nevertheless although expressive, such a highly dynamic environment may lead users in blurring or even loosing the mental image they have of their community (e.g. what goals are to be achieved, what task they are supposed to do, how do others contribute to the community) and of the individual knowledge items of public workspaces. This compromises the ability of individual CoP users to align their actions during a collaboration session with the actions of other members and hence threatens the group's cohesiveness. Absence of such cohesiveness results in harming the ability of the community to solve problems efficiently. This situation is exactly the opposite of what the tools are trying to achieve.

To avoid the aforementioned problems attempts are concentrated to control the consequences of such a highly dynamic environment. Hence the tools provide mechanisms with which the various events during a collaboration session can be captured, analyzed and made visible to end-users. These mechanisms constitute the means through which the tools can provide end-users with awareness functionality.

2. eLogbook Awareness Functionalities

2.1. Short Description of eLogbook

eLogbook [14] is a Web-Based collaborative environment particularly adapted to the needs of communities of practice (CoPs). It is being developed by the Swiss Federal Institute of Technology in Lausanne (EPFL). eLogbook is a general-purpose activity-oriented collaboration space that can be customised by users to serve as an asset management system allowing the collaboration over shared artefacts, as a task management system and/or as a discussion platform. eLogbook has been designed based on its simple "3A model" which relies on three fundamental entities: *Actors*, *Activities* and *Assets*. *Events* related to these three entities are governed by *Protocols*. eLogbook supports management of invitations, roles, and deliverables for the activities; it also supports access rights management for the assets. eLogbook provides user-centred and context-sensitive awareness information crucial in collaborative environments [4].

2.2. eLogbook User-Centred Awareness Features

2.2.1. Notification Relevance

A successful awareness service should provide only relevant and needed notifications, which are user and context dependent. In an attempt to provide each user with only relevant and interesting notifications based on his/her own interest and context, a filtering mechanism is currently being designed for eLogbook.

eLogbook keeps track of all actions occurring within the workspace in a chronological and contextual way. Then, for every action traced, a decision is made for whether or not to notify a user of it and/or highlight it. The decision is made based on the natural-policy-based filtering and the relevancy-based

filtering mechanisms, which will be described in this section. It is worth to mention that the filtering mechanism is still in its preliminary design phase and that it is going to be gradually implemented. A complete study ought to be done to assess its impact, and update its design and implementation accordingly (following the Palette participatory design methodology).

Event Tracking and Natural Policy based-filtering

To ensure privacy, eLogbook members are informed or held "aware" of the only events that relate to the activities in which they are involved, the assets which they can access and/or actors declared visible to them. This is achieved by a natural policy-based filtering mechanism, which produces a set of notifications that each user is allowed to receive according to predefined activity and asset access rules. If the user chooses to completely disable the automatic filtering techniques and does not specify any personal notification preferences, he/she will be notified of all the events belonging to the set of allowed notifications.

Relevancy Filtering Mechanism

This mechanism combines collaborative and content-based filtering techniques and takes into account implicit and/or explicit indicators in order to decide whether it will be useful or relevant to notify a particular user of the occurrence of an event within the collaborative workspace. The question of notification relevancy can be addressed by considering the action performed, its type and the entities involved in it (Table 1 lists all possible eLogbook actions along with the type and entities involved with it). The relative importance of an event for a specific target user varies as a function of:

1) His/her relation to the entities involved and the type of action performed.

2) The relevancy of the event to other peers or entities the user «trusts» (collaborative filtering).

3) His/her own context.

First, **the relation to the event entities and types** are deduced from explicit as well as implicit indicators.

Explicit factors are directly indicated by the target user in at least one of the following ways:

§   The user has *rated* the item(s) considered.

§ The user has specified explicitly (in **the profile**) his/her topics of interest which match the item tags (content-based filtering).

§ The user has adjusted his/her **notification preferences** by directly asking to be notified about the type and/or entities of the event considered.

Implicit factors are indirectly inferred from the user's interaction with the environment. They rely on the user's actions, relationships and role within the collaborative workspace in order to decide whether or not it would to be useful to deliver a notification about a the occurrence of a particular event. A user will only be made aware of events related to activities or groups in which he/she has shown interest or been active. Indicators of activeness could be direct exchange of messages between groups, or indirect communication via the manipulation of activity resources such as shared documents. Based on these indicators, a decision is made regarding the relevancy of the event with respect to this user.

Second, the same kind of relation assessment between the target user and the entities and event type is also performed on **other actors**, with whom the target user has strong social ties and/or has similar interests.

Third, the filtering mechanism takes into account the context of the users. Properly defining the key aspects, which constitute the context of a user, is a complex issue [12]. For now, it is planned to take into account the user's connecting device and the task being performed. As an example, the filter can become more selective, when the user connects from a mobile device, to better adapt to the latter's previously mentioned constraints.

Event Type	Entity Involved	Entity Type	Event Descriptive Notes
New or Update Activity Invitation	Invited entity	Actor, Activity and/or Role	- An invitation to join a newly created activity or an already existing one. By default the status of a user for a new invitation is
	Inviting or Initiator entity	Actor	
	Addressee of the invitation	Activity	

	Indirectly involved entities	Other members of this activity	
New Asset Access	Target entity	Actor, Activity and/or Role	Access rights granted can be read-only or full rights.
	Inviting or Initiator entity	Actor	
	Accessed entity	Asset	
	Indirectly involved entities	Other Actors who have access rights over these assets	
Create, Read, Update, Delete role/deliverable	Initiator	Actor	- Updating a role can consist of changing the rights of this role. - Updating a deliverable can consist for example of changing its submission deadline or its submission order.
	Created entity	Role/Deliverable	
	Indirectly involved entities	Activity (to which the role or deliverable belongs) Actors (having this role/expecting to submit this deliverable)	
Semantic Links	Initiator entity	Actor	There are predefined semantic links such as *subactivity* for activities, *comment, complements* for assets, *succeeds* for deliverables
	Linked entities	Activities, Actors, Deliverables, Roles, or Asset	
Rates /Tags	Initiator entity	Actor	
	Tagged or rated entity	Activity, Actor, Deliverable, Role, or Asset	
Read, Update, Delete Asset/Activity	Initiator entity	Actor	
	Read, updated or deleted entities	Asset/Activity	
	Indirectly involved entities	Activities, Actors or Roles (members of the activity/owners of the asset)	
	Initiator entity	Actor	
	Represented entities	Actor(s)	

Event Type	Entity Involved	Entity Type	Event Descriptive Notes
New or Update Activity Invitation	Invited entity	Actor, Activity and/or Role	- An invitation to join a newly created activity or an already existing one. By default the status of a user for a new invitation is "pending". - The invitation status can be updated by the invited member to "accept" or "reject". - The admin(s) of the activity can cancel the invitation by setting the status to "forbidden".
	Inviting or Initiator entity	Actor	
	Addressee of the invitation	Activity	
	Indirectly involved entities	Other members of this activity	
New Asset Access	Target entity	Actor, Activity and/or Role	Access rights granted can be read-only or full rights.
	Inviting or Initiator entity	Actor	
	Accessed entity	Asset	
	Indirectly involved entities	Other Actors who have access rights over these assets	
Asset Submission	Initiator	Actor	
	Created entity	Role/Deliverable	
	Controlling entities	Actor(s)	
	Addressee of submission	Deliverable (for which the asset was submitted)	
	Indirectly involved entity	Activity (to which the deliverable belongs)	

Table 1: List of eLogbook events.

2.2.2.   Notification Delivery & Display Means

Adequate ways of delivery also vary as a function of each user's notification style and context. These two elements influence the way in which notifications are displayed and also the delivery means used for communicating information. Some people like to receive notifications by email; some others prefer RSS

or ATOM feeds as notification channels, while some others might not wish to receive any notification unless they are connected to eLogbook. Moreover, some people might have different delivery means preference for different event types. In addition, based on their context, they might wish to have a summarised event notification or a more complete event description. Notification styles also take into account other elements purely related to information display preferences (textual, graphical, audio or video-based notifications). We will examine in this section the different delivery means that eLogbook uses to send notifications and highlight events occurring with the workspace.

Web browser

It is possible to interact with the eLogbook through 3 different GUI views: the Content View, the Graphical View and the Context-Aware View. The Content View is similar to a mailbox that lists entities of a specific type (activities, actors, assets) based on the user's selection criteria. The Graphical View can be best described as a social network map made of entities and displaying different types of relations existing between them. By representing the relationships between the entities in network diagrams, this view enables users to overview the big picture of their activities, actors, and assets. While the Graphical View and Content View are still in their preliminary design phase, the Context-Aware View has already been implemented, but still requires adjustments. A detailed description of the Context-Aware View, accompanied with illustrating examples, will follow. Then, its added value in terms of awareness display means will be discussed.

Description of the Context-Aware view

The Context-Aware View consists of a centre or focal element, surrounded by four regions, each of which listing related entities of a special kind [6]. Based on the previously mentioned 3A model, the centre element can consist of an asset, an actor, an activity or an activity deliverable. In the surrounding areas, not only are the entities related to the centre displayed, but also their relation with the central entity and the eventual related actions - that the current user is allowed to perform - are appended. Awareness "cues" of different types are seemingly incorporated in every area through the use of symbolic icons, colours and the manipulation of the order in which information is displayed. Figure 1 illustrates an example where a specific activity is chosen as the focal element. In this case, the deliverables shown are the ones belonging to the activity, the assets are the ones assigned to the activity, the activities are the one linked to the central activity and the actors shown are the ones invited to the focal activity.

Figure 1: Example of the Context-Aware View. Focal Element: Activity.

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Added Value of the Context-Aware View

The participatory design approach chosen within the Palette project brought eLogbook designers and developers closer to the needs of CoPs members and representatives. As a matter of fact, the CoPs expressed their wish to work in an environment that can serve simultaneously as a task or activity, an asset management system and a discussion platform through a user-friendly interface which limits complications and pioneers ease of use and acceptability. Moreover, unobtrusive and relevant workspace, task, presence, informal and historical awareness were clearly expressed as crucial elements for successful coordination and collaboration. The Context-Sensitive View was designed mainly to respond to those needs. On one hand, just by changing the type of the focal point, the interface can serve a different purpose, keeping however the same overall skeleton and structure. Moreover the view is seamlessly augmented with pertinent awareness indicators. This being said, this view offers multiple functionalities through a reactive ergonomic interface, which embeds relevant awareness information of different kinds.

Embedded Awareness Cues

Awareness indicators serving different types of awareness are seamlessly incorporated in the Context-Aware View. Table 2 lists some of those indicators or cues and their display means and relates them (as it is can be seen from the third column below) to one ore more types of awareness defined in the literature and summarized in section 1.1.

Awareness Cues	Display	Awareness Types
Indication of the users statuses	- When the user is online, the "status" icon turns to green.	Social/Presence awareness
Edition of shared assets	- When a member is editing a specific asset, a "Lock" icon replaces the editing & deletion "icons" for other "editors" or "owners" of the asset.	Group structural, workspace awareness
Reminder of deliverables deadlines	1 Deliverables with close deadlines are highlighted in red & appear first on the list. 2 Those with future deadlines appear next. 3 Those which deadline had passed appear last and are displayed in grey.	Task awareness / historical awareness (in case 3)
Specification of the assigned rights over shared assets	Use of Icons: - An "editor" is indicated with a pen. - An "owner" is indicated with a crown. - A "reader" is indicated with an eye.	Group structural, workspace awareness
Indication of an activity invited member's response	- A button indicates whether the user has joined, refused or accepted the invitation - If the user has joined the invitation, a red cross allows the current user to abandon the activity at any point in time. - If the invitation is pending or refused, a check mark replaces the red cross to allow the user to join the activity.	Group structural, historical, workspace awareness
Indication of the roles assigned to activity members	- The Role is written under the user's name. - The actions that this role is allowed to perform are listed through the use of icon.	Group structural, historical, social awareness
Indications of the average rating of an activity	Average rating displayed below the item's name when placed in the center, using stars.	Informal, conversational awareness
Indication of the mostly used tags for a specific entity	- The more a tag is used, the bigger its font will be.	Informal, conversational awareness

Table 2. Examples of Awareness Cues.

Email

Users can choose to receive information through email. At the occurrence of every eLogbook event, notifications via email will be sent to users if such a notification is deemed useful (based on the previously discussed filtering mechanism).

Moreover, the users, willing to be informed or be aware of what is happening within a certain activity or around a particular document for example, can directly request information by sending an email request [7]. The eLogbook server would reply to them through email with the requested information. This scheme can be defined as a *pull awareness mechanism*.

In Figures 2 and 3 we give an example of email exchange between an actor and the eLogbook. Figure 2 shows the email that the actor has to send to the eLogbook (action.elogbook@epfl.ch), with the specific subject «get my assets». Figure 3 shows the email returned by eLogbook, with all the names of the assets that the actor can access, as well as a link which directs the actor to the eLogbook Context-Aware View.

```
To: action.elogbook@epfl.ch
Subject: get my assets
Body:
```

Figure 2: Email for getting all the assets of the current actor.

```
Subject: My assets
Body:

Here is a list with the names of your assets:

-Palette-DOW
-berria da
-paper on filtering techniques
-database design

For more information
http://elogbook.epfl.ch/context/actor/30/
```

Figure 3: Email with all the assets that belong to the current actor.

Feeds

The information transfer within eLogbook must abide by three primordial conditions: unobtrusiveness, relevancy & conciseness. The display of the context and the content of an activity and/ or an asset in the

eLogbook interface was designed so as to take those three important aspects into account. Similarly, the RSS (Real Simple Syndication) feeds will also be provided as they are deemed as adequate notification delivery means allowing to satisfy the three conditions mentioned above. To start with, unobtrusiveness is achieved because notifications are sent via a familiar interface where users usually expect and intentionally check for updates. Secondly, the compact format of RSS feeds is particularly useful for mobile users subjected to device constraints. News is sent in a concise way and optional fields (such as images) are skipped for mobile users. Moreover, in order to meet the "relevancy" condition, the information sent via RSS will be filtered to make it personalised and adapted to each receiver's interest and needs (the filtering techniques used have been are discussed in previous section). Thus, even though members register for the same eLogbook RSS feed, the notifications sent over RSS channels will automatically differ from one user to another.

Figure 4 shows the emulated user interface of the feed-oriented awareness services on a Blackberry® device.

Figure 4: Emulated user interface of the feed-oriented awareness services on a Blackberry device.

2.2.3.   Summary

Delivering notifications is a major concern in CSCW. Nevertheless excessive interruptions might be harmful. The eLogbook awareness mechanism attempts to overcome this problem by filtering the events depending on each user's interest, notification preferences and context. Furthermore, not only is the

quantity and quality of information addressed, but also its delivery and display means. eLogbook offers different ways of rendering awareness information in order to best adapt to each user's style and situation.

3. CoPe_it! Awareness Functionalities

3.1. Short Description of CoPe_it!

In this section, we briefly outline some key concepts of CoPe_it! This short description attempts to sketch the context in which the available awareness services function so as to explain their purpose and role.

CoPe_it! is a web based tool supporting argumentative collaboration of CoPs – for a more detailed description of CoPe_it! see deliverable D.MED.02. CoPe_it! workspaces provide the ground where collaborative activities of CoPs take place. CoPs can have one or more workspaces where all their users can upload diverse types of knowledge items such as notes, ideas and comments as well as un-typed items such as files, images and videos. Within workspaces, users can associate all knowledge types in arbitrary ways that suit their understanding of the domain. Moreover they can freely change the type of the knowledge items (e.g. changing a note to an idea and vice versa) at any point during the collaboration. Workspaces can be either public – meaning that they are shared by a group of people – or private. In CoPe_it! workspaces permit semi-synchronous collaboration: the emphasis is on the place rather than on the time dimension. To support the evolution of collaboration in CoPs, CoPe_it! builds upon an incremental formalisation approach through which the emergent transformation of loosely coupled, informal and unstructured workspaces to highly structured, formal workspaces is achieved. A projection renders a workspace at a particular formality level to end users. For each projection different views (or visualisations) are possible.

Within CoPe_it! the notion of a CoP exists explicitly. Users may belong to one or more CoPs and membership to a CoP is based on an invitation scheme. Distinct roles can be assigned within a CoP that determine and control the access of users to resources. In terms of privileges a hierarchical organisation scheme for CoPs is assumed. Every CoP has one or more CoP administrators whose main responsibilities are to accept or reject request for CoP membership of outside users and setting up the CoP's public workspaces. Moreover, a workspace can have one or more workspace administrators responsible for moderating that particular workspace.

3.2. CoPe_it! Awareness Mechanisms

In the following we outline the mechanisms that CoPe_it! offers in order to deliver awareness information to CoP members. Each mechanism is described further to portray what information is available and how it is conveyed to users.

3.3. User Bar

A basic part of the user main interface is the information that indicates the presence or not of individual CoP members within CoPe_it!. The bottom-left pane in Figure 5 (entitled *Quick Contacts*) – embedded in the main screen – shows which users that belong to the same CoP as the current logged on user are currently online and which are not. Special visual cues (called presence indicators) convey this status. A green bullet indicates a user that is currently online, while a gray bullet indicates a user not currently online (Figure 6).
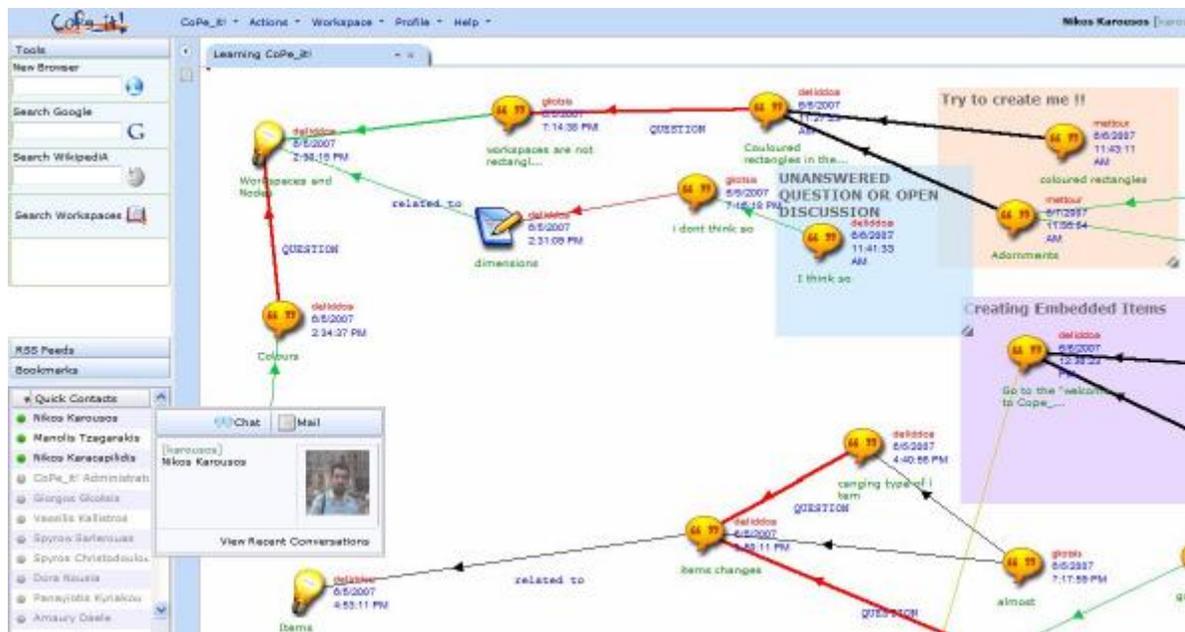

Figure 5: Information on the status of individual users that belong to the same CoPs as the current user.

By hovering over a user in the presence pane, a window displays information on the user profile. This is the information that the users have decided to share. It gives the current logged on user the ability to get in touch either by email or by chat. Hence spontaneous and ad hoc interactions can be possible.
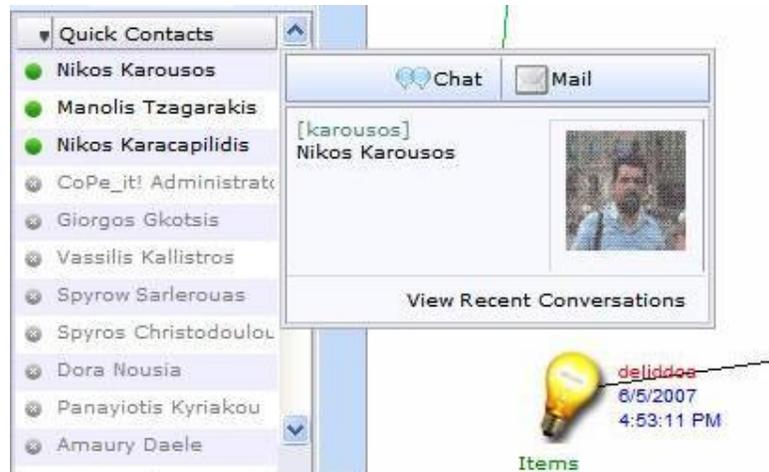
Figure 6: Presence indicators in CoPe_it!. A green bullet indicates an online user while a gray one an user that is currently offline. By hovering over a user's name, a window displays profile data and gives the opportunity for communication.

A special visual cue will indicate users that have a particular role in those CoPs in which the current user is a member. For example special icons will indicate users that are CoP or workspace administrators.

It should be noted that the list of users visible on the quick contacts pane are those that belong to the same CoP as the current user and not those who are working on the same workspace as the current user. This case is described in the context of another awareness mechanism.

3.4. Mini map

Every workspace in CoPe_it! is equipped with the ability to get an overview of the workspace in which a user is currently collaborating (Figure 7). Within the mini map the user is able to see areas of activity of that workspace that indicate which issues are being discussed by other community members. Due to the synchronous nature of the workspace, this will also enable users to see where at this point in time the most collaborative activity is happening. While the main display permits a user to focus on his/her own tasks, the mini map lets the same user glimpse on which issues other members of the workspace are currently engaged. In different situations, this may also provide valuable insights that facilitate the coordination of collaborative actions within a workspace.
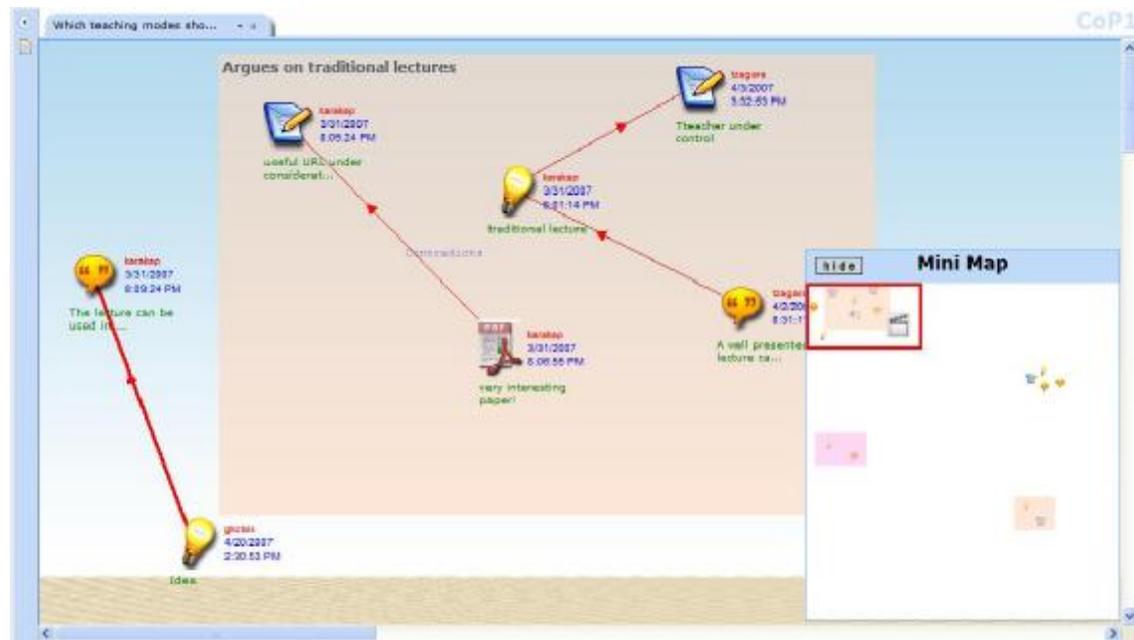
Figure 7: Mini map giving an overview of the entire workspace. This allows users the see where the other members are currently active. The mini map can also facilitate coordination.

3.4.1. Workspace Head up Display (WHUD)

Every workspace will also provide a transparent area at the bottom of the display that will present and report information about current events in the workspace in which the user is currently working – the workspace head up display (W-HUD, Figure 8). This will be the main mechanism through which events of the synchronous collaboration in a workspace will be perceivable by the user. In particular the W-HUD will allow a user to:

- Get information about the users that are currently working in that workspace.
- Get notification on the actions other participants carry out in the workspace events related to individual artefacts e.g. artefact creation, deletion, update etc.
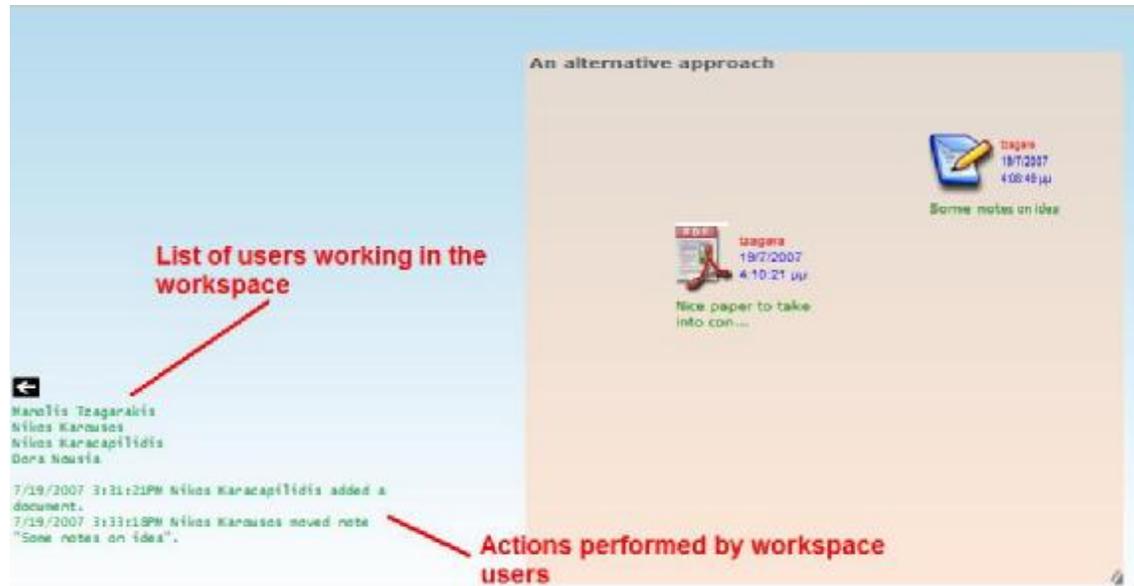
Figure 8: Workspace head up display.

As with the online CoP users presented in previous section, services for initiating spontaneous interactions will be provided via email or chat.

3.4.2. Workspace and Resource History

At the workspace level, users will be able to query what events happened in the past. Various filtering options will be available so that they can see changes within a workspace grouped by user, resource or operation (e.g. what relationships have been added, what deletions and insertions occurred etc). As an alternative modal interface, such chronological information can also be obtained by examining individual artefacts on the workspace.

In addition to chronological information visual cues indicating the access intensity of individual resources will be provided. Figure 9 illustrates how 'access intensity' is rendered visible to users. A usage bar is shown next to each resource that can take colours from white to red. A darker colour indicates more frequent access by a larger number of users than a lighter one. This aims at making visible which resources of a workspace are accessed the most and which are not. This may give useful insights on which resources have not been taken into consideration.

A survey on teaching methods   Some ideas on eLearning   An interesting paper   Palette DoW   Evaluation report of the 1st project review.

Figure 9: Usage information of various resources in workspaces. The coloured bar indicates how frequently the resource has been accessed. A darker shade of red colour indicates more frequent access by a larger number of individual members.

3.4.3. Workspace Teleporting

Cope_it! enables users to peek at other workspaces that may or may not be in their CoP and see what activities happen there without being noticed by the users that are currently working on that workspace. This is referred to as workspace *teleporting* according to similar mechanisms that are available in CSCW [11] . This kind of workspace teleporting is achieved by assigning a special role to individual users and in particular the role of *lurker*. Not all users have this role by default and assignment of this role to community members that in general do not have access to a workspace is controlled by the CoPs and workspaces administrator. Users that are able to lurk at other workspaces are made aware of this role by displaying special icons in their environment (e.g. binoculars next to the list of workspaces).

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3.4.4. CoP Statistics

For each CoP statistical information can be reported. This gives insights on the participation level of the members in the CoP. These statistics include:

Number of logins by CoP members where the number of members that logged on into CoPe_it! are presented and how this number evolved over a time period (Figure 10) .
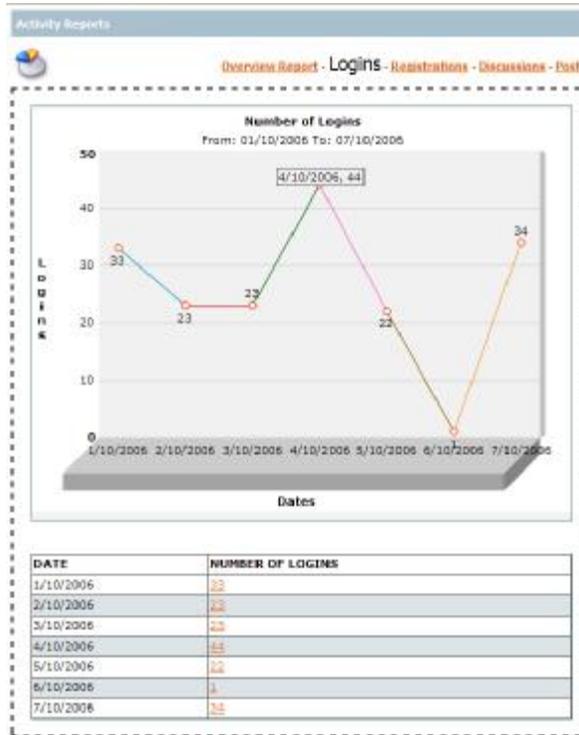
Figure 10: Statistics regarding the number of logins performed in a CoP.

Number of resources generated by the CoP during all collaboration sessions (Figure 11).

Figure 11: Statistics regarding the number of logins performed in a CoP.

Overview statistics on the activities within a CoP, that includes the most active workspace, the most active members etc. (Figure 12) .

Figure 12: Overview report.

3.5. Overview and conclusion

Summarising the above mechanisms, the following table gives an overview of the awareness cues available in CoPe_it! and indicates to which awareness type they contribute

Awareness Cues	Display	Awareness Types
Indication of the users' status	- When the user is online a green bullet appears in the user bar next to his /her name - The names of online users working in a workspace appear in the head up display.	Workspace/Social/Informal awareness
Indication of current activity in a workspace	- The mini map shows changes of the workspace due to the interaction of other working users. - Synchronously carried out operations are shown on the head up display.	Workspace/Social/Informal awareness
Indication of past activity in a workspace	- Icon of clock marks recently changed items since the last user's login. - Users can examine the history of the workspace and individual artefacts.	Workspace awareness
Indication of an item frequency of use	- Usage bar of the item appears in darker colour.	Historical/Workspace awareness
Indication of the rights over an item	- Ownership of an item – that in some situations may imply additional operations on that item - is indicated with an icon depicting a "star".	Group-structural awareness
Indication of teleporting to other workspaces	- Icon depicting glasses/binoculars next to all workspaces permitting teleporting is shown. - Glasses/binoculars are shown next to the current user's name in his/her profile.	Social /Informal awareness
Indication of the roles assigned to CoP members.	- CoP administrators that belong to the same CoP as the current user appears in the user bar with an icon depicting a red gear. Similar cues are used in the head up display. - Administrators of workspaces where the user has access appear in the user bar with an icon depicting a green gear. Similar cues are used in the head up display. - In the head up display, CoP and workspace administrators are ranked first in the list of workspace users.	Group-structural awareness
Indication of the activity within a CoP	- Statistics in the form of bars and charts are available to users.	Group structural, historical, social awareness

Table 3: Overview of awareness cues in CoPe_it!

The awareness capabilities of CoPe_it! attempt to address the problems that originate from the highly dynamic environment that CoPs require and CoPe_it! provides. These available awareness mechanisms address a mixture of asynchronous and synchronous concerns that reflect the semi-synchronous nature of the environment. This is in contrast to the approach existing collaboration systems have with respect to awareness as they target either synchronous or asynchronous issues of the collaboration.

The awareness mechanisms in CoPe_it! cover a critical range of aspects ensuring effective collaboration within CoPe_it! as they will permit spontaneous and ad hoc interaction between CoP members, their better coordination, better comprehension of the events within workspaces, better assessment of CoP activities and their evolution in time as well as facilitate learning of members in CoP (e.g. by permitting them to glance at other workspaces and see the conducted activities). The evaluation of these mechanisms in a real CoP setting will give more insights on how these have to be set up and deployed so that they can unfold their full potential.

4. Integration of eLogbook services into CoPe_it!

4.1. Design Rationale

Aiming at augmenting collaboration awareness in CoPe_it!, efforts have been concentrated on integrating eLogbook services into CoPe_it![1]. In particular, the integration efforts were driven by the idea to provide Context Aware view as one additional view of collaboration workspaces that are created and maintained in CoPe_it!. Such views are not provided by CoPe_it! but nevertheless would contribute positively towards effective collaboration of CoPs. In the next paragraphs we outline the design rationale of this integration.

Satisfying CoPs needs might sometimes require a useful interaction between two different services. For instance, CoPs who have adopted CoPe_it! to support mediation and collaboration, might still benefit from the eLogbook Context-Aware View. As a matter of fact, this view (as described in section 2.3) offers a high degree of contextualisation and seamlessly incorporates informal, conversation, task-based, presence and group structural awareness. This makes it very useful in situating the context of a discussion for a user and guide him/her in the decision making process. To make this view accessible for CoPe_it! members, the following mapping between CoPe_it! and eLogbook abstractions was designed.

§ A CoPe_it! discussion can be mapped to an eLogbook Activity.

§ Issues are also activities, each of which is linked to the discussion it belongs to with the link «issue».

§ An alternative for an issue can be thought of as a deliverable for an eLogbook activity.

§ A position in favour or against an alternative is an asset submitted to meet a deliverable with the comment «in favour» or «against» added. Documents attached to a position are attached to the asset as well.

§ A position in favour or against a position is an asset linked to another asset, with the type of link being either «in favour» or «against».

When the user selects the option "Context-Aware View" found on the workspace menu, CoPe_it! sends a request to eLogbook to do the mapping by calling eLogbook REST Services.

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[1] A series of integration issues between CoPe_it! and eLogbook services is in progress; it is noted that this document is dedicated only to those related to awareness issues.

4.2. Integration of eLogbook Services into CoPe_it!

In this section, an example will be examined of how eLogbook Context-Aware View is called from CoPe-it! and what can be seen from this view as the user switches from one focal element to another. Figures 13 and 14 show how users can request the Context-Aware View of eLogbook when working in CoPe_it! and how this is presented to them.
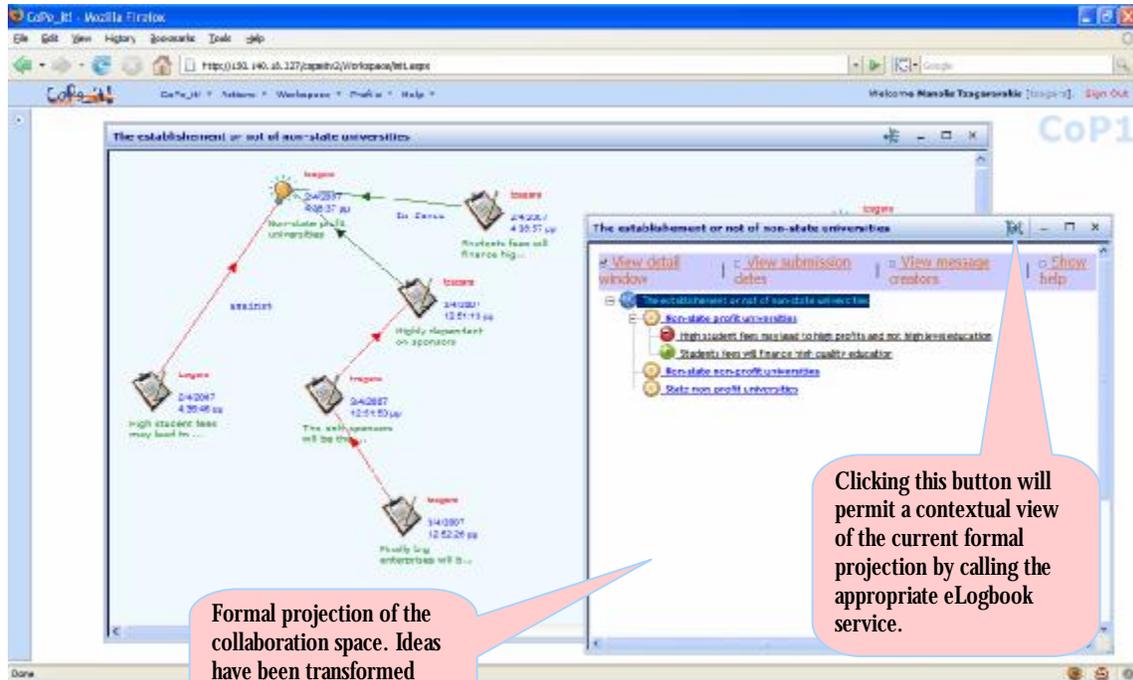

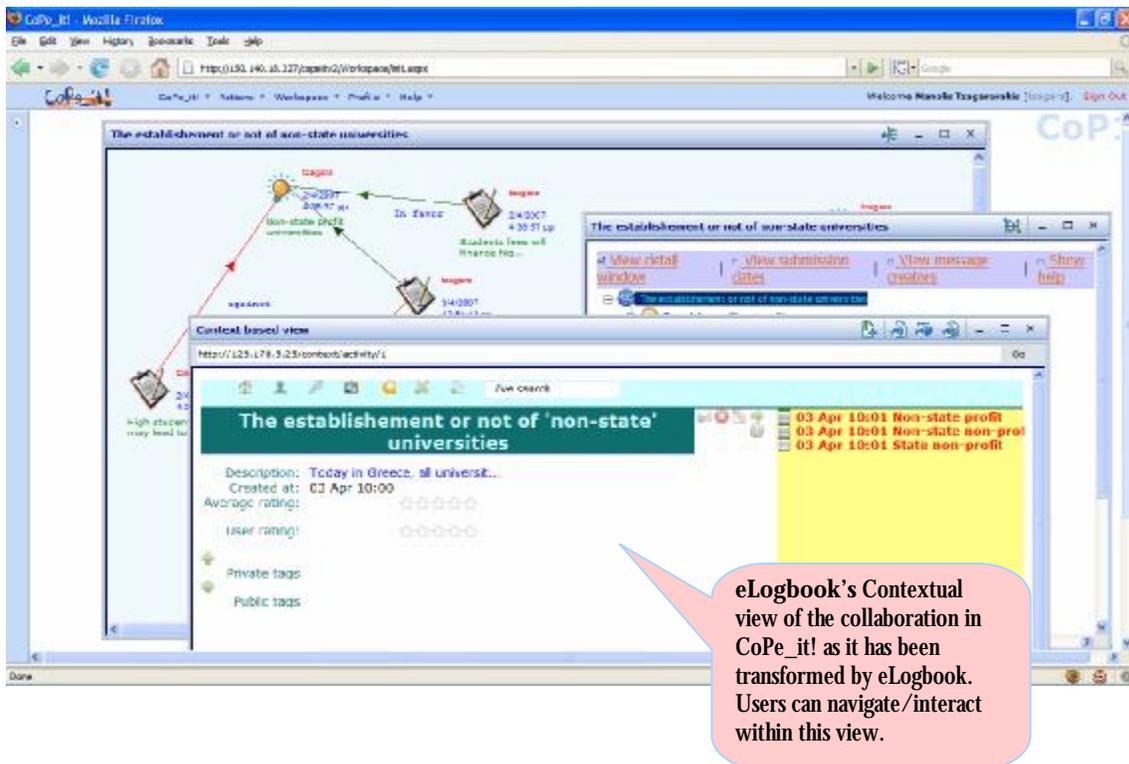Figure 13: At the formal view of collaboration the user can request Context-Aware view from eLogbook.

Figure 14: Context-Aware View of the collaboration as it has been transformed by eLogbook. The view is rendered in a separate window.

Next, we analyse in greater detail what information is displayed to users given various focal elements of the collaboration.

Case 1: When the focal element is a discussion, the user can see:

- § The list of issues linked to it.
- § The list of participants invited to the discussion.
- § The list of general documents useful to trigger the discussion.

Case 2: When the focal element is an issue (Figure 15), the user can see:

- § The different alternatives and the possible deadlines before which positions ought to be taken for those alternatives.
- § The people involved with the issue.
- § The list of documents and positions related to the issue.

Figure 15: Focal element is an Issue.

Case 3: When the focal element is an alternative (Figure 16), the user can see:

- § The positions taken for this alternative (in favour or against).
- § The people who responded to this alternative.
- § The issue to which it is related.

Figure 16: Focal element is an alternative. The description of the alternative is displayed to the user.

Case 4: When the focal element is a position (an asset in eLogbook - Figure 17), the user can see:

- § The alternative(s) in favour of or against which the centre position was taken.
- § The position(s) which were taken with respect to this position.
- § The people who took this position.

Figure 17: Focal element is a position (asset).

Case 5: When the focal element is an actor (Figure 18), the user can see:

§ The issue(s) and discussion(s) in which he/she is involved.

§ The position(s) he/she had taken.

§ The alternatives he/she was suggested.

§ The other actors involved with him/her in argumentative discussions.

Figure 18: Focal element is an actor

5. Future Work Plan

We have presented the means with which eLogbook and CoPe_it! attempt to offer awareness services to end users. Both tools are under further development, in an attempt to enhance their functionalities according to the real needs of CoPs. As far as awareness services are concerned, future work plans focus primarily on the following issues:

Completing the implementation of the proposed awareness services: The fist version of both tools (eLogbook and CoPe_it!) has implemented only some of the proposed services. The full development of the previously described services is expected to be done during the development of the second version of these tools.

Evaluating the awareness functionalities: Although the set of awareness functionalities originate from CoPs requirements, their actual usefulness has to be assessed in real working environments. This is something that will be done as soon as the implementation of all awareness services will be completed.

Implementation of additional awareness services: Related requests, coming out of the project participatory design process, will be assessed for integration with the abovementioned services.

6. References

1. Carroll J. et al.: Awareness and teamwork in computer-supported collaborations. Interacting with Computers, Vol. 18, Issue 1 (January 2006), pp. 21-46.

2. Chen, L., and Gaines, B. : A Cyber-Organism Model for Awareness in Collaborative Communities on the Internet. International Journal of Intelligent Systems, 12(1), 1997.

3. Dourish P. and Bellotti V.: Awareness and coordination in shared workspaces. Proceedings of the 1992 ACM Conference on Computer-Supported Cooperative Work (Toronto, Ontario, Canada, November 01 - 04, 1992). CSCW '92. ACM Press, New York, NY, 107-114. DOI= http://doi.acm.org/10.1145/143457.143468.

4. El Helou S., Gillet D., Salzmann Ch. and Rekik Y.: Feed-Oriented Awareness Services for eLogbook Mobile Users. The 2nd International Conference on Interactive Mobile and Computer aided Learning (IMCL 2007), Jordan, April (2007).

5. Gillet. D., Salzmann Ch., Rekik Y.: Awareness: An Enabling Feature for mediated Interaction in Communities of Practise. 1st European Conference on Technology Enhanced Learning, Greece, 2006. (Online version: http://cnm.open.ac.uk/ projects/ectel06/pdfs/ECTEL06WS9d.pdf)

6. Gillet D., El Helou S., Rekik Y., and Salzmann Ch.: Context-Sensitive Awareness Services For Communities of Practice. To appear in the 12th International Conference on Human-Computer Interaction (HCI2007), Beijing, 22-27 July (2007).

7. Gillet D., Man Yu C, El Helou S., Berastegui Madina A., Salzmann Ch, and Rekik Y. Tackling Acceptability Issues in Communities of Practice by Providing a Lightweight Email-based Interface to eLogbook: a Web 2.0 Collaborative Activity and Asset Management System. To appear in TEL-CoPs'07: 2nd International Workshop on Building Technology Enhanced Learning solutions for Communities of Practice.

8. Gross, T., Stary, C. and Totter, A. : User-Centered Awareness in Computer-Supported Cooperative Work-Systems: Structured Embedding of Findings from Social Sciences, International Journal of Human-Computer Interaction, Vol. 18, No. 3, 2005, pp. 323-360

9. Greenberg S., Roseman M.: Workspace Awareness for groupware. CHI Conference Companion (1996) 208-209.

10. Gutwin, C., Stark, G., and Greenberg, S. Support for workspace awareness in educational groupware. First International Conference on Computer Support For Collaborative Learning (Indiana Univ., Bloomington, Indiana, United States). J. L. Schnase and E. L. Cunnius, Eds. Lawrence Erlbaum Associates, Mahwah, NJ, 1995, pp.147-156.

11. Gutwin, C., Greenberg, S. and Roseman, M. Workspace Awareness in Real-Time Distributed Groupware: Framework, Widgets, and Evaluation. In Proceedings of the Conference on Human-Computer Interaction: People and Computers - HCI'96 (Aug. 20-23, London, UK). Springer-Verlag, Heidelberg, 1996. pp. 281-298.

12. Lueg, C.:On the Gap between Vision and Feasibility. In Proceedings of the First international Conference on Pervasive Computing (August 26 - 28, 2002). F. Mattern and M. Naghshineh, Eds. Lecture Notes In Computer Science, vol. 2414. Springer-Verlag, London, 45-57.

13. Nutter D., Boldyreff C.: Historical Awareness Support and Its Evaluation in Collaborative Software Engineering. Twelfth International Workshop on Enabling Technologies: Infrastructure for Collaborative Enterprises (2003) 171.

14. Rekik Y., Gillet D., El Helou S., and Salzmann Ch.: The eLogbook Framework: Sustaining Interaction, Collaboration, and Learning in Laboratory-Oriented CoPs. The International Journal of Web-Based Learning and Teaching, Vol. 2, Issue 3 (2007)

15. Schmidt, K.: The Problem with 'Awareness': Introductory Remarks on 'Awareness in CSCW', Computer Supported Cooperative Work, v.11 n.3, p.285-298, 2002 (doi>10.1023/A:1021272909573).

16. Speier, C., Valacish, J., S., & Vessey, I.: The effects of task interruption and information presentation on individual decision-making. Proceedings of the International Conference on Information Systems, 1997.

17. Spira, J.B abd Feintuch, J.B.: The Cost of Not Paying Attention: How Interruptions Impact Knowlege Worker Productivity, Basex, 2005.