

# **Participatory Design for Awareness Features: Enhancing Interaction in Communities of Practice**

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## **Abstract**

This paper describes the approach adopted for developing awareness services in two Web-based collaboration applications, namely CoPe\_it! and eLogbook. Both tools are developed in the framework of Palette, a European project which aims at sustaining individual and organizational learning for CoPs (Communities of Practice) by designing, implementing and validating a set of innovative and interoperable Web services using a participatory design approach.

## **Keywords**

Awareness, communities of practice, Web applications, collaboration, interaction.

## **Introduction**

Defined by (Dourish P. and Bellotti V. 1992) 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 (Carroll J. et al. 2006). Awareness of actions and artifacts in a community allow participants to have a general perception of the community’s activities, progress, and problems. Through the awareness information, the participants can find potential collaborators for exchanging ideas, for elucidating an unclear concept, or for accomplishing a particular task. Providing such awareness information motivates participation, guides future course of actions, and promotes knowledge sharing. Consequently, awareness is a significant factor in making individual and organizational learning in CoPs a successful and sustainable experience.

Due to the salience of awareness in environments dedicated for collaboration, the Palette consortium had planned the development of a dedicated tool for awareness services. However, the standalone nature of legacy awareness tools has been criticized in (Schmidt, K. 2002), as their de-contextualization reduces significantly their effectiveness. Taking this problem into account, together with outcomes of the participatory design process followed throughout the evolution of the Palette project, the development strategy was amended. The idea was to consider awareness as an integral part of collaboration services and focus on ways to integrate it into these tools. By doing so, awareness services can be provided in the context of each individual tool making it possible to better adapt them to the particular needs.

The paper is organized as follows. First, the types of awareness information required are discussed. Second, the awareness delivery means and rendering methods in CoPe-it! and eLogbook are presented. The last section summarizes the paper and the future work.

## Identifying the needed awareness types

The Palette project follows the participatory design approach in order to actively involve users in the design process of community tools. To steer the methodology, two teams were created: the pedagogical team composed of *CoPs mediators* was responsible for investigating the practices of CoPs and the technological team was responsible for developing the required tools.

Initially, *CoPs mediators* conducted studies on the nature, behaviors, problems and goals of the Palette CoPs through several means such as interviews and surveys. These aspects were related to the activities carried out by CoP members. The outcome of the investigations was a report summarizing the CoP requirements. This report was subsequently communicated to the *service mediators*, the representatives of each tool in the technological team. Then, the design and implementation of the required features took place. To assess the state of the development process, the new features were finally subject to evaluation by CoPs, followed by possible modifications depending on whether or not they satisfy CoP needs.

With respect to the topic of this paper, the incorporation of awareness services into collaboration support tools was a commonly reported CoPs requirement. The report indicated also the kind of information CoP members wish to be aware of. In the following, two illustrative case studies corresponding to two representative Palette CoPs are briefly examined and the kind of awareness information they need is highlighted. Then, awareness types, previously identified in the literature, and which combined together meet the CoPs awareness needs, are summarized.

### Highlighting the needed awareness types through case studies

The Lancaster CoP is a CoP located within the Doctoral Programme for practitioners (e.g. lecturers, e-learning professionals, educational developers) in further and higher education at the Department of Educational Research in Lancaster University. It aims at enabling students to complete their PhDs. Lancaster needs an awareness mechanism that notifies students of what they are expected to submit and notifies them of their submission deadline. Also, a notification mechanism informing tutors of students' submissions and students of tutors' online feedback is also important. In fact, making members aware of actions, which are of significance to them, motivates their engagement in the community.

The ePreP CoP is another Palette CoP formed of educators from French and French-speaking international institutions. Its main goal is to discuss practices related to the development of a first higher education cycle preparing students for the competitive entrance exams to the French "Grandes Ecoles" through the use of information and communication technology (ICT). The ePreP coordinator reported the need for a service that notifies members of the posting of new artifacts, the initiation of new activities or projects, the roles distribution within each project ("observer", "active member" in the "Wikiprépas" activity), the arrival of new members, and the submissions deadlines. Providing statistics about the actions performed over shared artifacts such as how many people read them, tagged them and commented on them was also reported as very useful.

### Relating awareness needs to literature findings

The literature of Computer Supported Collaborative Work (CSCW) reveals that various sets of awareness types have already been proposed in (Chen, L., and Gaines, B. 1997; Gutwin, C., Stark, G., and Greenberg, S. 1995; Gutwin, C., Greenberg, S. and Roseman, M. 1996; Nutter D., and Boldyreff C. 2003). In order to address the CoP awareness requirements, we selected a combination of several awareness types appearing in the aforementioned literature, addressing awareness at both individual and group levels, and targeting different collaboration aspects. The resulting combination includes the following awareness types:

- Informal awareness: This type of awareness of a community refers to the general knowledge of who is around and what he/she is doing. It has been pointed out as a factor for enabling spontaneous interaction (Gross, T., Stary, C. and Totter, A. 2005).
- Presence awareness: It involves information about the status of users. This information indicates each user's availability, aptitude and willingness to collaborate with others.
- Social awareness: It concerns the information that a person maintains about others, their presence and their activities. It includes issues like the degree of attention and the level of interest of a person.
- Task awareness: It involves information about the aim of a task, its requirements and how it fits within a bigger plan. Reminding members of their submissions or evaluation deadlines, notifying them of new tasks or projects initiated, fall under this category.
- Group-structural awareness: It involves information about participants' roles and responsibilities, their positions on an issue.
- Historical awareness: It involves contextual information of the creation and changes of an artifact over time.
- Workspace awareness: It concerns the up-to-the-minute knowledge about others' actions within a shared workspace (Greenberg S., Roseman M. 1996). This includes knowledge about the workspace in general, information about other participants' interactions with the shared space and the artifacts it contains. 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?), artifact history (how did this artifact reach this state?), etc. (there is a complete list in (Gross, T., Stary, C. and Totter, A. 2005). Thus, workspace awareness encompasses informal, presence and historical awareness.

It is important to note that the adopted awareness types are not considered as independent but that they rather overlap in a collaborative environment (Greenberg S., Roseman M. 1996). Hence, some awareness functionalities that have been implemented may be related to more than one awareness type.

## **Awareness in Palette collaboration services**

In this section, we outline the awareness features available in Palette's collaboration services CoPe\_it! and eLogbook. We describe what information is delivered to users, and what means are used to facilitate transparent delivery of this information. For each tool, we relate the available awareness functionality to the awareness type it contributes.

### **eLogbook description**

eLogbook is a Web 2.0 collaborative environment particularly adapted to the needs of CoPs. It is being developed at the Swiss Federal Institute of Technology in Lausanne (EPFL) and can be customized by users to serve as an asset management system allowing the collaboration over shared artifacts, a social network connecting people, a task management system permitting the organization of activities and the distribution of tasks, as well as a discussion platform. It is based on the 3A model, where a community is viewed as a group of actors conducting joint activities and collaborating over shared assets or artifacts in order to reach their goals. eLogbook provides context-sensitive awareness information crucial in collaborative environments (Rekik Y., Gillet D., El Helou S., and Salzmann Ch. (2007). Awareness information is sent via mail and RSS feeds, and through the context-sensitive Web interface seamlessly augmented with pertinent awareness indicators. Examples of awareness information that eLogbook provides are grouped according to their type and listed below.

## **eLogbook awareness features**

### *Social/Presence Awareness*

Even though eLogbook doesn't yet allow completely synchronous interaction, indicating that a user is actually connected to eLogbook triggers interaction with other's people's work environment. In particular, the status (online/offline) is perceived through the change of the color of the actor's icon.

### *Informal/Conversational Awareness*

The context-sensitive view embeds several awareness cues of this type. For instance, the average rating of an actor, an activity or an asset, through the use of stars is displayed next to the center element name. The tagging frequency is also highlighted through making the tag size proportional to its usage frequency.

### *Task awareness*

The reminder of the deadlines for the submission and the evaluation of deliverables is a kind of task awareness. Reminders are sent by mail or accessible via RSS feeds. Also, in the context-sensitive Web interface, the order in which deliverables of an activity appear and the color in which the corresponding date is displayed varies in terms of the closeness of the deadline and whether or not the related submissions and/or evaluations have been completed.

### *Historical awareness*

All actions happening within the workspace by actors and related with shared assets, shared activities and other actors, are all logged with a time stamp. Even though some related awareness information is pushed into the Web interface, it is also envisaged that the users be able to get on demand some particular information by sending an email to eLogbook. This is because providing a pull awareness mechanism adds flexibility and better responds to the different users notification styles. For example, the user can send an email to eLogbook requesting to get a history of all modifications and annotations of a particular document that have been done during a certain period of time.

### *Group-structural awareness*

When an activity is chosen as the focal element in the context-sensitive view, the different roles assigned to its members are provided. In addition, the color of the button displayed next to the role indicates whether or not the user has accepted to join the activity and take the role s-he was assigned. In the same way, awareness cues embedded in the assets area of the context-sensitive view show the rights the central element has over the listed assets (i.e. an "editorship" right is represented with a pen, an "ownership" with a crown and a "view-only" right with an eye). It is worth mentioning that group-structural awareness information is also accessible via email and RSS feeds upon request or prior subscription.

### *Workspace Awareness*

eLogbook provides awareness of the manipulation of a shared resource. For example, in the context-sensitive view, when a member is editing an asset, a "Lock" icon replaces the editing and deletion icons for other actors who also have the right to edit this same asset. If users move the mouse over the "lock" icon, they will be made aware of who is editing the asset through a pop up message. In addition, and as it was mentioned earlier, delivering all the previously mentioned awareness types, such as historical, presence and group-structural awareness are prerequisites for providing workspace awareness.



**Figure 1: Embedded awareness cues in the Context-Sensitive View. Focal Element: Activity**

### *Embedded awareness cues in the Context-Sensitive View*

CoPs expressed the need to work in a user-friendly environment that can serve simultaneously as a task and asset management system, a social network, and a discussion platform. The context-sensitive view was designed as a response to this need. In fact, this view consists of a central element, surrounded by three main regions, respectively dedicated to activities, assets and actors (Gillet D., El Helou S., Rekik Y., & Salzmann Ch., 2007). Based on the previously mentioned 3A model, the central element can consist of either an asset, an actor or an activity. Selecting an entity to become the context or the central element causes a change in the surrounding areas to display related entities, their relation with it and the eventual related actions that a user can perform on it. Consequently, just by changing the type of the focal point from an activity to an actor or an asset, the interface can serve different purposes, keeping however the same overall skeleton and structure. Awareness “cues” of different types are seamlessly incorporated in every area through the use of symbolic icons, colors 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 assets posted in this activity, the actors participating in it and the other activities related to it, are displayed.

### **CoPe\_it! description**

CoPe\_it! is a Web-based tool supporting argumentative collaboration in CoPs. CoPe\_it! workspaces provide the ground where collaborative activities 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 formalization 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 visualizations) are possible.

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 with the approach that existing collaboration systems have with respect to awareness, as they target either synchronous or asynchronous aspects of the collaboration. The

awareness mechanisms in CoPe\_it! cover a critical range of aspects ensuring effective collaboration within CoPe\_it!. This is achieved by allowing CoP members to initiate spontaneous and ad hoc interactions, coordinate more efficiently, have a better comprehension of the events within workspaces, and a better assessment of CoP activities and their evolution in time. Effective collaboration is also due to the fact that the learning process of members in CoP is facilitated by, for example, permitting them to glance at other workspaces and see the conducted activities.

### **CoPe\_it! awareness features**

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.

#### *Social/Presence awareness*

The user bar provides indication of 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 workspace head up display.

#### *Group-structural awareness*

The Workspace Head up Display (WHUD) provides 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". The WHUD also provides 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.

#### *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.

The interface of CoPe\_it! provides indication of teleporting to other workspaces. In particular, an icon depicting glasses/binoculars next to all workspaces permitting teleporting is shown. A similar icon is shown next to the current user's name in his/her profile.

#### *Historical awareness*

The interface (Figure 2) of CoPe\_it! provides indication of the activity within a CoP. Statistics in the form of bars and charts are available to users. There are several types of statistics. First, there are statistics about the number of logins performed in a CoP. Second, there are overview statistics on the CoP activities that reporting the most active workspace, the most active members, etc. Third, there are statistics about number of resources generated by the CoP during all collaboration sessions.

The interface of CoPe\_it! provides indication of frequency of use of an item. It also provides indication of past activity in a workspace. Icon of clock marks recently changed items since the last user's login. User can examine the history of the workspace and individual artifacts.



Figure 2: Overview statistical report

### Workspace awareness

The mini map provides indication of current activity in a workspace. It shows the changes of the workspace due to the interaction of other working users. 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 3). Within the mini map the user is able to see areas of activity of that workspace, while the areas indicate the issues 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.

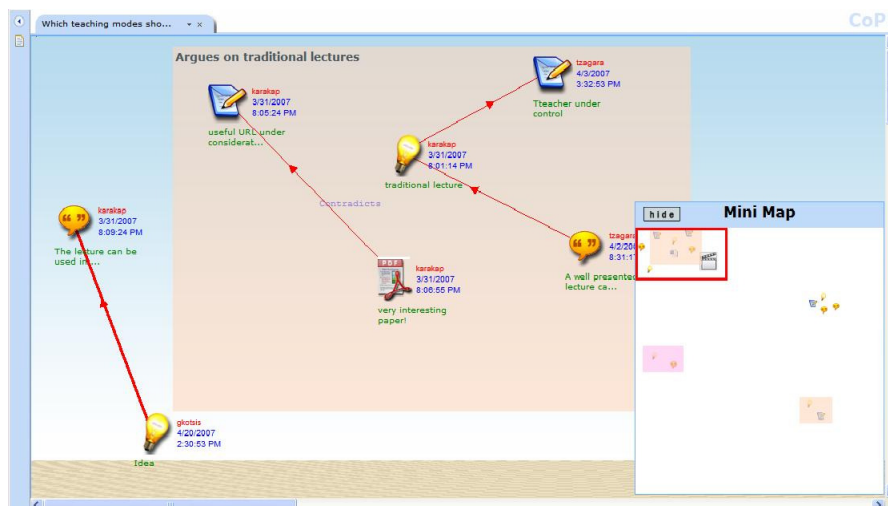


Figure 3: The Mini map allowing users to see whether other workspace members are currently active

### Conclusion and Future Work

Following the Palette participatory design approach, CoPs mediators reported what awareness information are needed by CoP in order to sustain collaboration and motivate participation. Combining the findings of CoP mediators and the previous literature findings in terms of awareness types, the

different kinds of required awareness information were identified. Then, the implementation of eLogbook and CoPe\_it! awareness services followed. Awareness rendering and delivery means include embedding awareness cues in each tool's main Web interface as well as sending notifications by email or RSS feeds. Services and CoPs mediators will continue assessing the awareness services, delivered based on feedback from CoPs members using the tools, and services will be then improved accordingly. One issue already reported is that users are sometimes bothered by excessive notifications or embedded awareness information. Consequently, mechanisms to rank awareness information according to their importance to the target user are being considered. These mechanisms will rely on the user explicitly stated preferences as well as on his/her actions within the workspace, in order to decide whether or not to make a target user aware of a particular event.

## References

- Beasley, R.E., & Vila, J.A. (1992). The identification of navigation patterns in a multimedia environment: A case study. *Journal of Educational Multimedia and Hypermedia*, 1(2), 209–222.
- Carroll J. et al. (2006). Awareness and teamwork in computer-supported collaborations. *Interacting with Computers*, 18(1), 21-46.
- Chen, L., and Gaines, B. (1997). A Cyber-Organism Model for Awareness in Collaborative Communities on the Internet. *International Journal of Intelligent Systems*, 12(1).
- Dourish P., & Bellotti V. (1992). Awareness and coordination in shared workspaces. *Proceedings of ACM Conference on Computer supported cooperative Work (CSCW'92), Toronto, Canada, November, 1992*. New York, US: ACM Press(pp.107-114).
- El Helou S., Gillet D., Salzman Ch. & Y. Rekik Y.(2007): Feed-Oriented Awareness Services for eLogbook Mobile Users. *Proceedings of the 2nd International Conference on Interactive Mobile and Computer aided Learning (IMCL), Jordan, April 17-21, 2007*.
- Gillet. D., Salzman Ch., Rekik Y. (2006). 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>)
- Gillet D., El Helou S., Rekik Y., & Salzman Ch. (2007). Context-Sensitive Awareness Services For Communities of Practice. *Proceedings of the 12th International Conference on Human-Computer Interaction (HCI2007), Beijing, July 22-27, 2007*.
- Gillet D., Man Yu C., El Helou S., Rekik Y., Berastegui A., Salzman Chr., & Rekik Y. (2007). Tackling Acceptability Issues in Communities or Practice by Providing a Lightweight Email-based Interface to eLogbook: a Web 2.0 Collaborative Activity and Asset Management System. *Proceedings of the 2nd International Workshop on Building Technology Enhanced Learning solutions for Communities of Practice (TEL-CoPs'07), Crete, Greece, September 17, 2007*.
- Gross, T., Stary, C. and Totter, A. (2005). User-Centered Awareness in Computer-Supported Cooperative Work-Systems: Structured Embedding of Findings from Social Sciences, *International Journal of Human-Computer Interaction*, 18(3), 323-360.
- Greenberg S., Roseman M. (1996). Workspace Awareness for groupware. *CHI Conference Companion, 1996*.(pp. 208-209).
- Gutwin, C., Stark, G., and Greenberg, S. (1995). 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. Cunniss, Eds. Lawrence Erlbaum Associates, Mahwah, NJ, 1995.(pp.147-156).
- Gutwin, C., Greenberg, S. and Roseman, M. (1996). 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, August. 20-23, 1996*. (pp. 281-298).London, UK.:Springer-Verlag, Heidelberg.
- Nutter D., and Boldyreff C. (2003). Historical Awareness Support and Its Evaluation in Collaborative Software Engineering. *Twelfth International Workshop on Enabling Technologies: Infrastructure for Collaborative Enterprises, 2003*(pp.171).
- Rekik Y., Gillet D., El Helou S., and Salzman Ch. (2007). The eLogbook Framework: Sustaining Interaction, Collaboration, and Learning in Laboratory-Oriented CoPs. *The International Journal of Web-Based Learning and Teaching*, 2(3).
- Schmidt, K. (2002). The Problem with Awareness: *Introductory Remarks on Awareness in CSCW, Computer Supported Cooperative Work*, 11(3), 285-298.