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Palette

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

Instrument: Integrated Project

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Deliverable manager

- Bernadette Charlier, UNIFR
- Annick Rossier, UNIFR

List of Contributors

- Christian Maissen, UNIFR
- Nikos Karacapilidis, CTI

Summary

This deliverable presents the Proceedings of the two main scientific workshops organised by PALETTE during its second year.

The EIAH 2007, international workshop: “**Learning and working in CoPs : theoretical and technological issues**” held in Lausanne in the 26th of June 2007. This workshop challenged how communities and practice are represented and conceptualized as well as their relations with the workplace and learning processes.

It has specifically addressed the following topics:

- How do we define the concept of practice in the workplace?
- How are leaning and work practices integrated?
- How do we represent or validate practices and competences?
- How do the different CoPs in which people are engaged contribute to this learning process?
- Which activities are supported by on-line tools and services?

It included one invited talk by Prof. M.Saunders, Lancaster University and 7 papers presented by interdisciplinary teams from PALETTE and from other organisations. It also offered a panel focused on the research methodologies used to study learning in CoPs with the participation of 2 young researchers working in the PALETTE project and 2 working in external organisations. All the workshop was video recorded and can be found on http://www.anaxagora.tudor.lu/Palette/conference_lausanne/

TEL-CoPs’07 on building Technology Enhanced Learning solutions for Communities of Practice

This workshop was held in conjunction with the Second European Conference on Technology Enhanced Learning - “Creating new learning experiences on a global scale”, 17-20 September 2007, Crete, Greece. The workshop focused on current research trends in technology enhanced learning solutions that aim at addressing the multiplicity and complexity of needs of Communities of Practice throughout their lifecycle. The workshop sought quality research papers that proposed solutions to the issues identified above. It advocated approaches that built on the synergy between concepts such as multimedia information authoring and reuse, knowledge management, as well as argumentation, negotiation and collaboration support. It aimed to bring together scientists and engineers who work on designing and/or developing the abovementioned solutions, as well as practitioners who evaluate these solutions in diverse real environments. Particular interest was given to approaches built according to well-established pedagogical principles. Six papers out of the ten presented were by PALETTE teams.

It also includes the presentation of the Workshop « PALETTE Workshop » realised in the framework of the **LORNET 2007** conference

<http://www.lornet.org/Home/tabid/394/language/en-US/language/fr-FR/Default.aspx> in Montreal on the 4 of November 2007.

**Proceedings of the EIAH 2007: 2nd International Workshop
on
Learning and working in CoPs:
theoretical and technological issues**

Workshop Chair

Brenadette Charlier, University of Fribourg, Switzerland
bernadette.charlier@unifr.ch

Program Committee

- **Denis Gillet**, EPFL, Switzerland
- **Jean-Luc Gurtner**, University of Fribourg, Switzerland
- **Daniel Peraya**, University of Geneva, Switzerland
- **Christine Vanoirbeek**, EPFL, Switzerland
- **Nikos Karacapilidis**, University of Patras & RA Computer
• **Technology Institute**, Greece
- **Thibaud Latour**, Research Center Henri Tudor, Luxembourg
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- **Peter Scott**, The Open University, UK
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- **Liliane Esnault**, E.M. Lyon, France
- **Monique Linard**, Prof. Emerite University Paris 10, France
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- **Jacques Wallet**, University of Rouen, France
- **Brigitte Denis**, University of Liege, Belgium
- **France Henri**, University of Quebec, Canada
- **Richard Hotte**, University of Quebec, Canada



EIAH 2007: International Workshop on June 26, 2007

Learning and working in CoPs: theoretical and technological issues

Apprendre et travailler dans les CoPs: enjeux théoriques et technologiques

Programme

09:00 – 09:15

Welcome – Accueil

09:15 – 10:15

Invited talk – Conférence invitée Chair: B. Charlier

- **Considering the idea of practice in learning through CoPs**
Murray Saunders, CSET, Lancaster University

10:15 – 10:45

Coffee Break – Pause Café

10:45 – 12:15

Session 1: Learning in CoPs, theoretical issues – Apprendre dans les CoPs, enjeux théoriques Chair: Lilliane Esnault

- **Variation in conceptions of “Communities of Practice” and its implication for research and development**
P. Ashwin, B. Charlier, A. Daele and M. Saunders
- **An Activity Perspective on Reification Processes in Distributed Communities of Practice. Implications for on-line tools design**
R. Zeiliger and L. Esnault
- **Modelling activity and development of communities of practices**
M. Kuenzel, B. Charlier and A. Daele
- **FORM@HETICE : Une étude de cas sous l’angle de la théorie des Communautés de Pratique (Short Paper)**
Arnaud Milstein et Brigitte Denis

12h 30

Lunch break – Pause repas

14:00 - 15:30

Session 2: Learning in CoPS, technological issues - Apprendre dans les CoPs, enjeux technologiques issues Chair: Christine Vanoirbeek

- **Instrumentation d'une communauté de pratique virtuelle: illustration avec le portail TE-Cap**
E. Garrot et S. George
- **Incremental formalization of argumentative collaboration**
N. Karacapilidis and M. Tzagarakis
- **Exploring the selection of technology for enabling the CoPs development (Short paper)**
D. Gorga

15:30 – 16:00

Coffee Break – Pause Café

16:00 - 17:00

Session 3 – Panel: **A la recherche de méthodes pour comprendre l'apprentissage et le développement des CoPs** Chair: France Henri

Caroline Brassard, *Universités du Québec à Montréal et de Chicoutimi*, Amaury Daele, *Université de Fribourg*, Nathalie Deschryver, *Universités de Genève et de Fribourg*, Mélanie Ciussi- Boss, *Université d'Aix en Provence*.

17:00 - 17:30

Closing Session – Session de cloture Chair: M. Saunders and D. Gillet

Open Discussion and summary of the day's progress – Future steps

*** Atelier bilingue – bilingual workshop. La langue du titre de la communication correspond à la langue utilisée pour celle-ci. The title indicates the language used for the communication.**

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Variation in conceptions of « communities of practice » and its implication for research and development

**Paul Ashwin*, Bernadette Charlier[@], Amaury Daele[@], and
Murray Saunders***

** CSET*

*Department of Educational Research
Lancaster University
England*

*[@]Centre de Didactique Universitaire
Université de Fribourg
Switzerland*

ABSTRACT. The notion of « Communities of Practice » (CoP) is an increasingly popular one in informing educational research and development and has been used to inform the work of the PALETTE Project. In this paper, we will give an initial introduction to the ideas behind CoPs and outline the particular conceptualisation of CoPs that has informed the initial design of the PALETTE project. We will then show that in the research literature in this area, they have been different emphases on the constituent parts that make up a CoP. Using the Doctoral Programme in Educational Research at Lancaster University as an example of a CoP, we will argue that these different emphases lead to different approaches to researching and supporting the professional development of CoPs and thus an awareness of the different ways in which CoPs are understood by researchers, developers and members of CoPs, is vital if international collaborative research and development projects such as PALETTE are to be successful in meeting their aims.

KEYWORDS: Communities of Practice, professional development, collaborative research

Communities of Practice

1. Introduction

In this paper, we will focus on how different conceptions of the notion of 'Communities of Practice' (CoPs) impact on attempts to undertake research and professional development within CoPs. By 'conception' we mean a particular way of thinking about a phenomenon, in this case CoPs that informs actors' approaches to engaging with that phenomenon.

In order to make progress on this discussion, we would like to propose that the idea of a community of practice is part of a theory on the way 'practice' itself yields knowledge and learning. This narrative turns to a consideration of the learning process but does so by figuring the locus of concern as learning in social or organisational contexts rather than individual cognitive process.

The idea of a CoP analyses an extended notion of professional and organisational knowledge, produced and sustained through situated working practice. However, it might be extended to include groups who come together to engage in purposeful action from different working or social environments thus forming a new group with its own set of practices (individuals in an interest group, a 'hobby group', a group of learners on a course etc). The approach integrates theories that explore professional learning process (see Eraut 2000, Schon 1991) with those that develop the idea of 'practice' itself (Giddens 1976, Lave and Wenger 1991, Wenger 1998 and 2000). It also implies a concept of the knowledge resources (this is understood very broadly to encompass formal, explicit and technical knowledge on the one hand and informal, tacit, social, cultural and discursive knowledge on the other) that are produced and accessed, metaphorically as 'rules' through practice. Knowledge resources in this sense, frame our group behaviour in working or learning environments (Blackler 1995, Bereiter and Scardamalia 1993). This approach has broken new ground and provides a fertile opportunity for new research into the way learning and work intersect and the way in which groups learn together. It has a corpus of theory that depicts the new entrant or novice in a social group as travelling through a cyclical journey of practice (the notion of 'practice' defined in the work of Giddens (1976) as 'routine rule governed behaviour' is helpful in understanding the way a CoP is composed of clusters of practices). By working and learning in a CoP, members are accessing and producing new knowledge (as knowledge resources that provide frameworks for action or rules) through both informal and formal learning processes. This process creates continually evolving clusters of practices. As these cycles proceed, the novice moves from the periphery to the centre in terms of experience and expertise.

The important dimension of this theoretical orientation is the way it involves a complex dynamic. This dynamic is constantly evolving as new members of a community of practice use the knowledge resources that are in place by following tacit and explicit rules but at the same time have the potential to create and add to the knowledge base at others' disposal. This is not to suggest that practice is the only source of knowledge resources but that it has moved to centre stage in our understanding. It is clearly an evocative frame of reference providing the theoretical base for many studies globally in which shared or collaborative learning is the central preoccupation, in professional groups (see for example Hilsdon 2004), in disciplines (see for example Graven 2004), in on-line environments (see for example Dewhurst, McLeod, Ellaway, 2004).

There are two aspects of our understanding of the theoretical underpinning of CoPs that should be emphasized. First, we see the notion of CoPs as *descriptive* rather than

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prescriptive, that is we see the notion of CoPs as a way of describing how practices are located within social contexts rather than as a tool for describing how organizations *ought* to approach their practices. Second, we see the notion as potentially applying to all social practices whatever their domain, be they drawn, for example, from commercial organizations, formal educational settings, or informal social networks. Thus our example in this paper is drawn from a formal educational setting but we would see our argument as applicable to the research and development of all CoPs.

2. The notion of CoPs that has informed PALETTE

At his beginning the PALETTE project has referred to Wenger (1998) for defining a Community of Practice (CoP). Such communities are groups of people who share a concern, a set of problems, or a passion about a topic (the *domain* of the community), deepen their practical knowledge and expertise in the area under consideration (the *practice* of the community), and interact on an ongoing basis (the *community* itself).

The relations between the members and their activities are described as following by Wenger, McDermott & Snyder (2002, pp. 4-5):

“As they spend time together, they typically share information, insight and advice. They help each other solve problems. They discuss their situations, their aspirations and their needs. ... They may create tools, standards, generic designs, manuals, and other documents. ... Over time, they develop a unique perspective on their topic as well as a body of common knowledge, practices, and approaches. ... They may even develop a common sense of identity.”

This description refers clearly to the nature of knowledge and learning into such communities. For Wenger and his colleagues, the knowledge of professionals is not independent from the act of doing their practice and enhancing it all along their professional life. This means that knowledge can not be reduced to an object or isolated information. It is dynamic, tacit as well as explicit and social as well as individual.

The relative vagueness of professional knowledge (or professional practice) has been described by Donnay & Charlier (2006). It is:

- not always available for the professional: it is constructed within professional situations which are not necessarily described with words. Practice is embedded in action and often used as routines not analyzed or consciously decided.
- not always accessible for others: it is constructed within specific contexts into a specific vision of the profession. For being accessible, practice has to be processed and decoded.
- not fully conveyed: because not fully verbalized. To specifically translate with words a complex professional action and the professional experience of someone is almost impossible.
- peculiar to each professional: professional practice determines our professional identity all the way through our professional life and within a specific organizational context. In addition, professional practice is also full of emotions and affects.
- not always transferable: it is valid for its author as long as it is efficient in his/her context. The consequence is that professionals tend to generalize their own practices and it is not easy for them to change. However in return, practices are credible for other professionals and could be a part of a collective practice.

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These issues concerning professional practice are at the heart of the PALETTE project. The aims are to analyse a particular social phenomenon – sharing and reifying professional practice within a professional community – and to develop technical services in order to support it. The development of these services is lead through a participatory methodology.

3. Different approaches to understanding CoPs in pedagogical research

In the PALETTE project, we are seeking to research CoPs in order to build technical services to support their development as communities of practice. In order to do this, it is clear that there needs to be a shared sense of what a community of practice consists of. As we discussed in the previous section, this shared sense is built around three aspects of CoPs: a shared *domain*, a shared *practice*, and a shared *community*.

However, although these three aspects are incorporated into the existing research into CoPs, different studies place a different aspect at the foreground of their analysis. For example, some researchers focus is on the *community*, element of the community of practice, as Price (2005) does in her consideration of the extent to which module teams in a business school share their tacit knowledge about assessment. Others, for example see Contu and Wilmott (2003), foreground the *practice* element of communities of practice. Finally, others emphasise the discourses that characterise the *domain* of different communities of practice, as Avis *et al* (2002) do in their consideration of the construction of learners in post-compulsory education and training. Each of these examples draws on the notions of community, practice, and domain but in each of these cases a different aspect takes centre stage and is taken as the primary unit of analysis.

The problem is that the differences between the foci of these studies are rarely acknowledged. However, the decision to place the community, the practice, or the domain in the foreground of any analysis of CoPs leads to different approaches to undertaking research and professional development within CoPs. We will illustrate this point by taking the Doctoral Programme in Educational Research at Lancaster University as an example.

4. An example of the impact of different approaches to understanding CoPs

The Doctoral Programme in Educational Research is a programme for practitioners in further and higher education, Department of Educational Research, Lancaster University. These practitioners are drawn from a variety of roles including lecturers, educational developers, e-learning professionals and, although they are mainly based in the UK, are drawn from across the world. This PhD programme involves two years of taught modules (Part 1), which result in the production of work that is of a publishable quality, and two years (Part 2) of researching and writing a 40 - 50,000 word thesis.

If we think about researching and developing this CoP, we can see that foregrounding different aspects of the CoP leads to quite different approaches.

4.1. A focus on the Doctoral Programme community

If we were to foreground the systemic aspects of our CoP, that is to focus on it as a *Community* of practice, then our focus in research would be on how the CoP functions as a

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community. For example, we might seek to understand the level of shared understanding that those involved in the CoP have of their tasks and examine the ways in which the CoP seeks to maintain a collective identity and purpose. In developing the CoP we would seek to design interventions that are focused on developing a shared identity and purpose within the community.

4.2. A focus on the practices of the Doctoral Programme

If we were to foreground the practice element of the CoP, then our focus in research would be on how to understand the teaching and learning practices of the students in the CoP. For example, we might seek to understand the way in which different teaching and learning practices relate to the quality of students' learning. Thus our focus would be on how these practices lead to a critical understanding of the subject matter rather than on the students developing a shared understanding of their identity. In developing the CoP, we would seek to design interventions that are focused on improving students' understanding of this subject matter.

4.3. A focus on the discourses of the domain of the Doctoral Programme

If we were to focus on the discourses that inform the domain of our CoP, then our focus in research would be on how teaching and learning interactions position students and tutors in different ways. For example, we might seek to understand how the discourses of discussions in the CoP led to students and tutors being positioned as passive or active and how this impacted on their experience of the teaching and learning environment. In developing the CoP, we would seek to design interventions that are focused on making the discourse explicit so that the CoP could gain a better understanding of how its members were being positioned and examine ways of challenging or changing this discourse.

Thus it is clear that these different foci lead to quite different approaches to the research of CoPs. In the first the focus is on shared identities, in the second it is on ways of improving practices, and the third it is on changing the discourse of the domain. These foci also lead to different type of professional development interventions in relation to the CoPs. In addition, members of the CoPs may have different senses of which of these foci are central to their experience of CoPs. Therefore, without a clear understanding of the different ways in which CoPs are understood by those who practice in, those who develop and those who research them, it is possible that significant misunderstandings can occur that could threaten the success of attempts to develop CoPs. It is the reason why a special task has been dedicated to develop a grid analysis that will support the diagnostic of the needs and vectors of self-development for CoPs. This tool will support the dialog between the actors.

5. Conclusion

In this paper we have shown that even within a shared overview of the idea of communities of practice, an emphasis on different aspects of CoPs can lead to very different ways of researching and developing these communities. In addition, this research and development needs to be aware of the conceptions of these different aspects held by those involved in the CoPs. This suggests that at both the level of an international collaborative research project such as PALETTE, and at the level of our work with individual CoPs, explicit discussions of our different understandings of the relations between the community,

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the practice and the domain are vital if we are to be able to take account of the impact of these differing understandings when working together.

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An Activity Perspective on

Reification Processes in Distributed Communities of Practice. Implications for Online Tools Design

Romain Zeiliger *, Liliane Esnault @

** CNRS-GATE,*

93 ch. des Mouilles

69130 Ecully

FRANCE

@ EM LYON

23 Avenue Guy de Collogue

69134 Ecully Cedex

France

ABSTRACT. This position paper considers the process of reification in the context of distributed communities of practice whose members get connected through the Internet. It focuses on the process of computerized reification i.e. reifying by constructing symbolic representations with online software tools. The aim of the paper is to explore the perspective brought by considering this process as an activity system in the sense of the Activity Theory, in order to capture some unexpected dimensions of reification. We hypothesize that constructing computerized symbolic representations would be valued by community members not merely for its capacity to create points of focus around which the negotiation of meaning becomes organized (Wenger) but also for its capacity to provide joint activities that compensate for a lack of participation. Over investing the computerized activities would eventually reshape the community. The paper builds on observations of distributed communities of practice of whom the authors are members. Implications for the design of online collaborative software tools and knowledge management tools are envisaged.

1. Introduction

In a first book Wenger (1998) presented communities of practice (CoPs) as group of people where shared practice - considered here as a social production of meaning - is a source of coherence : “practice is about meaning as an experience of everyday life” [Wenger,1998:52]. Communities of practice get organized around a process of “negotiation of meaning” which involves the interaction of two components : “participation” and “reification”. In a second book [Wenger,02] he tackled “the challenge of distributed communities”, insisting mostly on the social and business aspects without acknowledging a possible predominant role of the technologies.

Distributed communities are communities whose members are not co-located and interact through computers. With the development of Internet more communities of practice get distributed. Those communities “have to resort to technologies that are not real substitutes for face-to-face interactions” [Wenger, 02,116]. In distributed CoPs learning through observation, imitation, social participation and shared practice is more difficult than when members attend face-to-face meetings. In distributed CoPs most of the social interaction is mediated by computer-based interactions and computer-supported symbol manipulation tools. Written language for example is mediated by chat, forum, email, while spoken language is supported by teleconference tools like Skype, Netmeeting. Other kind of symbolic representations like maps (concept-map, mind-map, knowledge map) or schemas are also extensively used. In distributed CoPs it is likely that reification – giving form to our experience by producing objects - is shaped by the use of computers, even for the most technically-skilled “reflective practitioner”. As noted by [Nonaka,95] “sharing tacit knowledge takes place through joint activities and requires physical proximity”. But when there is no proximity, community members still participate in joint activities; the difference then is that these activities are computer-based. Can we then say that they share tacit knowledge ? Or do they have to make everything explicit ? Do all explicit representations have then the same status ? How available technologies shape their activities ?

There seem to be an inherent paradox in talking of communities that are founded by the sharing of tacit knowledge while they are not co-located and have to resort exclusively to computer networks. This paradox anchors in the well known and controversial debate about what we call knowledge: “In a computerized system knowledge is articulated and divorced from direct action and becomes a manipulable abstraction” [Jackson,01]. However such communities of practice exist for sure. In this paper we hypothesize that distributed communities joint activities get deeply organised around exchanging symbolic representations and that computerized reification may take a more important place - to the detriment of participation - serving perhaps other purposes than the one pictured by Wenger. We propose to adopt an Activity Theory perspective on distributed CoPs computer-based activities to help investigate this hypothesis.

2. Participation and reification in CoPs.

“Participation refers to a process of taking part and also to the relations with others that

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reflect this process” [Wenger,98:54] “it is a complex process that combines doing, talking, thinking, feeling and belonging”. In short participation is action plus relation or relation constructed in the context of an activity. Participation is a source of identity. Identity is constructed relatively to the community and is a motor for learning.

Reification is “giving form to our experience by producing objects (...) In so doing we create points of focus around which the negotiation of meaning becomes organized (...) reification in CoPs covers a wide range of processes that include ... representing, naming, encoding (...) as well as perceiving, usingin all these cases aspects of human experience and practice are congealed into fixed forms and given the status of object” [Wenger,98]. Building symbolic representations with a computer is a reification process.

The negotiation of meaning which is central to CoPs “weaves participation and reification to secure some continuity of meaning across time and space” [Wenger, 98:63] : there are “misalignments” inherent in participation as well as in reification that can be repaired and get compensated so that participation and reification form a duality and not an opposition. They shape each other. In some situations some imbalance may occur and we would argue this is likely to be the case with distributed CoPs. Wenger has foreseen this situation : “participation and reification are two channels of power available to participants” [Wenger,98:91], but he tend to explain it in terms of politics rather than in terms of “social frustration and tool addiction”.

3. Participation and reification in distributed CoPs : a few hypothesis.

The main hypothesis that will be discussed here is that distributed communities members suffer a lack of participation which they compensate by concentrating on the reification activity: the lack of participation is primarily a lack of action due to the difficulty for isolated members to **engage in joint activities**. Joint activities usually provide opportunities for building inter-personal relations. Isolated members who are deprived of joint activities have difficulties to build inter-personal relations. In distributed CoPs community members “need to devote much more time to (...) building personal relationships” [Wenger,02 :120]. We hypothesize that i) reification is then over invested to compensate this imbalance, ii) over reification is also shaped and driven by computer use. Within the Activity Theory (AT) framework, reification can be viewed as an activity system i.e. a group of people that interact with tools over time with a shared motive. We think that AT may help investigate such hypothesis.

Because the members of distributed CoPs are isolated it is likely that they engage in *individual* activities more often than in *joint* activities. In distributed communities joint activities get mediated by technologies that require efforts, specific skills, very efficient tools with probably less outcomes in term of inter-personal relations. Members that seldom meet in the real world are also likely to have more difficulties to organize their work, including organizing virtual meetings. However the community would not exist without interaction between its members and activity theory stresses that social activities are the necessary framework where inter-personal relations may be built in the course of the process of negotiation of meaning. So the members of distributed communities – of course – still

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engage in joint activities : chat, forum, tele-conferences, “e-places” and other tools abound that support “**virtual joint activities**”. Despite the efforts deployed by these systems to improve interaction and awareness it is known that such virtual activities cannot support the same level of participation that can be expected in real world meetings. There are exceptions and well known advantages in virtual networking, but it is usually recognized that “access to technology can be a barrier to communication”. Person-to-person interactions through computers have not the directedness of face-to-face meetings (there are some exceptions) and they require more skills and practice in human-computer interaction (HCI). Moreover “most technologies remain focussed on the sharing of abstracted, harder aspects of knowledge in the form of reports and documents” [Kimble,02].

In the process of mastering the computer tool, members surely develop a **practice of computer use** that eventually may - in their preoccupations - take the place originally dedicated to the practice around which the community was structured. The original practice that founded the community and the practice of computers may intermix over time. Except in specific cases (where the tools are identical) these practices are deeply different: individual work and interactions through computers take the form of exchanging symbolic representations while original practices are mediated by a great variety of tools and allow for direct experience sharing: trust building for example is conveyed by attitudes, gestures, behaviour that do not translate well with online tools.

Let us take the example of a distributed community of practice focussed on ski mountaineering (there are a lot of them). Let say that they have very few occasions to directly share their practice (skiing together): the original practice (skiing) is mediated by the ski equipment and is deeply contingent of the environment (mountains and weather), while the community interactions are mediated by computer forum and data-bases (or other computer tools). Such communities of practice have a lot of active members and are very meaningful: they do create knowledge. Community members develop both the ski practice and the computer practice over time. Their community is structured around sharing the practice of skiing, but they tend to share also computer practices and to adopt new behaviours that are shaped by the computer technology that supports their network: yes, in these communities computers do influence the practice of skiing !

What we are willing to discuss here is : what are the consequences of this dual situation on the processes of learning, identity, participation and reification emphasized by Wenger. In this position paper we will not go beyond mentioning a few research ideas and reflections. Further investigation is of course strongly required.

About distributed communities :

- In distributed communities there is little opportunity for sharing experience and negotiate meaning interactively.
- In such distributed communities the original practice and the computer practice form a duality: each one shape the other.
- In such communities participation (in Wenger sense) is low. Establishing social relations is difficult and tend to develop through the production of reifications.
- In such communities the members are in relation with computer tools before than being in relation with other members. The relation with the computer tools is a

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source of identity and a passage toward social relations.

- Because of a certain personalization of computers, human-computer interaction “takes on more and more traits of joint activity” [Tikhomirov,99:357], to the detriment of community “real” joint activities.

About over reification in distributed communities :

- In such communities there is an imbalance between individual activities and joint activities which leads to an over reification process. It causes an imbalance between participation and reification whose consequence is a difficulty to achieve “mutual recognition”.
- Over reification is also caused by the distribution of members locations and the need to explicit elements of the local context that otherwise would remain hidden.
- Reification in distributed communities may have a more social purpose than in traditional communities.
- Excessive reification is still intended to “focussing the negotiation of meaning”, but when combined with an imbalance of participation it may eventually lead to an illusion of negotiation. Reification cannot “become a substitute for a deep understanding of and what it stands for”.
- Computer-based reification activities are often the only joint activities that are available. Reification is a pretext for joint activities whose main purpose is increasing participation.
- Reification is used as a placeholder to participation (*a token* that substitutes to real participation).
- “Reifications are always potentially enriching and potentially misleading”. They require interpretation in a context and the context may be lost in distributed communities. “Participation is essential to repairing the potential misalignments inherent in reification” [Wenger, 98, 64].
- An important percentage of reifications cannot be interpreted in term of externalizing experience and thus cannot be exploited by knowledge management.
- In the wording of Actor Network Theory we would say that some reifications could be interpreted as inscriptions targeted at translating the members interests.

About the role of computers and computer-based activities in over reification:

- Reification is often centred on aspects of the computer experience rather than on elements of the discussed domain.
- Over reification also finds its roots in the appeal and extensive use of computers.
- We may have a phenomena we would call : “the computerization of reifications”. Psychological effects of computerization include “a transformation () of stable meanings of personality and personality’s goals” [Tikhomirov, 99:353]. Hypertrust, invasive computer-specific goals are among the negative effects.

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- Because of the over reification process there is an excessive focus on computerized interaction tools.
- It is known that reifications cannot “capture in their form the practice in context”. Computer based reifications cannot either, but they may convey an illusion that they are more able to do so (a computer provisional representation is “*more hard*” than its equivalent paper draft). Computer reifications may easily convey the idea that meanings are in the artefacts themselves.
- A known drawback in CSCW is that a lot of things that were implicit in presential work have to be made explicit. Computer based explicitation although necessary, may become an habit, even an addiction. “Recently there has been a trend towards recognising that there are some aspects of knowledge (..) which cannot be articulated, abstracted, codified, captured and stored” [Kimble,02]. What we want to stress here is that there is a danger for communities centred on practice in over investing symbolic representations which are “*systems from which the human actor has been removed*”.

We will now adopt an Activity Theory perspective for analysing the computer-based reification activity in distributed CoPs.

4. An Activity Theory perspective on computer-based reifications in distributed communities of practice.

1- The Activity theory framework

“Activity theory (AT) is a commonly accepted name for a line of theorizing and research initiated by the founders of the cultural-historical school of Russian psychology, Vygotsky, Leont’ev, Luria, in the 1920s and 1930s” [Engestrom, Miettinen, p1]. Over the 15 past years the Activity Theory ideas had an increased impact on such fields as learning, human – computer interaction, distributed cognition and theories of practice. The basic principles that are constitutive of the Activity Theory conceptual system and that are relevant to the issues discussed here are: the principle of unity of consciousness and activity, the principle of object oriented-ness of activity, the duality of internalization and externalization processes, the principle of tool mediation, and the hierarchical structure of activity. We shall not recall those principles with more details here : a summary may be found in [Kaptelinin, Kuutti, Bannon, 1995].

Activity theory and Wenger’s theory of learning as a social participation in communities are consistent: the idea that “practice is first and foremost, a process by which we can experience the world and our engagement with it as meaningful” [Wenger,98, 51] matches very well the AT idea that our relation with the world is mediated by activity, that activity and consciousness are united. When Wenger says that “reification shapes our experience” he is consistent with the internalization/externalization principle. When he says that “a good tool can reify an activity” he agrees with the tool mediation principle. The social theory of learning pictured by Wenger fits with Russell view of learning “as expanding involvement – social as intellectual – with some activity system over time” [Russel,02]. The role of technology – in particular ICT - which is framed by Vygotsky tool mediation principle, may have been underestimated by Wenger. Some Activity Theory proponents like Tikhomirov insist on the “psychological effects of computerization”. Some effects like “a transformation

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in the whole system of motives, stable meanings of personality, and personality's goal" [Tikhomurov,99:353] may be relevant to the study of distributed communities.

We shall now use some of those principles to investigate the hypothesis of distributed CoPs over-reification activity. In the discussion that follows we now use the term "**activity**" with reference to Leontiev's model of activity structure.

An Activity Theory perspective on reification in distributed CoPs. Distributed CoPs members have a domain of activity (professional or not) where their practice is developed; some computer-based joint activities through which they interact with other community members, an individual (external) activity and a mental activity (internal, reflexive) related to the practice of the community to which they belong. Roughly, what AT can teach us is : that each one of these activities is driven by a purpose (principle of object-oriented-ness), each activity has a goal-oriented level of actions and a contingency-driven level of operations where computer is a mediating tool: computer practice changes the range of the external activities (the domain one and the community one as well) which in turn shape the community members mental activity (internalization/externalization loop).

Adopting the framework of Activity Theory, the structure of the computerized reification activity of virtual communities members could be viewed as follows :

- operations (contingent upon the computer environment) = operations on computers, manipulating symbolic representations using online tools features.
- actions (directed to a goal)= constructing symbolic representations (text or graphical) Directed to one of these goals :
 - a) externalizing self thought (mind mapping).
 - b) interacting with remote members (ex shared editing, joint navigation, ...).
 - c) preparing points of focus for negotiating meaning with others (drafting).
 - d) practising the tools.
 - e) fulfilling a need for action.
 - f) externalizing tacit knowledge.
- activity (directed by a motive)
 - a) political : commitment to action is motivated by acquiring power within the community.
 - b) identitary : acting is valued because it is viewed as a source of identity
 - c) enactional : acting is motivated by an appealing tool.
 - d) relational : action is a pretext for working with others.
 - e) asset management : acting is targeted at capitalizing codified knowledge.

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With this 3-levels structure, what Activity Theory brings to this perspective on isolated members activity is :

- a clear distinction between action – which translate to an observable behaviour , and activity - which is directed to an unobservable motive: building a single symbolic representation (a single goal) may be interpreted in terms of very different motives.
- a clear distinction between the actions (directed to a goal) and the operations both constrained and driven by the computerized tools. It is important to recall the flexibility of this structure overtime [Leontiev,72]: an unsuccessful operation may become a conscious action. For example, the mastering of a difficult computer tool may become a conscious goal, one of the pervasive computer-related goals mentioned above. On the contrary an appealing tool may trigger an enactional behaviour that blur the initial goal.
- Distributed CoPs get shaped by computer practice in so far that computer networks amplify the motives mentioned above.

Reification : activity, consciousness and knowledge.

“The object of knowledge is practical in the sense that it depends upon a specific kind of practice for its existence” [Dewey]. It makes sense then to say that communities of practice do create knowledge. However tacit (soft) knowledge is hard to formalize because “it is - in Polanyi’s terms - knowledge that is not at the forefront of consciousness [Polanyi,67, coined by Kimble,02]. Precisely, according to AT, activity is what mediate our relation to the “real world” [Nardi,96]. What we learn here is that even for the most “reflective practitioner” it is only **in the course of activities** that the forefront of consciousness may move so that tacit knowledge can become explicit. Codifying explicit knowledge comes second only: consciousness comes first. For that reason it is of prime importance that community members participate in activities – joint as well as individual; and it is important that online services promote activity, even before offering knowledge management services. This is where over reification fits in: we said that it may be interpreted at first as resulting from a frustrating lack of possibilities for action; but it may also evolve toward an **opportunity for activities**, on one condition however: that the support tools do not exclusively consider it as directly aimed at constructing codified knowledge. In other words supporting knowledge creation resorts mainly to supporting the activities in the course of which knowledge may eventually be externalised.

5. Implications for distributed CoPs tool design.

The hypothesis proposed above certainly requires further investigation. In this position paper we begin envisaging the outcomes it has in terms of designing online services for distributed CoPs.

- Reification software should provide an affordance (ability) for activity i.e. they should tend to engage users into **individual and joint activities**. What we want to

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stress here is that they should not merely facilitate operations (in the sense of AT) in being usable. They should promote action, they should appeal to the community members so that they commit into more activity. In short they have to promote **constructivism**. Direct manipulation through drag and drop operations, sketching, mind mapping tools are good examples.

- Reification services should support the passage from individual to joint activity and vv. They should not focus on finalized representations to the detriment of negotiable representations. They have to provide a free space (both in the concrete and abstract sense) for interaction and negotiation: graphical representations (maps or schemas) which have a loose structure are good because several participants may share the “screen real estate” for expressing their views.
- If we accept the hypothesis discussed here, we cannot consider that all computer reifications are explicit representations of tacit knowledge, nor that they even contain symbols referring systematically to objects in the world. Such reifications find their consistency in the intent of their authors, which remains largely inaccessible to computers. Reification services should not impose a logical consistency, nor build some processing on it. Hybrid representations are welcome.
- However reification online services should facilitate a possible evolution of the constructs toward representations consistent with knowledge management. This is called “incremental formalization”.

6. Conclusion

“If one simply looks at the manipulation of symbols, one is purely at the level of information theory. In contrast, Activity Theory (...) deals with the thought processes that occur among group members as they carry out activities that involve the mutual manipulation of these symbols and the mutual negotiation of their meaning” [Sherry, Myers, 98]. We have proposed that what distributed community members have in mind, their motives for engaging in symbol manipulation activities may go far beyond the aim of expliciting some tacit knowledge related to their experience in practice. Their motives may be political, identity, enactional, relational, as well of course as truly aimed at producing knowledge assets. A given reification may serve mixed purposes. Our attributing of such motives to distributed CoP’s members - although based on observations - certainly requires a deeper investigation. In the meantime we propose as a precaution that the design of online services targeted at supporting the activities of community members should not assume that all computerized reifications are a *sort of knowledge*. Designing services that can support joint activities driven by other motives should be also a concern.

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Modelling activity and development of communities of practice

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Manfred Künzle*, Bernadette Charlier*, Amaury Daele*

**University of Fribourg
Didactique Universitaire
90, Bd de Pérolles
1700 Fribourg
manfred.kuenzel@unifr.ch, bernadette.charlier@unifr.ch, amaury.daele@unifr.ch*

1. Abstract

This paper aims at designing a model that depicts the activities and the issues of development of a Community of Practice (CoP). It particularly addresses consultants and facilitators who are asked to support CoPs throughout their life cycle. After a literature review, the authors describe their exploratory study on several CoPs involved in different domains of activity. Five groups of CoPs activities (management, social, project-oriented, small actions and metacognitive) and three activity patterns are proposed in a model in order to distinguish different types of CoPs from the point of view of their development. Then the CoPs observed throughout the study are classified in different types following their preferential activity and objectives. Finally, further reflections are proposed for the support of CoPs activities as well as for the development of suitable technical services for CoPs.

KEYWORDS : *Communities of Practice, activity, metacognition, model, development*

2. Introduction

In the context of a European research and development project, the PALETTE project [Palette 07], we are looking for a community of practice (CoP) model that helps consultants and facilitators to grasp the situation in the community and estimate how the community will go on to develop. We have found important prompts in research and publication concerning CoPs, but not the model we are looking for. So we decided to build a model upon our own research on communities.

Research and publication concerning CoPs looks for instance at the participation in communities [Fuller et al. 05], how they operate online [Bourhis et al. 05], how they build and share knowledge [Klein et al. 05] what contribution they make to knowledge management [Hew & Hara 06] and how they are integrated in operations [Bate & Robert 02]. The PALETTE research project asks similar questions. Among other things, we are examining what effects jointly developed visions, work scenarios and Web services have on the development of CoPs. However, adopting an intervention approach of research, we will have to wait a little while for processed results bearing the status of scientific concepts and theories.

Others attempts to understand the phenomenon of CoPs in conceptual and definitional terms [Garrety et al. 04]. They struggle with the difficulty that CoPs, being a social phenomenon, undergo continuous development [Cox 05] and do not conform with conventions. The research today is no longer for a definition of CoPs which is as specific or comprehensive as possible, but rather a sophisticated conceptualisation [Dubé et al. 06] providing statements on what types of CoPs there are, what common features, needs and goals they have, and how they get there. Palette will also be able to make contributions to this.

This work with still just a few dozen communities but organized in professional activity domains is a step in that direction. We want to create a model that provides support to consultants and participants in analysing their community and helps to estimate how the community will go on to develop. Consulting and practice makes different claims on a model than science does. Science is interested in describing phenomena as sophisticatedly as possible and creating concepts with a theoretically well-grounded basis. It is also not afraid to create complex models. When science uses sophisticated models for surveying and analysis, there is sufficient time available. For consulting it is more important to get the first impression quickly and with a reasonable amount of effort; typical forms of expression are required. Typologies have a second advantage; in addition to fast classification, they also provide information on alternatives. Thirdly, they enable standard offerings to be developed and assembled for similar CoPs. Community consultants and facilitators need to estimate potentials and developments in their work. Types make it possible to group and compare experiences. Do similar types of communities also go through similar experiences?

In this paper we report the *construction of an activity model (3)* by looking at activity patterns in CoPs. A *decision matrix (4)* allows attributing CoPs to the

elements of the model. We finally *arrive at a typology (5)* of CoPs by main community and domain activities, secondary activities and direction of development. We then draw *conclusions for service development (6)*.

3. *Constructing an activity model*

We chose a simple method in order to arrive at community types. Firstly, we recorded activities by eight communities and grouped them. According to Leont'ev [Leont'ev 81] we distinguish activity from the goal oriented action and the automatically performed operations. Following Engeström [Engeström 87] we look at the system composed of subjects realizing the activity, the object and tools of the activities and the community sharing the same object. We found five groups of activities: project-type activities, short term domain activities, management and social activities, and coordinated metacognition or reflection. Almost all recorded activities can be assigned to these groups. Using this activity model we interviewed participants and facilitators from twelve more communities. Were there typical activity patterns? We found three groups of activity patterns. The next developmental steps for CoPs with one of these patterns were examined on this basis. At the moment our initial data prove our assumption that the groups with typical activity patterns also display typical developmental patterns.

Naturally we are planning to test our hypotheses and suspicions with advanced data and would also like to encourage other research groups to do so. For the moment we can take them on our journey so far and describe how we proceeded and what data and considerations we used to create the provisional models, the activity model and the typological developmental model.

Structured interviews were conducted with eight CoPs taking part in the Palette research project, with the CoPs being asked about their activities among other things. The summary was approved with the CoPs, meaning that we can assume that we recorded them correctly and more or less completely.

Two groups of activities were easy to identify. Firstly, activities which were called projects by the CoPs themselves and which include the creation or revision of documents or conducting of smaller evaluations or research projects. This first group of activities is distinguished by a high degree of coordinated sub-activities and by the fact that a goal is communicated.

A second group of activities such as a Christmas dinner, going for a drink together or congratulations on a new job can be classified in the "social activities" category. They are distinguished by the fact that they have nothing to do with the domain, the community's actual interest, have no other explicit goal than to promote community cohesion.

We have the problem of delimitation just with these two categories. Some activities within a project are definitely social activities and a joint project also

promotes community cohesion. However, delimitation is only a problem if one intends to assign every activity to only one category or if categories are required which selectively contain only certain activities. Our goal, though, is to record types of communities later, which can be, for example, "Communities with a high level of project activity and little social activity outside projects" or "Communities with a high level of social activity but without projects". Therefore, at the moment it is enough to discover that we can differentiate projects from purely social activities and are aware that social activities are also always included in project activities.

A third group of activities is more difficult to grasp. These are activities such as distributing information on interesting links or conferences via a mailing list, posing questions and reacting to the answers, making one's own experiences available and discussing them with others, or also making important documents available to other people. These are short-term activities which are communicated with no higher objective or where the objective is inherent to the activity itself (I would like an answer to my question). These activities are also not co-ordinated with other activities as is the case in a project. They therefore really need to be clearly distinguished from the project dimension. Now there is, however, an important exception to this. Some more minor activities, typically questions and answers concerning certain e-learning platforms, for example, can lead to a project, to make a compilation of FAQs on the topic for example. Some groups may even decide to process the information as a report with recommendations on e-learning platforms. A project can therefore arise from short term domain activities.

Short term domain activities can be distinguished from social activities by their intentional reference to a domain inherent to the very first activity. Again it is clear that the CoP's domain can also be talked about during social activities like a Christmas dinner and that every exchange of questions and answers is also a social one. We therefore distinguish short term domain activities from social ones by their primary intention, to exchange via the domain.

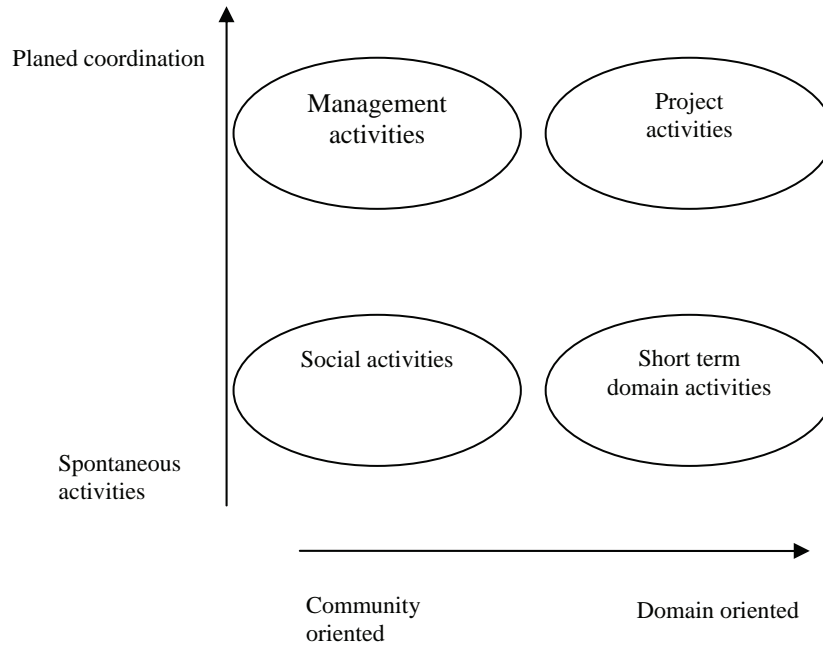


Figure 1. *Groups of activities and metacognition. The terms community and domain are used following Wenger [Wenger 98].*

As a fourth group we summarise four management activities which revolve around the filing of documents, organisation of meetings, facilitation, internal role distribution, work processes and setting up mailing lists. We call this the management category. It must be distinguished from the project. A series of activities is management if it refers primarily to the community. It is a project if it refers to the domain. The trickiest distinction is that from the social activity. Is the Christmas dinner now social, or management? If the objective is to strengthen community cohesion, then the activity is social. If the objective were to be to strengthen community organisation, because the Christmas dinner was the test run for an invitation system, the invitation procedure would be an management activity. Again, the objective delimitation is not the centrally important one for us, or the only one, but we are additionally able to take the subjective judgement. Members can decide whether they describe the activity as primarily social and improving cohesion, or primarily management and improving functioning.

We found a number of activities very difficult to classify: now if a working group is formed to investigate, reflect on and improve the organisation of the CoP – what is that? If the CoP gets together and exchanges experiences with its latest project– is that social, project-like or management? If we take intention as a

differentiation criterion, then the question is of improving similar future processes. If we describe the process, then that is a reflection. For such cases we agreed to introduce a new category, the metacognitive one, which can concern each of the four basic activities. Activities are assigned to this category if they are somewhat longer and more coherent, if they signify an exchange with several members, are therefore social and if they cover one of the basic categories, the domain-related projects or short term domain activities, or community focused social or management activities.

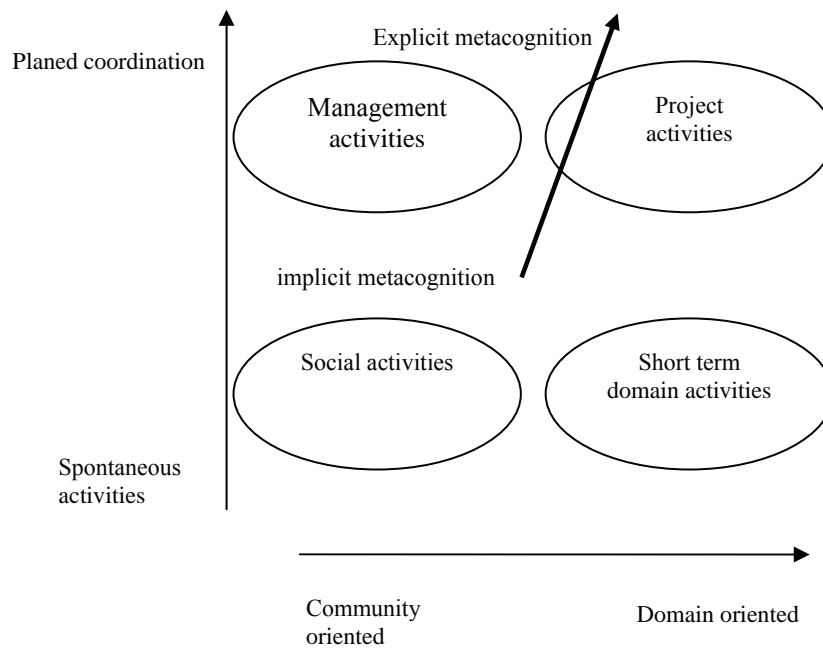


Figure 2. Four groups of activities and metacognition on each of them

4. Summary of the decision matrix for activities

This model could be used in a real context by labelling activities choosing among the two possibilities qualifying each of the following dimensions:

Domains at the focus: short term domain activities or projects

- Associated activities with communicated goals: *projects*
- Small combinations of activities with inherent goal: *short term domain activity*

Community at the focus: social or management activities

- Focus on explicitly named processes and structures: *management activities*
- Focus on cohesion and exchange: *social activities*

A Domain or Community activity at the focus: *metacognitive activity*

– *Explicit*: organised reflection with suggestions for improvement, aside from the basic activity.

– *Implicit*: Brief evaluations, retrospective reflections during the activity: understood as part of the basic activity.

The following description of the community think table – a community of knowledge managers – is an example how we use this matrix.

Think table has no *domain* related projects but a lot of short term activities that are mainly exchanges of one hour on a certain thematic during the two daylong meetings a year or short email exchanges over the mail list. These meetings are the main management activities, well planed with a lot of management activities. Social activities in between are rare. The community or domain activities are not explicitly reflected. Short and implicit evaluations of the last meeting steer the organisation of the next. The CoP could develop further activities. Because it has now some years of tradition a reflection of its activities could be interesting and the members could also be ready for a first project.

5. *Arriving at a typology*

Using this activities model we investigated the surveying and self-presentation of 12 communities which met for an exchange within the scope of the Swiss Agency of Development. These CoPs originate from extremely diverse domains such as engineering, developmental aid, gender interest, cultural diversity, education, environment, disaster.

We wanted to find out from these CoPs which activities are important for them and how satisfied they are with the activity. Important activities with which they are not satisfied simply signify a development potential which need not to be motivated.

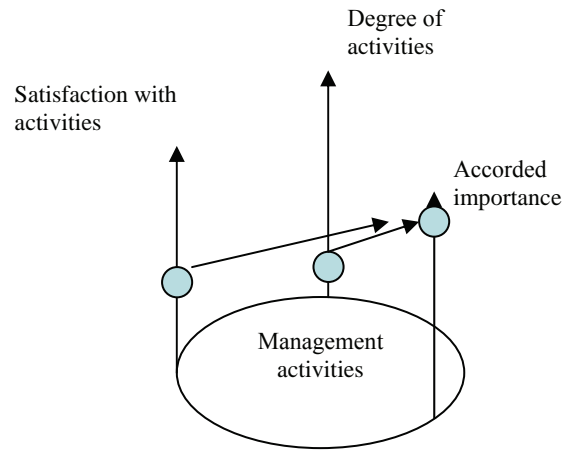


Figure 3: *The activity analysis vectors. We ask CoP members about levels of satisfaction with activities and the degree of activities (circles). A vector (arrow) is constructed by linking these levels with the accorded importance (cercle). Low satisfaction and a low degree of activity but a high accorded importance gives a rising vector that means a development potential.*

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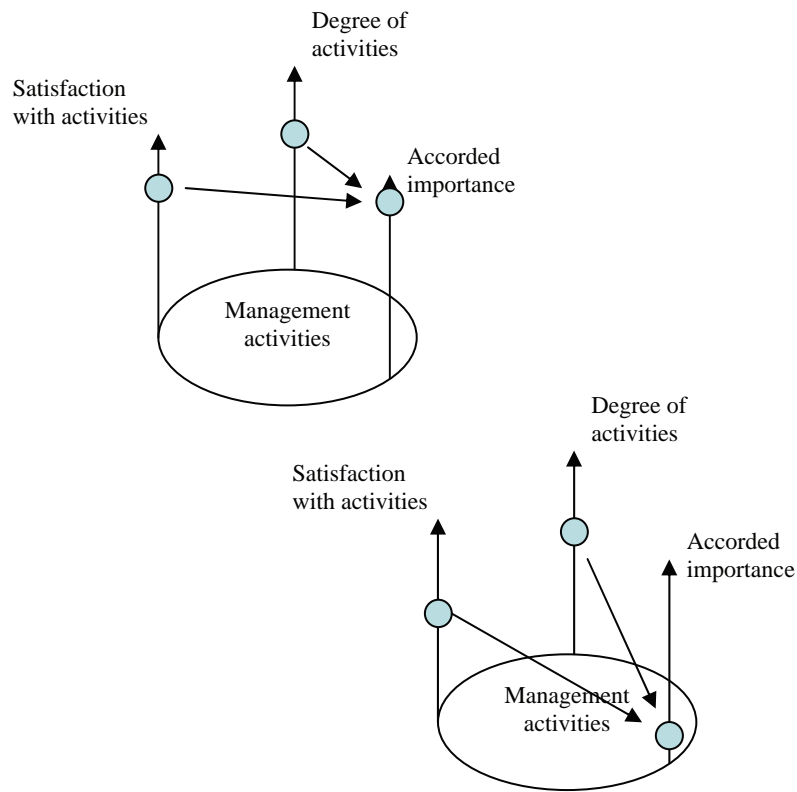


Figure 4. *Important activities with high degree of activity and high satisfaction have low development potential on this both level and satisfaction. The vectors towards the accorded importance are flat on a high level. Activities with low accorded importance need motivation before they can be developed. Vectors drop.*

Further, we wanted to know how they view their further development along this developmental potential. Twelve communities are not yet sufficient for a real model formation. Yet we are nonetheless able to decide whether, within the activities, each of these communities has a highly autonomous, individual profile or whether groups with similarities, therefore types, can be recognised. For an initial examination we had the opportunity to call in the structured, well-prepared self-presentation of thirteen other communities in order to be able to check the initial typology.

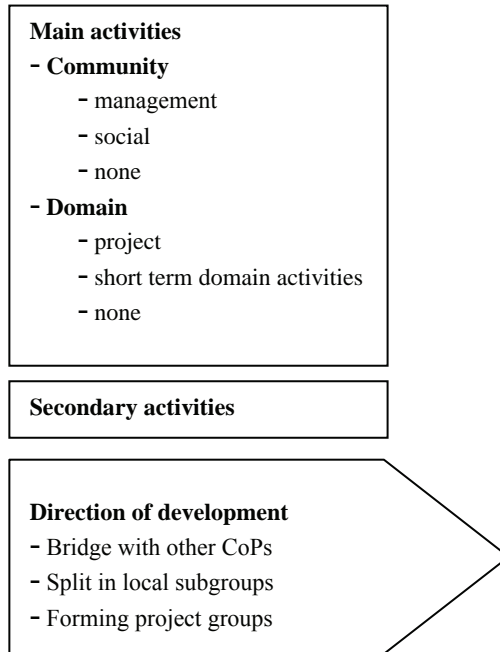


Figure 5. Activity and development grid for communities: Main activities, secondary activities and direction of development are major dimensions for the description of CoP. The examples stem of the twelve investigated CoP.

Therefore we used an activity and development grid to interview the CoPs. We asked for the main and the secondary activities (neglected or non existing activities) in both the community and the domain. Then we enriched the direction of development we detected with the activity analysis vectors with specific information about the CoP to understand the developmental directions in its context. We were especially in types CoP. We are able to distinguish the following three types at the moment.

1. We see communities which come together within an operation and implement joint projects. These communities have a low focus on purely social activities, because this already occurs during the remaining daily work. The project establishing the domain itself is so all-pervading and is so taken for granted that it is not described as an actual community activity. This CoP consciously focuses its main attention on organising the CoP and processes before, during and after its project activities and has its project and its organisation as the main object of metareflection.

Further development is seen in having a number of members of the CoP exchange with other similar communities, primarily making social contact, but then

also carrying out smaller exchanges of experiences, mainly on the fringes of conferences which deal with the domain of their own project.

Typical CoPs with this form of expression are those which deal with training procedures or disaster operations. The “Projects in an institution” CoP develops management and project-related activities as a whole, sub-groups spin off and take up social contact with other similar communities and also cultivate minor, joint activities with these communities.

2. A second community type consists of experts in a domain who wish to pass their topic onto others, this can be gender, culture, north-south divide and other subjects. Let’s call them “Communities with a mission”. They attempt to make available joint exchange and information on activities on their subject and cultivate extensive social exchange primarily in order to form opinions and judgements, therefore metareflection, on certain topics. Their development project is, then, more of the management kind: small local groups are meant to implement local projects. Further, they are interested in having as many people as possible deal at least peripherally with their topic. “Communities with a mission” primarily develop metareflective and management activities concerning their domain, alongside many social and minor activities and try to grow if possible. Further, as soon as enough people commit themselves locally, they have a tendency to spin-off local management units which find their cohesion in small local projects.

3. The third community type is that which practises an identical activity in its profession. For example, these are water engineers, development co-ordinators or coaches. Their main concern is to make know-how mutually available and to provide support, of a social nature too, in their daily work and in the event of problems. Social and minor activities are rarely accompanied by metareflection. From time to time a sub-group develops project-like activities or makes efforts to improve internal organisation.

6. Further meanings and conclusions for services development

Interviews with the CoPs members and moderators gave further meanings and tips for conclusions of the previous findings:

The conscious development of all groups occurs via sub-groups. These sub-groups implement projects, take up contact with other communities and network there or form local sub-groups with their own minor activities.

Communities with exclusively social and minor activities to do with the domain produce few documents and are satisfied with their current communication methods, which they are also familiar with from their workplace. They rarely report a difference between importance of an activity and satisfaction with it.

CoPs which place value on metareflection need the most intensive facilitator activity in order to keep reflection coherent, achieve profundity and to analyse. The

current communication instructions do not support cohesion and analysis of metareflection.

CoPs which implement projects do this in small groups. Their problem is making findings in the project and the documents accessible to others. Communities with current projects or with planned projects benefit from information and knowledge management tools.

In this perspective, PALETTE doesn't aim at offering a new integrated and exhaustive technological environment for CoPs. It aims [Gorga, 2007] at offering a set of services tailored to the specific needs of CoPs. In other words, PALETTE would allow the adaptation of the services performed by its users while using it, in order to satisfy the needs that were not properly accounted for in the original "version". Considering the specific case of CoPs activities system, tailoring could take the form of modules or features which can be added to or removed from the system by its administrator or final users. The promotion of such technical solutions as tailoring for example imply, beyond the interoperability of system, the necessity to depict the user perspective about tools functioning. That is the reason why interoperability issues and participatory design methodology constitute the ground of the PALETTE project.

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Form@HETICE :

... une étude de cas vue sous l'angle de la théorie des communautés de pratique

Arnaud Milstein, Brigitte Denis

*Centre de Recherche sur l'Instrumentation, la Formation et l'Apprentissage
Service de Technologie de l'Éducation - Université de Liège (CRIFA-STE-ULg)
5, Boulevard du Rectorat (bât. B32)
B-4000 Liège (Belgique)
arnaud.milstein@ulg.ac.be
b.denis@ulg.ac.be*

RÉSUMÉ. La notion de communauté de pratique peut jouer un rôle important dans une nouvelle réflexion sur l'apprentissage. De nombreuses théories sur le sujet se multiplient dans la littérature. Néanmoins, comme le soulignent Dameron et Josserand (2005), il manque une analyse processuelle du développement des communautés de pratique. Il existe un décalage réel entre la richesse conceptuelle des travaux sur cette forme d'organisation et le peu d'études en profondeur sur la dynamique de ce type de groupes, les « phases » de leur développement ainsi que sur l'impact effectif du partage des pratiques. Un certain nombre d'enquêtes (Dameron & Josserand, 2005 ; Cappe, 2005 ; Laferrière, 2005) ont déjà été réalisées. Notre travail entre dans cette démarche de validation du concept de communauté de pratique. Nous présentons ici une étude de cas : le projet Form@HETICE. Cet article décrit notre travail d'observation de la situation actuelle et d'identification de l'existence ou non de communautés de pratique au sein de ce projet.

MOTS-CLÉS : communauté de pratique, Form@HETICE, apprentissage social, formation continuée, partage de connaissances, réseau d'échanges, apprentissage, Technologies de l'Information et de la Communication, TIC.

1. Introduction

Actuellement, une perspective sociale de l'apprentissage influence de plus en plus l'organisation de la formation continue. C'est dans ce contexte que s'inscrit le développement de communautés de pratique (Lave & Wenger, 1991 ; Wenger, 1998 ; Wenger, 2005). Toutefois, cette notion reste encore floue et devrait être davantage être validée (Dameron & Josserand, 2005). Cet article vise à contribuer à clarifier ce concept et à l'illustrer à partir d'une étude de cas.

2. Une étude de cas: le réseau Form@HETICE

2.1. Objectifs

Form@HETICE est un réseau de partage de connaissances dans le domaine des Technologies de l'Information et de la Communication en Éducation (TICE). Il s'inscrit dans le contexte de la formation continuée d'enseignants des Hautes Écoles en proposant à des acteurs de terrain une série de formations et d'accompagnements à l'usage critique des TICE (cf. <http://www.stecrifa.ulg.ac.be/formahetice>).

Basé sur une étude de besoins (Deschryver & Charlier, 2000), ce projet a pour objet d'encourager et de promouvoir au sein de l'enseignement supérieur (Hautes Écoles de la Communauté française de Belgique) l'utilisation pédagogique et critique des TICE dans les pratiques des enseignants. Cinq axes contribuent à atteindre cet objectif :

- organisation de formations à l'usage d'outils et de supports technologiques destinées aux enseignants et étudiants des Hautes Écoles ;
- réalisation et mise à jour régulière de ressources de formation et d'auto-formation ;
- capitalisation des pratiques existantes et dissémination de ces expériences au sein du réseau Form@HETICE;
- accompagnement des enseignants dans la mise en place de projets innovants recourant aux TICE ;
- dynamisation, élargissement et pérennisation du réseau d'échanges Form@HETICE.

2.2. Activités du réseau

Les membres du réseau Form@HETICE sont des enseignants des Hautes Écoles (HE) dont certains ont un statut particulier, celui de « personne ressource » (PR). La mission des PR est l'implémentation technique et pédagogique des TIC dans l'enseignement et le soutien aux collègues intéressés par cette problématique.

Ils se réunissent en moyenne une fois par mois lors de **journées plénières**. La matinée est en général consacrée à des présentations et des discussions sur des sujets

choisis. L'après-midi est consacrée au travail en groupes thématiques. Entre les plénières, des outils sont mis en place pour faciliter les échanges à distance (site, liste de diffusion, Wiki et forums). Mais ces derniers sont en général spontanément très peu utilisés, les échanges et le travail s'effectuent avant tout en présentiel.

Les membres des **groupes thématiques**, avec l'aide d'un animateur, se fixent des objectifs et se divisent les tâches pour les atteindre. Ils sont responsables de leurs objectifs et de leur fonctionnement en groupe. En 2005-06, le réseau comportait quatre sous-groupes :

- **Le groupe « Formation à Accès Permanent » (FAP)** réunit une dizaine de personnes. Dès la première réunion, le groupe s'est basé sur les intérêts et les aspirations des enseignants à propos de la mise en place de formations accessibles à distance au sein des HE. Ses membres estiment que l'ambiance de travail est bonne et disent avoir envie de participer, d'apporter des idées et de partager, et tout simplement de se voir, car géographiquement, ils sont très éloignés les uns des autres et ils sont intéressés par ce qui se passe dans les différentes HE. En plus des journées plénières, le groupe a communiqué par e-mail pour échanger des informations ou poser des questions à d'autres membres. Les documents produits par le groupe, principalement via un Wiki, traitent entre autres de l'intégration de «l'enseignement virtuel» en formation initiale, de la présentation d'une collaboration virtuelle et d'une série de liens vers des sites intéressants dans le domaine.
- **Le groupe « Stages-TFE »** travaille sur le suivi des stages et des Travaux de Fin d'Études grâce aux TIC. Il s'est fortement réduit en cours d'année car les participants étaient très peu constants. Huit ou neuf la première fois, deux à trois en moyenne durant l'année. Lors de la première séance, le groupe a décidé de clarifier les deux concepts que sont « le suivi de stage » et le « travail de fin d'études ». Un premier problème est de suite apparu : il existe de nombreuses différences entre les départements des HE en matière de suivi de stages et de TFE. Après réflexion, une seconde difficulté s'est manifestée : les participants se sont rendus compte que les notions de stage et de TFE ne sont pas aussi liées qu'on aurait pu le croire. Le groupe a donc séparé les deux thématiques pour se concentrer uniquement sur l'utilisation des TIC dans le suivi des étudiants en stage. Durant les séances, le groupe et l'animateur ont surtout travaillé sur l'identification et l'analyse d'outils et de logiciels permettant un meilleur suivi à distance et un meilleur encadrement des stages. Comme le groupe précédent, celui-ci s'est uniquement vu durant les journées plénières et a communiqué à distance grâce aux e-mails et au téléphone. Les documents du groupe sont centrés sur les réflexions à propos des questions et des difficultés récurrentes liées à la gestion des stages.
- **Le groupe « Scénarios pédagogiques »** développe et imagine des scénarios pédagogiques recourant aux TIC. Le noyau du groupe qui resta le même durant l'année comprend quatre membres. Une ou deux personnes supplémentaires sont venues occasionnellement participer aux réunions. Le groupe s'est vu régulièrement lors des journées plénières, mais a très peu communiqué en-

dehors de celles-ci. L'animatrice a pris le rôle de facilitatrice plus que celui d'expert, contrairement au groupe « maîtrise de la langue française » et « Stages-TFE » où l'animateur jouait ces deux rôles. L'objectif du groupe était de construire une banque de données englobant une série de scénarios pédagogiques incluant les TIC. Mais durant l'année, le groupe a rencontré un certain nombre de difficultés qui ont freiné les échanges, dont le départ prématuré des membres avant la fin des réunions et le manque de conviction de certains quant à la pertinence de rédiger explicitement des scénarios pédagogiques. Finalement, chaque membre a travaillé de manière individuelle sur son scénario. Ceci a eu pour conséquence de limiter les échanges et les discussions au sein du groupe. L'animatrice a centralisé les différents travaux afin de les diffuser via le site du réseau. Les productions et les documents du groupe comprennent des exemples et des grilles d'évaluation des scénarios pédagogiques ainsi que des canevas d'élaboration d'un scénario.

- **Le groupe « maîtrise de la langue française ».** Ce groupe aborde l'apport des TIC dans la maîtrise de la langue française et comprend sept à huit personnes. Au départ, les personnes se sont rassemblées autour de la problématique des difficultés que rencontrent les étudiants confrontés aux exigences de maîtrise de la langue française. Le groupe est resté stable et soudé tout au long de l'année. Il a travaillé sur différents outils et logiciels permettant l'amélioration de l'orthographe, de la syntaxe et de la grammaire des élèves. Les membres du groupe ont exprimé des demandes précises à l'animateur concernant des difficultés rencontrées par leurs étudiants. Celui-ci a surtout joué le rôle d'expert en amenant des ressources lors des réunions. Cela n'a pas empêché les membres du groupe d'apprendre et de partager leurs points de vue, mais il n'y a pas eu de réelles productions communes. L'animateur a réalisé un certain nombre de démonstrations interactives de logiciels, avec pour but d'entamer des réflexions sur leur utilisation pédagogique. Les membres du groupe disent avant tout venir chercher de l'information. Le groupe s'est surtout rencontré durant les journées plénières, mais la communication passait aussi par les emails et le téléphone. Une personne dans le groupe a pris le rôle de secrétaire, ce qui permettait aux participants de recevoir après chaque réunion, un compte-rendu de ce qui avait été abordé et de garder une trace des discussions. Les objectifs du groupe ont évolué durant l'année en fonction des demandes des participants. Dans les productions du groupe, nous pouvons retrouver des documents sur la mise en page d'un document en traitement de texte (ici Word) et une liste (non exhaustive) de « bons logiciels » à utiliser en français.

2.3. Analyse sous l'angle de la théorie des communautés de pratique

Les membres du réseau Form@HETICE, dont ceux des groupes thématiques, poursuivent certains objectifs communs et s'organisent d'une certaine manière pour les atteindre. Mais peut-on qualifier ces groupes de « communauté de pratique » (CP) ?

a) Cadre conceptuel

Quels critères prendre en compte pour mener cette analyse ? Après une revue de la littérature (Cappe, 2005 ; Dupouët *et al.*, 2002 ; Laferrière 2005 ; Laferrière *et al.*, 2005 ; Vaast, 2002 ; Wenger, 2005), il apparaît que ce concept ne fait toujours pas l'objet d'une définition unanime. Notre approche se base sur une identification de ce type d'organisation à partir de différents critères (ou caractéristiques). Elle vise également à étudier leurs apports potentiels et leur impact sur le fonctionnement d'une telle communauté.

Selon nous, lors d'une analyse de cas, pour identifier ce type de groupe, les critères suivants doivent être pris en compte :

1. **Le contexte.** Il s'agit d'observer et de prendre connaissance du contexte où se développe la CP (historique, temps d'existence, rôles des membres, cultivée ou spontanée). Il s'agit de voir si le contexte est propice à l'apprentissage et au développement de groupes d'échanges.
2. **Les apprentissages personnels des membres.** Les membres d'une CP sont là avant tout pour réaliser des apprentissages dans leur domaine professionnel. Il est donc important d'identifier les apports de ce type de groupe dans les pratiques individuelles des membres. Nous devons identifier à quel(s) niveau(x) les apprentissages ont eu lieu et avec quels effets.
3. **Les trois critères de Wenger.** Les CP permettent de cadrer et structurer le travail collaboratif afin de systématiser les apprentissages et pérenniser un réseau d'échanges. Wenger (1998) propose trois critères nécessaires (mais pas suffisants) pour identifier une CP : l'engagement mutuel, l'entreprise commune et le répertoire partagé.
4. **La dynamique du groupe spécifique.** Une CP demande une dynamique de groupe spécifique, l'animateur doit avoir un leadership démocratique. Les membres quant à eux doivent s'impliquer dans le travail de groupe et favoriser au maximum les interactions. Le respect mutuel entre les membres est primordial et doit être omniprésent. Toute décision importante doit être le fruit d'une négociation permanente. Les membres doivent être dans un état d'esprit de coopération et pas de compétition. Chacun vient avec ses compétences et son niveau d'expertise dans le domaine.
5. **La structure des groupes.** Idéalement, une CP demande plusieurs couches successives (le noyau, les membres actifs et la périphérie) ainsi que la présence d'experts et de novices.

Entendons-nous sur l'utilité de cette approche. Il ne s'agit pas de rentrer dans une (inutile) démarche d'identification sur base de critères donnés dans le seul but qu'un groupe puisse affirmer porter l'étiquette « Communauté de Pratique ». Notre but est de mieux comprendre le fonctionnement d'une CP et de permettre de mieux distinguer ce type d'organisation par rapport à d'autres types de groupes existants comme une communauté d'apprenants ou une communauté d'intérêt (Henri et Pudenko, 2002).

b) Méthodologie

Pour identifier l'existence ou non de communauté(s) de pratique au sein du projet Form@HETICE selon ces critères, nous avons recouru à différentes méthodes : questionnaire adressé aux membres des groupes thématiques, interviews de la promotrice du projet et des animateurs des groupes, observations personnelles et discussions informelles au cours des réunions plénières.

Critères Méthodes	Contexte	Apprentissage	Critères de Wenger	Dynamique de groupes	Structure de groupes
Questionnaire		X	X	X	
Interviews	X		X	X	X
Observations	X				X

Le questionnaire a été créé à partir de la théorie sociale de l'apprentissage de Wenger et à partir de différents outils déjà utilisés dans le domaine. Nous nous sommes inspirés des grilles de lecture proposées par Cappe (2005, p. 8) et par Laferrière (2005, p. 6) ainsi que de la grille d'évaluation sur la participation à une communauté proposée par Langelier (2005).

c) Public-cible

Notre population est constituée des membres des quatre groupes thématiques présents au sein du projet Form@HETICE au cours de l'année 2005-2006, chacun de ces derniers pouvant être considéré comme une CP potentielle.

2.4. Résultats

L'analyse des données indique, sans équivoque que les groupes thématiques ne répondent pas à l'ensemble de nos critères (Milstein, 2006). Mais notre travail ne s'arrête pas là : nous pouvons identifier les points forts et points faibles de ces groupes et leur proposer des pistes d'action et de réflexion.

Nous constatons que les personnes ressources (PR) disent développer leurs compétences au niveau des TICE au sein des groupes thématiques. Seuls les membres du groupe « scénarios pédagogiques » n'ont pas fait transparaître ces acquis dans leurs réponses. Cependant, dans les trois autres groupes, les PR étaient en grande majorité d'accord pour dire qu'ils ont appris, qu'ils ont amélioré leurs pratiques et surtout que cet apprentissage s'est réalisé grâce aux interactions avec des professionnels du même domaine.

Parmi les quatre groupes thématiques étudiés, un seul aujourd'hui se rapproche de ce que l'on pourrait appeler une CP : le groupe « Maîtrise de la langue française ». Il n'en présente pas encore toutes les caractéristiques que nous avons définies, mais il montre une tendance vers l'émergence d'une CP. À ce groupe correspondent deux des trois critères proposés par Wenger : les membres de ce groupe ont développé de l'engagement les uns vis-à-vis des autres, ils ont une entreprise commune, échangeant sur leurs pratiques et partagent leurs connaissances.

Mais à l'instar des autres groupes, il présente des faiblesses au niveau du répertoire partagé. Pour le dire autrement, si on se réfère à la dualité participation/réification (Wenger & Snyder, 2000) qui sous-tend la dynamique de groupe d'une CP, il donne une part trop importante à la participation au détriment de la réification. Une procédure plus rigoureuse pourrait être mise en place pour assister les membres du groupe à imaginer, produire, créer ensemble des outils, des documents qui deviendraient le « patrimoine » de la communauté. De plus, l'analyse de l'animation et de la dynamique de ce groupe révèle que celui-ci ne correspond pas non plus à la dynamique spécifique d'une CP. Les membres du groupe s'appuient trop sur l'animateur pour faire vivre la communauté.

Dans les trois autres cas, les objectifs du projet que sont le partage et la mise en réseau sont atteints, mais les groupes ne peuvent pas être définis comme étant des CP. D'une part, aucun des trois critères de Wenger n'est significativement présent dans ces groupes. D'autre part, nous pouvons dire que ce qui lie les personnes entre elles, ce n'est pas uniquement la passion ou l'intérêt pour un domaine. C'est avant tout la structure du projet qui fait que ces personnes se retrouvent une fois par mois pour partager et échanger.

Malgré tout, si l'on se réfère aux différents types de groupes qui existent, c'est avant tout d'une CP que les groupes thématiques se rapprocheraient le plus, parce que leur finalité correspond à celle d'une CP, c'est-à-dire à améliorer les pratiques professionnelles des PR.

3. Conclusion

Cette étude se veut une modeste contribution à la problématique des communautés de pratique. Son apport consiste principalement en une réflexion sur les caractéristiques à considérer pour identifier et soutenir le développement de telles communautés. Pour atteindre ces buts, une instrumentation de la démarche d'analyse ainsi que du soutien aux activités devrait être approfondie. D'une part, le questionnaire mis au point et utilisé ici va dans ce sens. D'autre part, l'usage d'outils technologiques pourrait aider et stimuler les membres de ces groupes à réifier leurs connaissances et à développer un répertoire partagé.

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Instrumentation d'une communauté de pratique virtuelle : illustration avec le portail TE-Cap

Élise Garrot, Sébastien George, Patrick Prévôt

*Laboratoire LIESP, INSA-Lyon
21, avenue Jean Capelle
F-69621 Villeurbanne Cedex, France
elise.garrot@insa-lyon.fr ; sebastien.george@insa-lyon.fr ;
patrick.prevot@insa-lyon.fr*

RÉSUMÉ. Dans cet article, nous étudions les besoins en instrumentation des Communautés de Pratique (CoPs) virtuelles. Nous montrons en quoi les environnements support aux communautés virtuelles en général ne répondent pas à tous ces besoins et proposons une démarche de conception itérative et participative d'un environnement destiné aux CoPs virtuelles. Nous mettons particulièrement en avant la gestion structurée des informations produites par la communauté et des interactions entre les membres, en montrant la nécessité de les classer à partir de thèmes liés à la pratique des acteurs. La démarche proposée est illustrée par la conception du portail TE-Cap, destiné à une communauté de tuteurs à distance. Nous présentons tout particulièrement l'outil de classification développé sur ce portail, que nous voulons rendre générique à tout type de CoP virtuelle.

MOTS-CLÉS : Communauté de pratique ; Environnement informatique ; Démarche de conception.

1. Introduction

Cet article tente d'apporter une réponse à la question « *Comment des outils en ligne et des services peuvent-ils soutenir les communautés de pratique ?* ». Pour cela, nous nous intéressons aux Communautés de Pratique (CoPs) virtuelles, que nous définissons comme des CoPs médiatisées par ordinateur. Nous présentons tout d'abord les principales caractéristiques de ce type de communauté, pour ensuite détailler les points fondateurs pour une démarche de conception d'environnements supports. Nous illustrons cette démarche par la présentation du portail communautaire TE-Cap que nous avons développé afin de supporter une CoP de tuteurs à distance.

2. Caractéristiques des CoPs

D'après [WENGER et al. 02], les CoPs sont des groupes de personnes au sein desquels les interactions entre membres permettent d'enrichir leur expérience, d'approfondir leurs connaissances et d'affiner leur expertise : *“groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis.”* [SNYDER et al. 04] insistent sur la construction des compétences, à travers la collaboration entre membres : *“A community of practice is a particular type of network that features peer-to-peer collaborative activities to build member skills”*. Cette définition reprend les idées de [VYGOTSKY 97] selon lesquelles l'interaction sociale joue un rôle fondamental dans le développement de la cognition. Les CoPs fonctionnent ainsi comme des “systèmes d'apprentissage social” où les membres se connectent pour résoudre des problèmes, partager des idées, établir des standards, construire des outils et développer des relations entre pairs. [SCARBROUGH & SWAN 99] mettent également en avant l'aspect social des CoPs : *“Socially, CoP are the fabrics of knowing as members of CoP acquire communal identity around a shared passion, relationships, roles and ways of intermingling common knowledge, practices and approaches”*. Les membres, en interagissant sur le même sujet, définissent des connaissances, des pratiques et des approches communes, et créent une identité communautaire à laquelle ils se sentent appartenir.

Dans le contexte de cette étude, nous synthétisons les principales caractéristiques d'une CoP. Une CoP :

- favorise la construction de compétences, de connaissances et d'expertise ;
- incite les membres à partager un intérêt, des idées ou un ensemble de problèmes ;
- contribue à développer un sentiment d'appartenance à une véritable communauté en construction : établissement de standards, conception d'outils communs, partage d'approches et de pratiques.

Ces caractéristiques entraînent des besoins d'instrumentation pour les CoPs. Nous nous intéressons dans la partie suivante à l'instrumentation des communautés

virtuelles en général, pour étudier si les environnements informatiques proposés répondent bien aux besoins spécifiques des CoPs virtuelles.

3. Instrumentation des communautés virtuelles

[PREECE 01] définit une communauté virtuelle (« online community ») comme : *“any virtual social space where people come together to get and give information or support, to learn, or to find company”*. Cette définition met en avant la notion d'espace virtuel dans lequel les personnes prennent et apportent des informations. Cette notion est également reprise par [FERNBAC & THOMPSON 95] qui insistent sur le besoin pour une communauté virtuelle de disposer d'un espace dédié : *“a specified boundary or place (e.g. a conference or chat line) that is symbolically delineated by topic of interest.”* Ainsi, aux caractéristiques précédentes, propres aux CoPs, nous devons ajouter la définition d'un espace spécifique dans lequel les membres des CoPs virtuelles vont interagir.

Dans le cadre du développement d'une technologie support à une communauté virtuelle, [PREECE 01] affirme que celle-ci doit être conçue en fonction de deux critères :

- un critère de **sociabilité** (« sociability »). Trois composantes contribuent à une bonne sociabilité : un but commun qui donne une raison de participer ; des personnes ayant chacune un intérêt, une attente ou un besoin ; des directives (un langage et des protocoles communs qui gèrent les échanges et guident les interactions).

- un critère d'**utilisabilité** (« usability ») du logiciel en tant que medium et un espace d'accueil d'interactions sociales. Quatre composantes sont essentielles : le support aux dialogues et aux interactions (facilité et rapidité) ; la présentation claire des informations (facilité de compréhension) ; la facilité et la rapidité pour trouver la bonne information ; la simplicité et la rapidité d'accès (exécution du logiciel).

[WILLIAM & COTHREL 00] associent trois types de management à la sociabilité : le développement des membres, le management des biens de la communauté, le management des relations au sein de la communauté. Plus spécifiquement, pour qu'une communauté virtuelle fonctionne intelligemment, cela nécessite une stratégie claire, des leaders, des règles et rôles, et des contenus utiles basés sur l'expertise. Les critères de sociabilité et d'utilisabilité sont également repris par [KOH & KIM 04] selon une approche socio-technique.

La prise en compte de ces deux critères conduit à mettre à disposition des membres, d'une part, des **outils de communication** tels que chat, blog ou forum et, d'autre part, des **répertoires** pour classer les documents proposés par les membres. Mais [CHARLIER et al. 06] ont souligné le manque d'outils et d'environnements communautaires virtuels soutenant la résolution de problèmes concrets liés à la pratique, le manque de support pour matérialiser la connaissance et la rendre accessible aux membres de la communauté et l'inadéquation des outils (e.g. forum,

listes de discussion) utilisés par ces communautés pour la construction de la connaissance et de l'identité des CoPs

Nous ajoutons donc un troisième critère aux critères de sociabilité et d'utilisabilité : celui d'**utilité**. Il s'agit là de la pertinence de l'environnement vis-à-vis des besoins et attentes de la communauté. Cela passe par une démarche de conception participative associant dès le départ les membres de la communauté qui expriment leurs attentes et besoins. Régulièrement, cette pertinence doit être contrôlée grâce à des outils de mesure d'efficacité dont est dotée la plate-forme.

4. Proposition d'une démarche d'instrumentation d'une CoP virtuelle

4.1. Besoins en instrumentation d'une CoP virtuelle

En nous appuyant sur les caractéristiques des CoPs précédentes, déterminons les besoins spécifiques en terme d'instrumentation d'une CoP virtuelle :

- aider chaque membre de la communauté à formaliser ses expériences et ainsi à développer ses connaissances et compétences ;
- favoriser le repérage des sources d'expertise et des compétences identifiées au sein de la communauté, en rapport avec la pratique des membres ;
- offrir un « chez soi » virtuel, spécifique à la communauté, dans lequel elle va construire sa propre identité, avec des thèmes et un vocabulaire liés à la pratique des membres ;
- favoriser le stockage de toutes les informations produites par la communauté, que ce soit un résultat d'interactions entre pairs (réflexions, idées, outils...), ou un apport individuel (témoignage, document, lien Web intéressant...) ;
- favoriser la recherche d'informations stockées qui peuvent être pertinentes pour un membre, en rapport à sa pratique.

Dans le cas d'une CoP virtuelle, les échanges entre membres sont des sources d'informations intéressantes à stocker de la même façon que tout autre document. Généralement, les interactions au sein des communautés virtuelles sont supportées par des mails, des chats ou des forums, outils pour lesquelles l'information est assez volatile. Seuls les forums sont classés par thèmes mais chaque message ne peut correspondre qu'à un seul thème (prédéfini dans la plate-forme) et la recherche s'effectue par mots-clefs. Nous pensons essentiel pour une CoP virtuelle d'offrir désormais une possibilité de structuration des informations produites et des interactions entre membres, selon plusieurs thèmes liés à la pratique des acteurs.

4.2. Démarche de conception de l'environnement

Dans une démarche d'instrumentation d'une CoP virtuelle, nous pensons essentiel d'adopter une approche itérative et participative. Cette démarche nécessite, d'une part, de développer l'environnement dans un souci de modularité et d'évolutivité et, d'autre part, d'impliquer les membres dans l'évolution de cet

environnement. Cette démarche donne la possibilité aux membres de construire une identité commune au sein de l'espace virtuel et de s'approprier les outils de façon à construire leurs propres pratiques autour de cet environnement. Nous proposons la démarche de conception suivante (cf. figure 1) :

Étape 1) Identification des spécificités de la CoP, à l'aide d'entretiens avec des membres ou à la lecture de documents concernant leurs pratiques :

- identification du **vocabulaire** et **thèmes** liés à la pratique : utilisé pour construire une classification pour stocker et rechercher les informations produites par la communauté. Il évolue lors de l'usage de l'environnement par les acteurs ;
- identification des **connaissances** et **compétences** liées à la pratique des acteurs. Elles sont inscrites dans le profil des membres, selon une échelle de valeur (novice, intermédiaire, expert) ;
- identification des **types d'informations** utiles à la CoP (échanges de différentes natures, documents, liens Web...), ceci afin de déduire les outils de gestion des informations à mettre à disposition sur l'environnement.

Étape 2) Développement des outils suivants :

- outils de **gestion des informations** de chacun des membres, qu'il peut décider de rendre publiques (ou non). Il a ainsi un espace de travail privé et apporte des informations à la CoP à partir de cette espace ;
- outils d'**aide à la formalisation** : pour aider chaque membre à témoigner de ses expériences et pratiques et ainsi l'amener à une réflexivité favorisant le développement de ses connaissances et compétences.
- outils de **support aux interactions** : moyens de communication nécessaires entre membres de la CoP, en distinguant ceux considérés comme source d'informations (et donc à stocker) et ceux qui assurent la mise en relation entre les membres de la CoP (par exemple la possibilité d'envoyer des mails privés) ;
- outil de **stockage des informations** : à partir des thèmes identifiés dans la première étape, avec une même interface quelle que soit l'information, ceci dans un souci de cohérence de l'environnement. Nous proposons de les présenter sous forme d'une classification construite a priori (amenée ensuite à évoluer par l'usage). L'intérêt d'établir une classification initiale est de proposer un référentiel à partir duquel les membres peuvent réagir, soit en proposant de nouveaux thèmes, soit en lançant une discussion sur la classification elle-même, ce qui est un moyen supplémentaire d'amener les membres à réfléchir à leurs pratiques ;
- outil de **recherche des informations** pouvant être utiles à un membre à partir d'une même interface et des thèmes identifiés dans la première étape ;
- outil d'**aide à l'évolution du dispositif** : la plate-forme doit être équipée d'un outil de récolte de traces d'utilisation des différents outils proposés, afin de permettre le retour d'usage (utilisé dans l'étape 4).

Étape 3) Utilisation par les acteurs : chaque membre propose ses mots-clés pour le classer et rechercher de l'information. Ces mots-clés sont soumis au modérateur de la communauté qui décide de les ajouter ou non. Les mots-clés utilisés par les membres sont comptabilisés, ce qui permet par exemple de supprimer

celles jugées inutiles. Cette évolution des thèmes est nécessaire pour tenir compte de l'évolution même des usages et pratiques.

Étape 4) Retour d'usage : il s'agit régulièrement de redéfinir avec les acteurs (par analyse des traces d'utilisation et par questionnaire) les outils utiles, inutiles ou manquants parmi ceux développés dans la deuxième étape.

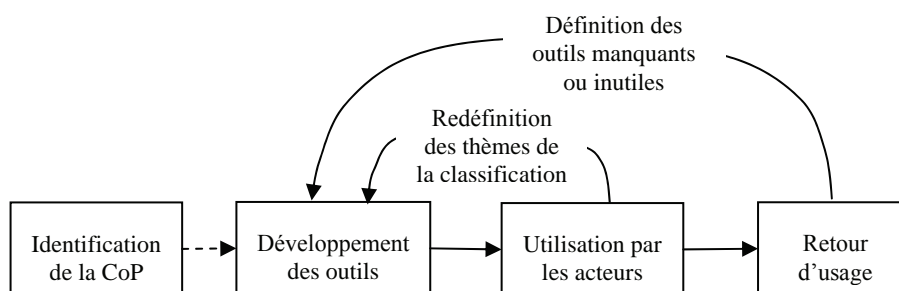


Figure 1. Démarche de conception de l'environnement

5. Conception d'un environnement informatique pour une CoP : le portail communautaire TE-Cap

5.1. Identification de la communauté à laquelle est destinée l'outil

Le portail communautaire TE-Cap a été développé pour répondre aux besoins d'une communauté de pratique de tuteurs à distance [GARROT et al. 07]. Dans le cadre d'une démarche itérative et participative, nous avons réalisé sept entretiens semi-dirigés auprès de tuteurs. À partir de ces entretiens et de la littérature traitant du tutorat, nous avons identifié cette communauté :

- les thèmes en relation avec une pratique de tutorat (représenté sous forme d'un modèle) ;
- les compétences et connaissances nécessaires aux tuteurs pour qu'ils puissent jouer leur rôle ;
- les informations utiles aux tuteurs dans leur pratique et qu'il est nécessaire de gérer par le portail. Elles sont réparties en trois catégories : messages des tuteurs (peuvent être de différentes natures : témoignages, discussions ou demandes d'aide) et commentaires associés, documents (proposés individuellement par les tuteurs ou résultat d'un travail collaboratif au sein de la communauté) et liens Web (les tuteurs peuvent soumettre des liens Web qu'ils trouvent intéressants).

La première étape de conception de la plate-forme TE-Cap a consisté à bien identifier la communauté à laquelle est destinée la plate-forme, ainsi que les pratiques de ses membres. Une CoP étant émergente par nature, un outil support n'a

pas pour rôle de construire la communauté mais plutôt d'offrir les ressources utiles et adaptées pour le développement de la communauté.

5.2. Choix de développement du portail TE-Cap

La conception de la plate-forme TE-Cap, repose sur le CMS (*Content Management System*) Joomla. Nous avons opté pour ce CMS en fonction de critères et parmi une liste conséquente de CMS existants¹. Les raisons principales de ce choix sont, d'une part, qu'il propose des fonctionnalités de base que nous n'avons pas besoin de développer à nouveau (telles que la gestion des utilisateurs, des messages et des documents) et, d'autre part, que ses fonctionnalités reposent sur des composants indépendants, facilitant ainsi l'évolutivité et la modularité de TE-Cap. Dans cette logique, nous avons modifié certains composants et en avons ajoutés d'autres afin de répondre aux besoins identifiés précédemment. Ainsi, nous avons développé les composants de classification et de recherche des ressources proposées par les membres de la communauté (cf. partie 5.4), dont l'interface repose sur le modèle des thèmes en relation avec une pratique de tutorat que nous avons défini dans la première étape.

5.3. Profil des membres et support aux interactions

Nous avons montré précédemment l'importance pour une CoP de favoriser le repérage des sources de connaissance et compétences, identifiées au sein de la communauté. Ainsi un tuteur novice dans un domaine pourra repérer un tuteur expert à qui il pourra demander de l'aide. L'entraide entre les membres d'une CoP est un des fondements pour le développement des compétences de chacun. Pour cela, nous rendons disponible le profil de chacun des tuteurs construit sur les informations suivantes :

- identité (pays, profession, âge...) ;
- parcours professionnel et universitaire (expérience du tutorat, formation au tutorat...) ;
- formations encadrées (noms des formations, disciplines enseignées, établissements ou entreprises de formation) ;
- compétences auto-déclarées par le tuteur (pédagogique, technique, expertise du contenu...).

Le portail offre deux possibilités d'interactions entre les membres de la communauté :

- l'envoi d'un mail à un membre de la communauté à partir de son profil. Ainsi, si un tuteur est intéressé par le profil d'un membre de la communauté, il peut choisir de lui adresser un mail pour une communication d'ordre privé. Cet outil assure une mise en relation entre les membres et donne la possibilité de développer des relations entre pairs en dehors de l'espace offert par la plate-forme ;

¹ <http://cmsmatrix.org/>

– l'écriture de messages avec la possibilité de répondre lors de la consultation de ces messages par d'autres membres. Avant validation du message, le rédacteur doit indiquer son « intention » à l'écriture du message : témoignage, demande d'aide ou discussion. Ce choix l'incite à réfléchir au contenu du message qu'il vient d'écrire, ce qui l'engage à une réflexivité sur la pratique dont il témoigne. C'est également une indication pour la réponse au message par les autres membres. Après validation du message, le rédacteur est orienté vers une interface de classement du message selon plusieurs thèmes, interface que nous présentons en détail dans la partie 5.4 (cf. figure 3). Cet outil fonctionne comme un forum au niveau du mode de communication mais est classé de façon plus structurée selon des thèmes associés aux pratiques de la communauté et ces thèmes évoluent selon la communauté.

Dans un premier temps de conception de la plate-forme, nous avons souhaité offrir uniquement des outils de communication indispensables aux interactions entre membres, en distinguant un outil de mise en relation entre pairs et un outil d'échanges classés par thèmes et selon l'intention du rédacteur.

5.4. Gestion des informations par le portail

Le portail TE-Cap offre plusieurs outils de création, partage et stockage des informations apportées ou produites par chacun. Lorsqu'un tuteur se connecte, il peut notamment choisir de gérer ses messages, gérer ses documents ou gérer ses liens web (cf. figure 2). Pour chacune de ces fonctionnalités, il visualise la liste des ressources qu'il a déjà soumises, le nombre de fois où elles ont été visualisées par les membres de la communauté et peut créer de nouvelles ressources. Cette conception de la plate-forme donne la possibilité au tuteur de gérer les informations qu'il apporte à la communauté, ainsi que l'intérêt suscité par celles-ci (nombre total d'accès).

TE-Cap : pour la capitalisation des expériences de tutorat

Accueil > Gérer mes messages

Menu principal

- Accueil
- Tous les membres
- Tous les messages
- Nous contacter

Identification

Bonjour, Thomas

[Se déconnecter](#)

Qui est en ligne

- Thomas

Gérer mes messages

☐ Ecrire un nouveau message

Tous les messages pour l'utilisateur : **Thomas**

Filter titre: Tri: **Date desc**

Public/Privé	Edit	Titre	Date	Catégorie	Nb accès
		Quel distance garder avec mes élèves ?	25-01-2007	Demande d'aide	21
		Problème rencontré avec un élève	25-01-2007	Témoignage	4
		Mon rôle n'est pas reconnu dans mon établissement	15-01-2007	Témoignage	52
		Un élève en difficulté	05-01-2007	Demande d'aide	40
		Quelle activité proposer pour apprendre l'arithmétique ?	03-01-2007	Discussion	14

Résultats 1 - 5 sur 5

Figure 2. Gestion des messages par chaque membre de la communauté

Le stockage des informations produites par la communauté est réalisé grâce à une interface de classification (cf. figure 3) utilisée à chaque nouvelle soumission par l'un des membres, que ce soit un message, un document ou un lien Web. Cette classification résulte là encore de notre démarche de conception itérative et participative, condition sine qua non d'acceptation et d'appropriation des outils par la communauté. Les échanges qui ont lieu entre les membres d'une CoP sont une source de connaissances à exploiter, c'est pourquoi il faut les classer comme tous les autres types de ressources, selon des thèmes liés aux pratiques des acteurs. Nous voulons rendre cet outil générique, afin d'être transposable à d'autres CoPs virtuelles, en donnant pour chacune la possibilité de définir ses propres thèmes.

☐ Rôles du tuteur vis-à-vis des apprenants
☐ Etablissement impliqué
☐ "Métier" de tuteur
☐ Formation concernée
☐ Directives données au tuteur
☐ Activité tutorée
☐ Apprenant(s) concerné(s)
 ☐ Profil
 ☐ Comportement
 ☐ Situation par rapport au groupe
 ☒ En difficulté
 ☐ Moyenne
 ☐ En avance
 Autres :
 Autres :
☐ Outils/ressources techniques et pédagogiques
☐ Discipline enseignée
☐ Plate-forme TE-Cap

Figure 3. L'interface de classification et de recherche des ressources de TE-Cap

6. Conclusion

Nous avons dégagé les caractéristiques principales des CoPs virtuelles afin de déterminer les besoins concrets auxquels un outil support à la communauté peut répondre. Nous avons montré l'importance pour la conception de ce type d'outil de suivre une démarche itérative et participative, proposant une mise en relation des outils de communication avec un outil de gestion des connaissances produites par les échanges au sein de la communauté. Le portail communautaire TE-Cap, destiné à supporter une CoP de tuteurs à distance, illustre la démarche proposée. Le

développement d'un outil de classification permet de classer et rechercher toutes les informations produites par la communauté à partir d'une interface proposant des thèmes propres aux pratiques liées à la communauté.

Actuellement, TE-Cap est utilisé par des tuteurs de la communauté de pratique t@d, initiée et facilitée par Jacques Rodet². Nous obtiendrons un premier retour d'usage du portail. Nous nous appuierons sur ces résultats dans le prochain cycle de conception. Nous souhaitons à terme généraliser cette démarche et rendre l'outil de classification générique pour le transposer à d'autres portails communautaires, en donnant la possibilité pour chaque CoP de déterminer ses propres thèmes.

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² <http://jacques.rodet.free.fr/xtad.htm>

Incremental formalization of argumentative collaboration

Nikos Karacapilidis*, Manolis Tzagarakis**

** Industrial Management and Information Systems Lab
MEAD, University of Patras, 26500 Rio Patras, Greece
nikos@mech.upatras.gr*

and

*Research Academic Computer Technology Institute
University Campus, 26500 Rio Patras, Greece
karacap@cti.gr*

*** Research Academic Computer Technology Institute
University Campus, 26500 Rio Patras, Greece
tzagara@cti.gr*

ABSTRACT. Arguing that a varying level of formality needs to be offered in systems supporting argumentative collaboration, this paper proposes an incremental formalization approach that has been adopted in the development of CoPe_it!, a web-based tool that complies with collaborative principles and practices, and provides members of communities engaged in argumentative discussions and decision making processes with the appropriate means to collaborate towards the solution of diverse issues. According to the proposed approach, incremental formalization can be achieved through the consideration of alternative projections of a collaborative workspace.

KEYWORDS: Computer-Supported Collaborative Work, Communities of Practice, Knowledge Management, Argumentative Collaboration.

1. Introduction

Designing software systems that can adequately address users' needs to express, share, interpret and reason about knowledge during a session of argumentative collaboration has been a major research and development activity for more than twenty years (de Moor and Aakhus, 2006). Designing, building, and experimenting with specialized argumentation and decision rationale support systems has resulted to a series of argument visualization approaches. Technologies supporting argumentative collaboration usually provide the means for discussion structuring, sharing of documents, and user administration. They support argumentative collaboration at various levels and have been tested through diverse user groups and contexts. Furthermore, they aim at exploring argumentation as a means to establish a common ground between diverse stakeholders, to understand positions on issues, to surface assumptions and criteria, and to collectively construct consensus (Jonassen and Carr, 2000).

When engaged in the use of these technologies, through a software system supporting argumentative collaboration, users have to follow a specific formalism. More specifically, their interaction is regulated by procedures that prescribe and - at the same time - constrain their work. This may refer to both the system-supported actions a user may perform (types of discourse or collaboration acts), and the system-supported types of argumentative collaboration objects (e.g. one has to strictly characterize an object as an idea or a position). In many cases, users have also to fine-tune, align, amend or even fully change their usual way of collaborating in order to be able to exploit the system's features and functionalities. Acknowledging that the above are necessary towards making the system interpret and reason about human actions (and the associated resources), thus offering advanced computational services, there is much evidence that sophisticated approaches and techniques often resulted to failures (Shipman and McCall, 1994). This is often due to the extra time and effort that users need to spend in order to get acquainted with the system, the associated disruption of the users' usual workflow (Fischer et al., 1991), as well as to the "error prone and difficult to correct when done wrong" character and the prematurely imposing structure (Halasz, 1988) of formal approaches.

As a consequence, we argue that a varying level of formality should be considered. This variation may either be imposed by the nature of the task at hand (e.g. decision making, joint deliberation, persuasion, inquiry, negotiation, conflict resolution), the particular context of the collaboration (e.g. legal reasoning, medical decision making, public policy), or the group of people who collaborate each time (i.e. how comfortable people feel with the use of a certain technology or formalism). The above advocate an incremental formalization approach, which has been adopted in the development of CoPe_it!, a web-based tool that is able to support argumentative collaboration at various levels of formality. CoPe_it! complies with collaborative principles and practices, and provides members of communities

engaged in argumentative discussions and decision making processes with the appropriate means to collaborate towards the solution of diverse issues. According to the proposed approach, incremental formalization can be achieved through the consideration of alternative projections (i.e. particular representations) of a collaborative workspace, as well as through mechanisms supporting the switching from one projection to another.

This paper focuses on the presentation of the above approach. More specifically, Section 2 comments on a series of background issues related to reasoning and visualization, as well as on related work. Section 3 presents our overall approach, illustrates two representative examples of different formality level and sketches the procedure of switching among alternative projections of a particular workspace. Finally, Section 4 discusses advantages and limitations of the proposed approach and outlines future work directions.

2. Background issues

The representation and facilitation of argumentative discourses being held in diverse collaborative settings has been a subject of research interest for quite a long time. Many software systems have been developed so far, based on alternative models of argumentation structuring, aiming to capture the key issues and ideas during meetings and create a shared understanding by placing all messages, documents and reference material for a project on a “whiteboard”. More recent approaches pay particular attention to the visualization of argumentation in various collaborative settings. As widely argued, visualization of argumentation can facilitate problem solving in many ways, such as in explicating and sharing representations among the actors, in maintaining focus on the overall process, as well as in maintaining consistency and in increasing plausibility and accuracy (Kirschner et al., 2003).

Generally speaking, existing approaches provide a cognitive argumentation environment that stimulates reflection and discussion among participants (a comprehensive consideration of such approaches can be found in (Karacapilidis et al., 2005)). However, they receive criticism related to their adequacy to clearly display each collaboration instance to all parties involved (usability and ease-of-use issues), as well as to the structure used for the representation of collaboration. In most cases, they merely provide threaded discussion forums, where messages are linked passively. This usually leads to an unsorted collection of vaguely associated positions, which is extremely difficult to be exploited in future collaboration settings. As argued in (van Gelder, 2003), “packages in the current generation of argument visualization software are fairly basic, and still have numerous usability problems”. Also important, they do not integrate any reasoning mechanisms to (semi)automate the underlying decision making processes required in a collaboration setting. Admittedly, there is a lack of consensus seeking abilities and decision-making methods.

Taking the above into account, we claim that an integrated consideration of visualization and reasoning is needed in an argumentative collaboration context. Such an integrated consideration should be in line with incremental formalization principles. More specifically, the above integration should efficiently and effectively address problems related to formality (Shipman and Marshall, 1994). As discussed in (Shipman and McCall, 1994), “users want systems be more of an active aid to their work - to do more for them; yet they already resist the low level of formalization required for passive hypertext”. Existing work on incremental formalization argues that problems related to formality have to be solved by approaches that (i) do not necessarily require formalization to be done at the time of input of information, and (ii) support (not automate) formalization by the appropriate software.

At the same time, the abovementioned integrated consideration should be also in line with the *information triage* process (Marshall and Shipman, 1997), i.e. the process of sorting and organizing through numerous relevant materials and organizing them to meet the task at hand. During such a process, users must scan, locate, browse, update and structure effortlessly knowledge resources that may be incomplete, while the resulting structures may be subject to rapid and numerous changes.

3. Our approach

The research method adopted for the development of the proposed solution follows the Design Science Paradigm, which has been extensively used in information systems research (Hevner et al., 2004). Having followed this paradigm, our main contribution lies in the development of a web-based tool for supporting argumentative collaboration and the underlying creation, leveraging and utilization of the relevant knowledge. Generally speaking, our approach allows for distributed (synchronous or asynchronous) collaboration and aims at aiding the involved parties by providing them with a series of argumentation, decision making and knowledge management features. Moreover, it exploits and builds on issues and concepts discussed in the previous section.

3.1. Analysis of requirements

A series of interviews with members of diverse communities (from the engineering, management and education domains) has been performed in order to identify the major issues they face during their argumentative collaboration practices. These issues actually constitute a set of challenges for our approach, in that the proposed collaboration model and infrastructure must provide the necessary means to appropriately address them. These issues are:

- *Management of information overload*: This is primarily due to the extensive and uncontrolled exchange of comments, documents and, in general, any

type of information/knowledge resource, that occurs in the settings under consideration. For instance, such a situation may appear during the exchange of ideas, positions and arguments; individuals usually have to spend much effort to keep track and conceptualize the current state of the collaboration. Moreover, such situations may ultimately harm a community's objectives.

- *Diversity of collaboration modes* as far the protocols followed and the tools used are concerned: Interviews indicated that the evolution of the collaboration proceeds incrementally; ideas, comments, or any other type of collaboration object are exchanged and elaborated, and new knowledge emerges slowly. When a community's members collaboratively organize information, enforced formality may require specifying their knowledge before it is fully formed. Such emergence cannot be attained when the collaborative environment enforces a formal model (i.e. predefined information units and relationships) from the beginning. On the other hand, formalization is required in order to ensure the environment's capability to support and aid the collaboration efforts. In particular, the abilities to support decision making, estimation of present state or summary reports benefit greatly from formal representations of the information units and relationships.
- *Expression of tacit knowledge*: A community of people is actually an environment where tacit knowledge (i.e. knowledge that the members do not know they possess or knowledge that members cannot express with the means provided) predominantly exists. Such knowledge must be able to be efficiently and effectively represented.
- *Integration and sharing of diverse information and knowledge*: Many resources required during a collaborative session have either been used in previous sessions or reside outside the members' working environment. Moreover, outcomes of past collaboration activities should be able to be reused as a resource in subsequent collaborative sessions.
- *Decision making support*: Many communities require support to reach a decision. This means that their environment (i.e. the tool used) needs to interpret the information types and relationships in order to proactively suggest trends or even calculate the outcome of a collaborative session (e.g. as is the case in voting systems).

3.2. Conceptual approach

To address the above issues, our approach builds on a conceptual framework where *formality* and the *level of knowledge structure* during argumentative collaboration is not considered as a predefined and rigid property of the tool, but rather as an adaptable aspect that can be modified to meet the needs of the tasks at hand. By the term formality, we refer to all the rules enforced by the system and to which all discourse actions of users must comply. Allowing formality to vary within the collaboration space, incremental formalization, i.e. a stepwise and controlled

evolution from a mere collection of individual ideas and resources to contextualized and interrelated knowledge artifacts, can be achieved.

In the proposed collaboration model, *projections* constitute the “vehicle” that permits incremental formalization of argumentative collaboration (see Figure 1). A projection can be defined as a particular representation of the collaboration space, in which a consistent set of abstractions able to solve a particular organizational problem during argumentative collaboration exists. With the term abstraction, we refer to the particular discourse types, relationships and actions that are available at a particular projection, and with which a particular problem can be represented, expressed and - ultimately - be solved.

Each projection of the collaboration space provides the necessary mechanisms to support a particular *level of formality*. More specifically, the more informal is a projection, the more easiness-of-use is implied; at the same time, the actions that users may perform are intuitive and not time consuming (e.g. drag-and-drop a document to a shared collaboration space). Informality is associated with generic types of actions and resources, as well as implicit relationships between them. However, the overall context is human (and not system) interpretable. On the other hand, the more formal is a projection, easiness-of-use is reduced (users may have to go through training or reading of long manuals in order to comprehend and get familiar with sophisticated system features); actions permitted are less and less intuitive and more time consuming. Formality is associated with fixed types of actions, as well as explicit relationships between them. The overall context in this case is both human and system interpretable.

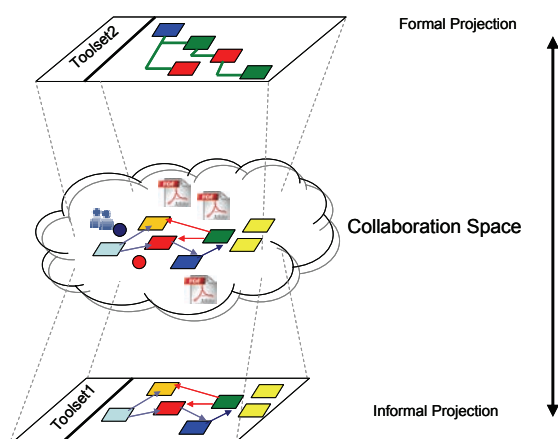


Figure 1. *Alternative projections of a collaboration space*

An informal projection also aims at supporting information triage. It is the informal nature of this projection that permits such an ordinary and unconditioned evolution of knowledge structures. While such a way of dealing with knowledge resources is conceptually close to practices that humans use in their everyday

environment (e.g. their desk), it is inconvenient in situations where support for advanced decision making processes must be provided. Such capabilities require knowledge resources and structuring facilities with fixed semantics, which should be understandable and interpretable not only by the users but also by the tool. Hence, decision making processes can be better supported in environments that exhibit a high level of formality. The formal projections of the collaboration space come to serve such needs.

3.3. Examples

To better illustrate our approach, this subsection presents two alternative (already implemented) projections of a particular collaborative session (the session is about which is the most appropriate treatment for a patient with breast cancer). The first one is fully informal and complies with the abovementioned information triage principles, while the second one builds on an IBIS-like formalism (Conklin and Begeman, 1989) and supports group decision making.

3.3.1. Informal projection

As mentioned above, the aim of an informal projection of the collaboration space is to provide users the means to structure and organize information units easily, and in a way that conveys semantics to users. Generally speaking, informal projections may support an unbound number of discourse element types (e.g. comment, idea, note, resource). Moreover, users may create any relationship among discourse elements (there are no fixed relationship types); hence, relationship types may express agreement, disagreement, support, request for refinement, contradiction etc. Informal projections may also provide abstraction mechanisms that allow the creation of new abstractions out of existing ones. Abstraction mechanisms include:

- *Annotation and metadata*: the ability to annotate instances of various discourse elements and add (or modify) metadata.
- *Aggregation*: The ability to group a set of instances of discourse elements so as to be handled as a single conceptual entity. This may lead to the creation of additional informal sub-projections, where a set of discourse elements can be considered separately, but still in relation to the context of a particular collaboration.
- *Generalization/Specialization*: The ability to create semantically coarse or more detailed discourse types. Generalization/specialization may not lead to additional informal projections but may help users to manage information pollution of the collaboration space leading to ISA hierarchies.
- *Patterns*: The ability to specify instances of interconnections between discourse elements (of the same or a different type) as templates acting as placeholders that can be reused within the discussion.

Figure 2 presents an example of an informal projection of the collaboration session considered. Medical doctors discuss the case of a particular patient aiming at

achieving a decision on the most appropriate treatment. Since initially the process of gathering and discussing the available treatment options is unstructured, highly dynamic and thus evolving rapidly, the informal space provides the most appropriate environment to support collaboration at this stage. The aim is to bring the session to a point where main trends crystallize, thus enabling the switch to a formal projection (upon the participants' wish).

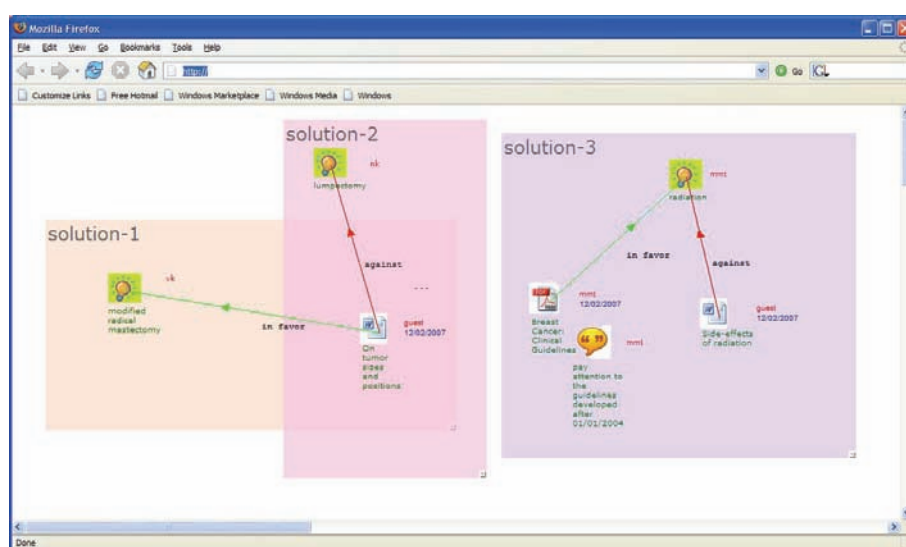


Figure 2. *Instance of an informal projection*

In the example of Figure 2, three approaches to the patient's treatment – proposed by three different users – have been (so far) elaborated, namely “modified radical mastectomy”, “lumpectomy” and “radiation”. Each proposed treatment is visible on the collaboration space as an “idea”. Participants may use relationships to relate resources (documents, links etc.), comments and ideas to the proposed treatment. The semantics of these relationships are user-defined. Visual cues may be used to make the semantics of the relationship more explicit, if desired. For instance, a red arrow indicates comments and resources that express objection to a treatment, while green arrows express approval of a treatment. Note that the resource entitled “On tumor sizes positions” seems to argue against the solution of “lumpectomy” while, at the same time, it argues in favor of “modified radical mastectomy”. This is due to the information contained in it (in that some “chunks” advocate or avert from a particular solution; this is to be further exploited in a formal projection). Other visual cues supported in this projection may bear additional semantics (e.g. the thickness of an edge may express how strong a resource/idea may object or approve a treatment). Informal projections also provide mechanisms that help aggregating aspects of collaboration activities. For example the colored rectangles labeled as “solution-1”, “solution-2” and “solution-3” help participants visualize what the current alternatives are. Although - at this projection

instance – these rectangles are simply visual conveniences, they play an important role during the switch to formal projections, enabling the implementation of abstraction mechanisms.

3.3.2. Formal projection

While an informal projection of the collaboration space aids the exploitation of information by users, a formal projection aims mainly at the exploitation of information by the machine. As noted above, formal projections provide a fixed set of discourse element and relationship types, with predetermined, system-interpretable semantics. More specifically, the formal projection presented in Figure 3 is based on the approach followed in the development of *Hermes* (Karacapilidis and Papadias, 2001). Beyond providing a workspace that triggers group reflection and captures organizational memory, this projection provides a structured language for argumentative discourse and a mechanism for the evaluation of alternatives. Taking into account the input provided by users, this projection constructs an illustrative discourse-based knowledge graph that is composed of the ideas expressed so far, as well as their supporting documents. Moreover, through the integrated decision support mechanisms, participants are continuously informed about the status of each discourse item asserted so far and reflect further on them according to their beliefs and interests on the outcome of the discussion. In addition, the particular projection aids group sense-making and mutual understanding through the collaborative identification and evaluation of diverse opinions.

The discourse elements allowed in this projection are “issues”, “alternatives”, “positions”, and “preferences”. Issues correspond to problems to be solved, decisions to be made, or goals to be achieved. They are brought up by users and are open to dispute (the root entity of a discourse-based knowledge graph has to be an issue). For each issue, users may propose alternatives (i.e. solutions to the problem under consideration) that correspond to potential choices. Nested issues, in cases where some alternatives need to be grouped together, are also allowed. Positions are asserted in order to support the selection of a specific course of action (alternative), or avert the users’ interest from it by expressing some objection. A position may also refer to another (previously asserted) position, thus arguing in favor or against it. Finally, preferences provide individuals with a qualitative way to weigh reasons for and against the selection of a certain course of action. A preference is a “tuple” of the form [position, relation, position], where the relation can be “more important than” or “of equal importance to” or “less important than”. The use of preferences results in the assignment of various levels of importance to the alternatives in hand. Like the other discourse elements, they are subject to further argumentative discourse.

The above four types of elements enable users to contribute their knowledge on the particular problem or need (by entering issues, alternatives and positions) and also to express their relevant values, interests and expectations (by entering positions and preferences). Moreover, the system continuously processes the elements entered by the users (by triggering its reasoning mechanisms each time a

new element is entered in the graph), thus facilitating users to become aware of the elements for which there is (or there is not) sufficient (positive or negative) evidence, and accordingly conduct the discussion in order to reach consensus.

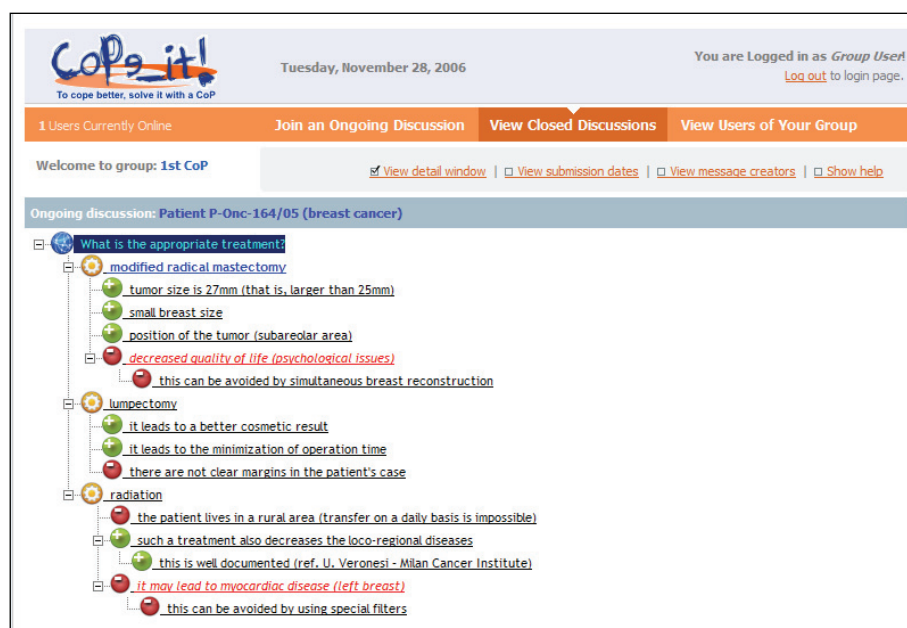


Figure 3. Instance of a formal projection

Further to the argumentation-based structuring of a collaborative session, this projection integrates a reasoning mechanism that determines the status of each discourse entry, the ultimate aim being to keep users aware of the discourse outcome. More specifically, alternatives, positions and preferences of a graph have an activation label (it can be “active” or “inactive”) indicating their current status (inactive entries appear in red italics font). This label is calculated according to the argumentation underneath and the type of evidence specified for them (“burden of proof”). Activation in our system is a recursive procedure; a change of the activation label of an element is propagated upwards in the discussion graph. Depending on the status of positions and preferences, the mechanism goes through a scoring procedure for the alternatives of the issue (for a detailed description of the system’s reasoning mechanisms, see (Karacapilidis and Papadias, 2001)). At each discussion instance, the system informs users about what is the most prominent (according to the underlying argumentation) alternative solution. In the instance shown in Figure 3, “modified radical mastectomy” is the better justified solution so far. However, this may change upon the type of the future argumentation. In other words, each time an alternative is affected during the discussion, the issue it belongs to is updated, since another alternative solution may be indicated by the system.

3.4. *Switching projections*

The projections discussed above could individually serve the needs of a particular community (for a specific context). However, they should be also considered (and exploited) jointly, in that a switch from one to the other can better facilitate the argumentative collaboration process. Adopting an incremental formalization approach, a formal projection can be considered as a filtered and machine-interpretable view of an informal one. Our approach is able to support cases where argumentative collaboration starts through the informal projection (see Section 3.3.1), where instances of any discourse element and relationship type can be created (by any participant). Such collaboration may start from an empty collaboration space or may continue elaborating an informal view of a past collaboration session (existing resources and relationships between them can thus be reused).

At some point of the collaboration, an increase of the formality level can be decided (e.g. by an individual user or the session's facilitator), thus switching to the formal projection (see Section 3.3.2), where discourse and relationship type instances will be transformed, filtered out, or kept "as-is". The above are determined by the associated (visualization and reasoning) model of the formal projection (consequently, this process can be partially automated and partially semi-automated). For instance, referring to the projections discussed above, the colored rectangles shown in Figure 2 will be transformed to the alternatives of Figure 3 (each alternative is expressed by the related idea existed in Figure 2). Moreover, provided that a particular resource appearing in the informal view has been appropriately annotated, the formal projection is able to exploit extracts ("chunks") of it and structure them accordingly. Such extracts appear as atomic objects at the formal projection. For instance, consider the multiple arguments in favor and against the alternatives of Figure 3; these have been resulted out of the appropriate annotation of the resources appearing in Figure 2.

One may also consider a particular argumentative collaboration case, where decrease of formality is desirable. For instance, while collaboration proceeds through a formal projection, some discourse elements need to be further justified, refined and elucidated. It is at this point that the collaboration session could switch to a more informal view in order to provide participants with the appropriate environment to better shape their minds (before possibly switching back to the formal projection). Note that there may exist more than one informal projections that are related to a particular formal view (depending on the type of the discourse element to be elaborated). Switching from a formal to an informal projection is also supported by our approach.

3.5. *Other issues*

In addition to the above, our approach permits users to create one or more private spaces, where they can organize and elaborate the resources of a collaboration space according to their understanding (and their pace). Although

private in nature, users are able to share such spaces with their peers. Moreover, each projection is associated with a set of tools that better suit to its purposes. These tools enable the population, manipulation and evolution of the discourse element types allowed in that particular projection. There can be tools allowing the reuse of information residing in legacy systems, tools permitting authoring of multimedia content, annotation tools, as well as communication and management tools.

A web-based prototype version of CoPe_it!, supporting various levels of formality using projections as the ones described above, has been implemented. The prototype makes use of Web 2.0 technologies, such as AJAX (Asynchronous JavaScript and XML), to deliver the functionalities of the different projections to end users. Based on these technologies, concurrent and synchronous collaboration in every projection is provided. Individual collaboration sessions are stored in XML format. There is at least one XML schema for each formality level (i.e. projection) that encodes and implements the constraints and rules that are active in it. More formal levels are manifested as more strict XML schemas, where types and relationships are fewer and more explicit than in cases of less formal levels.

4. Discussion and Conclusion

Referring to (Shipman and Marshall, 1994), we first draw remarks concerning the advantages and limitations of the proposed approach against issues such as cognitive overhead, tacit knowledge, premature structure, and situational differences. Speaking about the first issue, we argue that our approach mirrors working practices with which users are well acquainted (they are part of their ordinary tasks), thus exhibiting low “barriers to entry”. Moreover, it reduces the overhead of entering information by allowing the reuse of existing documents (mechanisms for reusing existing knowledge sources, such as e-mail messages and entries or topics of web-based forums, have been also integrated). In addition, our approach is able to defer the formalization of information until later in the task. This may be achieved by the use of the appropriate annotation and ontology management tools. In any case, however, users may be averted from the use of such (usually sophisticated) tools, thus losing the benefits of a more formal representation of the asserted knowledge resources. A remedy to that could be that such processing is performed by experienced users. One should also argue here that, due to the collaborative approach supported, the total overhead associated with formalizing information can be divided among users.

Speaking about management of tacit knowledge, we argue that the alternative projections offered, as well as the mechanisms for switching among them, may enhance its acquisition, capturing and representation. Limitations are certainly there; nevertheless, claiming that our approach promotes active participation in knowledge sharing activities (which, in turn, enhances knowledge flow), we expect that all four phases (i.e., internalization, socialization, combination and externalization) of the Nonaka's and Takeuchi's (1995) famous knowledge transformation spiral can be

leveraged. Reuse of past collaboration spaces also contributes to bringing previously tacit knowledge to consciousness.

Our approach does not impose (or even advocate) premature structure; upon their wish, participants may select the projection they want to work with, as well as the tasks they want to perform when working at this projection (e.g. a document can be tagged or labeled whenever a participant wants; moreover, this process has not to be done in one attempt). Finally, considering situational differences, we argue that our approach is generic enough to address diverse collaboration paradigms. This is achieved through the proposed projection-oriented approach (each projection having its own structure and rationale), as well as the mechanisms for switching projections (such mechanisms incorporate the rationale of structures' evolution).

As mentioned above, the proposed approach is the result of action research studies for improving argumentative collaboration. It has been already introduced in diverse educational and organizational settings for a series of pilot applications. Preliminary results show that it fully covers the user requirements analyzed in Section 3.1. Also, it stimulates interaction, makes users more accountable for their contributions, while it aids them to conceive, document and analyze the overall argumentative collaboration context in a holistic manner. In addition, these results show that the learning effort for the proposed tool is not prohibitive, even for users that are not highly adept in the use of IT tools; in most cases, an introduction of less than an hour was sufficient to get users acquainted with the tool's features and functionalities.

Concluding, we argue that the proposed approach provides the means for addressing the issues related to the formality needed in argumentative collaboration support systems. It aims at contributing to the field of social software, by supporting argumentative interaction between people and groups, enabling social feedback, and facilitating the building and maintenance of social networks. Future work directions include the extensive evaluation of the corresponding system in diverse contexts and collaboration paradigms, which is expected to shape our mind towards the development of additional projections, as well as the experimentation with and integration of additional visualization cues, aiming at further facilitating and augmenting the information triage process.

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Exploring the selection of technology for enabling the CoPs development

Dorel Gorga

*Didactique Universitaire
Université de Fribourg
Boulevard de Pérolles 90
3ème étage, secteur E
1700 Fribourg
dorel.gorga@unifr.ch*

ABSTRACT. This paper aims to provide an exploration of tools and technologies that support common activity, to review the type of technologies and various features, and to explore how they can assist a community of practice through different phases of their evolution. Through surveying some of the technologies used for CoPs this paper serves as an introduction to the subject that discuss technology.

KEYWORDS: community, community of practice, knowledge management, knowledge sharing, network analysis, tailoring, technology for community of practice.

1. Introduction

Communities of practice are self-governing groups of people who share a set of problems or a passion for the common domain of what they do and strive to become better at it [Wenger 1998, 1998a]. They create value for their members and the organization hosting them through: developing and spreading new knowledge and capabilities; fostering innovation; building and testing trust in working relationships [Por & van Bekkum 2004]. Examples of communities of practice are found in many organizations and have been called by different names at various times, names such as “learning communities” at Hewlett-Packard Company, “family groups” at Xerox Corporation, “thematic groups” at the World Bank, “peer groups” at British Petroleum, and “knowledge networks” at IBM Global Services [Gongla 2001], but they remain similar in general intent.

Community software helps the communities of practice by offering a set of tools for: knowledge development and sharing; relationship and trust building; community facilitation and management; system administration and customization, typically through a web interface [Wenger 2001, 2002].

In most CoPs today, the members communicate about their practices and collaborate via e-mail, forum and distribution list. Nevertheless, e-mails are difficult to keep organized and are not easily searchable. This disadvantage becomes frustrating especially when new members join the CoP. It is known that the successful use of a system depends on the users, on their knowledge of the system, their attitudes towards it and the degree to which it matches their perception of the operations it is to support.

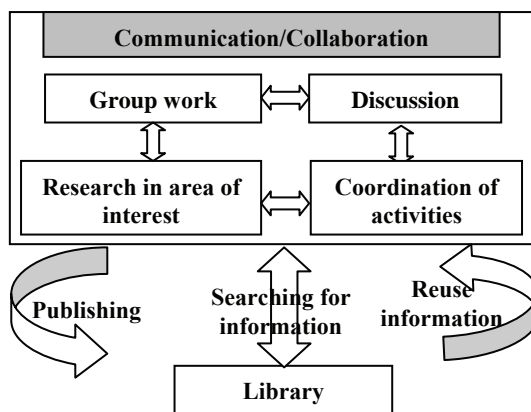
2. Tools' functionalities and CoP' requirements

One major concern in the development of adaptability, acceptability and accessibility of the tools and services is to develop a real communication between users and designers. A good design of technology is essential for the functioning of the CoPs. So, it is important that the technology designers have a good understanding of the goals, purpose, and the needs of the CoP before deciding how to design this technology to support the functioning of the CoP. The technology configuration will provide functionality to support learning, knowledge sharing and creation, as well as sociability and participation in the CoP [Preece 2000].

For analysing it, two main problems are crucial.

A). *How do we select the appropriate solution corresponding to the requirements of a particular community concerning the setting up and/or the promotion of its activities?*

To illustrate these requirements and depict the main flow of basic activities



(figure 1) within a Cop and their interactions and different levels of collaboration [Coleman 2002] we need to identify the necessary features of tools because a simple bulletin board or mailing list based on specific software, or a Web-based group with discussion threading and the ability to push e-mails maybe not enough.

Figure 1 Flow of activities

In contrast, with collaboration software, the history of the rich content that occurs in everyday problem solving and discussing is recorded and stored for others to see. All transactions and communications are in a searchable archive and this creates an “organizational memory”.

More and more real time functionality and options to the creation and dissemination of work is required. Additionally, the speed of technological development has continued apace. This new technologies (Weblogs, Wiki, instant messaging, web services, etc.) and standards like XML [Decker et al., 2000] for describing data and semantic Web [Berners-Lee, Hendler & Lassila, 2001] can play a enhanced role in assisting CoPs. The semantic Web deploys two further enabling technologies: RDF [Brickley, 1999] provides the semantic mark-up and ontology [Fensel, 2001] languages supply a shared common understanding of a domain. This new technologies encourage CoPs in different social actions defined in the framework proposed by Ngwenyama and Lyytinen [Ngwenyama et al. 1997] or in different stages of CoPs' lifecycles [McDermott, 2000]. The Wenger' communities evolution model [Wenger 1998] maps each of the five stages into their main functions like connect, commit, create context, operate, collaborate, sustain and maintain.

If in the initiation stage a CoP needs enabling technologies like e-mail, e-conferencing, listservers, online forums or Web-integrated platform, in the maturing stage it have more requirements for information repository, analytical and decision making tools, intelligent agents and feedback facilities and Cops dedicated portals with real time functionalities. In this case we have two distinct categories:

(1) *software offers dedicated services* (information and collaboration services) at communities of practice;

(2) *software designed to assist knowledge management*;

In the first category, collaboration tools are a central place (often referred to as groupware) where most package comprise an information repository (that can be accessed by Cops members who can collaborate working on common documents and can hold electronic discussions to learn or to develop new practice and expertise) or integrated calendar, group schedulers, e-mail notifications, e-conferencing facilities or other real-time meeting support. The second category provides solutions for creating centralized repositories for storing, sharing, retrieving and reusing knowledge where the deployment of semantic mark-up together with the ontology provide the formal specification of a knowledge domain to make explicit any domain assumptions. That's mean they integrate storage, communications and collaboration services into a single environment.

B). What functions or functionalities does the community require?

Maybe a good idea is to create a list of features (supported by explanation of the functions and options of tools) to be used to help potential users identify their expected needs by distinguishing essential, useful and non essential features. In this way, it makes sense in selecting software for one type of community as far as possible to look for a system that was developed with that type of community in mind. In the core of any tools, the conversation space is vital to the success of a potential community. We can identify a non exhaustive list of functions with different attributes linked to basic activities described above in figure 1:

Discussion

1. **Asynchronous communication** with e-mails based systems and bulletin board systems (we would need to address in the communities the development of operating protocols as to how it is used to ensure that is not used negatively) and **synchronous communication** like chat, instant messaging, e-conferencing (audio-video) with awareness functionalities.

Group work

2. **News and announcements** (are posted in different channel except the asynchronous channel) and **alert, calendar and task list**. Alert is an alternative approach to making people aware of changes (notification' systems). Calendar can be used as a record of events and to alert users of community events or outside world. Task list or activities list of the community (can be integrated with the calendar and alert features).

Research in area of interest and expertise

3. **Membership directory** develop the ability to encourage users to share information about themselves, such as their areas of expertise, interests and work experience, and so connect people and **contact lists** to encourage users to share contacts through a dedicated contacts directory (some members will find the real value of the community is to be able to access expertise).

4. **Link store** encourages members of the community in the ability to add links to share online resources (the system that have the ability to create folders or subfolders with clear headings, short description, the dates it was created, linked to an ontology) or to share a bookmarks.

Searching and Reusing information

5. **Searching and reusing information**. The search facility should be ideally (full-text) be able to search (by type of file) all internal documents, links and messages and archive or external.

Group work, Publishing and Library

6. **Product of documents** and **document repository** are two important features of a collaboration system. In the community is useful and fair to have

standards about which authoring software is used and in which format to produce the documents (email files, a long-threaded discussion or a specific document). In this case metadata linked to ontology is required and a full document management system with check-in and check-out of documents and version control, and an archive of previous versions.

Coordination of activities

7. **Polling** is a powerful tool for helping communities to foster active participation and even to make collective decisions.

8. **Awareness, user tracking and statistics.** This feature, useful in **workflow** or **project management**, sign offs or record management, assure information, for example, about who was using the system, how often they logged and in what time of day and especially what proportion of the community members who reads discussion groups does not actively participate.

9. **Usability, customisation and security.** The speed of the response times or to save one's password as a cookie on one's own machine may be a key to use of the system. The ability to personalise the environment by choosing a theme (public interface) or a language for layout and a good help of use of tool or FAQ increase the integration of the tools in the Cop' activities.

These functions described here could be useful to evaluate the software they have been used in a community building, and to triangulate with the results of actual user behaviour captured through statistics or direct observation of behaviour. In conclusion, the Cops' activities supported by the tools described below can be defined thus:

- To bring together the members of a community
- To identify and manage competences: Who knows what? Who does what?
- To capitalize knowledge and to share the good practices
- To work in project mode within a network trade
- To exchange with the other members and the experts
- To support cross collaborations with the profit of the innovation
- To develop the feeling of membership

3. Tools' selection

The selection of the most appropriate technology in the form of an integrated or specific tool is a significant part of creating and facilitating a community and is directly linked to CoPs requirements. While many communities are supported by Web sites providing knowledge sharing by means of online libraries, knowledge centres, specialist databases, information repositories, only a few of them get the fully necessary support. Technology platform are often described in terms of features, but in order to really evaluate this technology by a user perspective, it is

useful to start with analysis of existing tools.

Some of the software platforms presented bellow, designed to assist communities of practices, provide dedicated support able to offer CoPs the required IT facilities. The list of the products is only representative of the range of services available, but is by no means exhaustive. Analyzing these products yields not only a scan of products, but also a way of understanding the various aspects of a knowledge strategy based on communities of practice and how a this technology, more and more used by CoPs in virtual environments to support their activities, can affect the success of a community in each area of interest.

In the first category *software offers dedicated services* for CoPs we have some software suites who provide supportive of social structures, knowledge exchange and documents and contained taxonomy, a local search, an experts database, discussion and an events notification facility or community governance and polls or a limited virtual meeting space (audio or video-meeting).

1. **iCohere** [iCohere 2007] provide Web collaboration software tools for online communities, project teams and distributed organizations. Is available as a hosted application on the iCohere servers or for use in the customers' own servers as a site licence and claims advanced security considerations. This collaborative community software integrates all of the most critical community-focused features: online discussions, instant messaging, document management, and searchable member profiles, web conferencing and streaming PowerPoint presentation, etc. This technology enables engaging member communication and networking (relationship building), knowledge sharing and building, project collaboration and learning and development. In the table 1 the company provides which allocates core technical features to each focal primary area of activity of most CoPs.

CoPs activities	Core Technical Features
Relationship	Member networking profiles; Member directory with "relationshipfocused" data fields; Sub groups that are defined by administrators or that allow members to self-join; Online meetings; Online discussions
Learning	Recorded; PowerPoint presentations; E-learning tools; Assessments; Web conferencing; Online meetings; Online discussions; Website Links
Knowledge	Structured databases; "Digital stories"; Idea banks; Web conferencing; Online meetings; Online discussions; Expert database and search tools; Announcements; Website Links
Actions	Project management; Task management; Document collaboration; File version tracking; File check-in and check-out; Instant messaging; Web conferencing; Online meetings

Table 1 Core technology features

2. **Tomoye Simplify** [Tomoye 2007] platform offers a similar set of resources but not community governance and polls. It provides login facilities and membership privileges, customisation, navigation via bookmarks, threaded discussion forums and instant messaging, e-mail lists and digests, FAQs, content

ratings and search for knowledge and experts by a search engine over an XML database that includes multimedia content. Users can further subscribe to a subject of interest and receive regular e-mail updates, digests and links to new related objects.

3. **Knowings** [Knowings 2007]. The portal personalizes the accesses of users according to their roles (reader, author, expert...), language (multilingualism), responsibilities, centers of interest and competences. Finally of powerful search engines facilitates the access to relevant information. This portal proposes a complete solution of management of knowledge, of management of contents and collaborative work for CoPs: to collect, organize and manage the contents; to share and diffuse knowledge; to capitalize and transmit the experience; to automate their operational processes; to cooperate remotely and in asynchronous times; to cross competences and to enhance the cooperation.

In the second category, *software designed to assist knowledge management* we found some collaborative computing technologies used in the support of KM that also can be put into use with CoPs.

1. **Open Text LiveLink** [OpenText 2007] for Community of practice provides weblogs, FAQs, webcasts, an experts database, forum with threaded discussions, and role-based permissions for community users so that they can perform specified activities.

2. **SiteScape** [SiteScape 2007] provides both synchronous and asynchronous communication facilities, document management, shared scheduling, and instant messaging, as well as a number of task-and process-based tools. Web meetings, white boards, videoconferencings are also supporting.

3. **iLevel Software** [iLevel 2007] provides solutions that enable teams to collaboratively manage the entire lifecycle of business content using a unified, tightly integrated platform and repository. The tool offers extensive XML content management, Web-based document management, Web content management and intranet / extranet access to business information, but also a number of services that improve knowledge exchange and retrieval such as enterprise search, categorisation facilities, alerts, and collaborative capabilities.

4. **AskMe Enterprise's** [AskMe 2007] Community Services provide a comprehensive set of tools to foster and manage cross-boundary communities of practice. These include one-stop community pages where CoP's members can interact and share ideas with people who share an interest in their discipline, features such as subscriptions and incentives that drive community usage, and community management capabilities that enable COP leaders to oversee communities, set permissions and security, and drive activity. The key benefits of this tool:

- One point of access to the people, frequently asked questions, and documents employees need to solve critical business problems.

- Reduces re-invention by capturing solutions in a searchable knowledgebase.
- Fosters x-boundary connections and drives innovation by creating communities across geographical, departmental, and divisional barriers

4. Elluminate Live! [Elluminate 2007] is real-time e-learning and web collaboration tool built specifically for live, multimedia collaboration. This solution is proposed in three versions: Enterprise Edition (a live web conferencing environment for virtual meetings and remote training, with the ability to support dozens to hundreds of users), Academic Edition (a highly scaleable e-learning and collaborative environment for use by academic institutions), and Lite Edition (with basic functionality that includes full-duplex audio, interactive whiteboard, instant messaging, and advanced, yet easy-to-use, moderator tools). For example, in interaction to asynchronous distance learning, tutor and students communicate via full-duplex audio, live video, or text chat; write or draw on the interactive whiteboard; and share images, documents, and PowerPoint presentations. Tutors or professors can demonstrate a procedure via live webcam, show a high-resolution video, or take students on a guided web tour. Students can do small group work in breakout rooms, with separate audio, whiteboard, and text messaging, and come back together in the main room to present results to the entire class. Instructors can monitor student status with advanced moderator tools, conduct informal polling, and deliver ad hoc or previously developed quizzes. In this view, the tool is an interactive environment specialized for online meeting and training.

Our purpose was not to make an exhaustive list of the tools and their useful functionalities for the development of tools for CoPs, but only to bring some elements of reflections on "what is done" elsewhere.

5. Conclusion

Sometimes, using this technology where face-to-face member interaction can be substituted by virtual contact to various degrees, information manipulation still poses a significant obstacle to the flow of the information inside these communities. The emergence of the Semantic Web seems to improve the development of tools for the automated capturing, sharing, and retrieval of information. Hence it is necessary to look at the social implications of technology support for CoP activities. Adopting this perspective we have to contribute to adaptability, acceptability and accessibility of the tools and services. From a user perspective that means the interoperability is the ability of system to work together, to "plug-and-play" without any hassles. In the lights of the two categories of software presented, a possible technical solution to these demands seems to be tailoring. Tailoring is "the activity of modifying a computer application within the context of its use" [Mørch et al., 1998]. In other words, it is the adaptation of a system performed by its users while using it, in order to satisfy the needs that were not properly accounted for in the original "version".

Considering the specific case of CoPs activities system, tailoring could take the form of modules or features which can be added to or removed from the system by its administrator or final users. The promotion of such technical solutions as tailoring for example imply, beyond the interoperability of system, the necessity to depict the user perspective about tools functioning.

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A la recherche de méthodes pour comprendre l'apprentissage et le développement des CoPs

Conférence EIAH 2007 (Environnements Informatiques pour l'Apprentissage Humain)

Chair: France Henri

Caroline Brassard, Universités du Québec à Montréal et de Chicoutimi

Amaury Daele, Université de Fribourg

Nathalie Deschryver, Universités de Genève et de Fribourg

Mélanie Ciussi- Boss, Université d'Aix en Provence

1. Introduction

Cette table ronde rassemble quatre jeunes docteurs ou doctorants ayant choisi de mener leurs recherches doctorales avec, pour ou sur les communautés de pratique. Les échanges leur permettront d'apporter leurs réponses à des questions comme :

- Pourquoi s'intéresser aux communautés de pratique ?
- Comment définissez-vous ces communautés ?
- Dans votre recherche, quels sont les questions et concepts centraux ?
- Quelle(s) méthode(s) avez-vous adopté et pourquoi ?
- Quelle place occupe l'instrumentation des communautés dans votre recherche ?

Question et méthode de l'étude du partage pédagogique au sein d'une communauté universitaire

Caroline Brassard

Le partage pédagogique est une tendance de plus en plus présente dans les pratiques enseignantes à l'université. En effet, des enseignants universitaires tentent de transformer et d'actualiser leurs pratiques. Pour ce faire, certains s'investissent dans un processus de partage pédagogique au sein de communautés de pratique. Ce partage est, à l'occasion, soutenu par un environnement virtuel.

Dans le but de comprendre ce partage, une communauté de pratique d'enseignants universitaires a été observée. La question à la base de l'étude se libellait ainsi : Quelles sont les composantes et les conditions du partage en enseignement universitaire soutenu par un environnement virtuel ? Afin d'y répondre, il fallait identifier les composantes et les conditions du partage au sein d'une communauté de pratique utilisant un environnement virtuel en enseignement universitaire et ensuite les modéliser.

Une recherche développement émergeant sur un modèle a été effectuée (Loiselle, 2001). Le recueil de l'information visait toutes les traces du partage et des savoirs d'expertise. Les traces du partage renvoient aux données numériques colligées à partir de l'environnement, le courriel et le forum. En effet, pour analyser l'activité d'une communauté de pratique, l'observation systématique en différé des comportements verbaux écrits et du produit de réification est nécessaire (Pudelko, Daele et Henri, 2006). Quant aux savoirs d'expertise, ceux-ci sont accessibles par le biais d'entrevues semi-dirigées car le sujet explicite son vécu (Savoie-Zajc, 2003). La collecte des données s'est effectuée en continu durant un trimestre, générant une grande quantité de données mais permettant de préserver la richesse du contexte (Pudelko et al., 2006).

La méthode d'analyse des données est qualitative (Van der Maren, 1995). Une analyse de contenu des données provenant des diverses sources a été effectuée, les constantes ainsi que les particularités ont été dégagées et croisées. Ces choix ont été retenus afin de permettre une analyse en profondeur du partage. Pour l'analyse des

données, une grille de codage a été élaborée au départ à partir d'éléments théoriques pour catégoriser le contenu des diverses sources de données. Par la suite, une analyse de contenu par catégorisation (Bardin, 1983; L'Ecuyer, 1990) a été effectuée. Ces catégories d'analyse ont été construites selon le modèle C de L'Ecuyer (1990) sur la base des données recueillies.

Précisons également que la source des données a été retenue pour étayer notre analyse. Ainsi, les résultats tirés du forum et des courriels ont permis de mettre en lumière les pratiques authentiques des enseignants tandis que les résultats issus des entrevues ont permis de comprendre ce que les enseignants ont rapporté sur leurs pratiques. Cette complémentarité des sources a augmenté notre compréhension du partage au-delà des simples faits observables à travers les traces électroniques. Dans le cas de notre étude, il importait de faire le plus large portrait possible du partage. Cette façon de faire nous a permis d'avoir un modèle plus complet et davantage transférable.

Sociabilité et conflit sociocognitif vécus au sein de communautés virtuelles d'enseignants

Amaury Daele

La problématique dont il est question dans ce projet de thèse touche à celle des conditions du développement professionnel d'enseignants participant à une liste de discussion par courrier électronique. Cette problématique est ancrée dans les études menées depuis un certain nombre d'années à propos du développement professionnel des enseignants dans un contexte de groupe. Ces recherches ont mis notamment en évidence l'importance, pour l'apprentissage du métier d'enseignant, d'entrer en contact avec des collègues, d'analyser et de parler de ses pratiques... et ceci pour des raisons d'accessibilité des savoirs, de validité des pratiques échangées et de sécurité dans la relation professionnelle (Charlier, 1998 ; Day, 1999 ; Huberman, 1986). Dans les formations formelles initiales ou continues des enseignants, beaucoup de formateurs ont tiré parti de ces connaissances sur l'apprentissage de l'enseignement et privilégient ainsi les échanges de pratique et la réflexivité en groupe.

Mais parallèlement aux formations formelles, les communautés virtuelles relèvent plutôt de l'informel : il n'y a pas toujours de cadre institutionnel, la forme des échanges d'expériences ou de documents dépend des modes de communication et des technologies utilisées, les contenus des conversations sont souvent en prise directe avec le vécu professionnel immédiat des participants, l'implication dans les échanges est le plus souvent libre, il n'y a pas de lieu ni d'horaire fixés pour des réunions, etc. Nous touchons ainsi à plusieurs questions si l'on tente de comprendre non seulement le fonctionnement de ce type de dispositif mais aussi les motivations des enseignants à y participer et ce qu'ils en retirent pour leur pratique : comment une communauté virtuelle d'enseignants se définit-elle, se construit-elle au fil du temps ? Que viennent y chercher les participants ? Qu'y trouvent-ils par exemple de différent que dans une formation continue ou que dans les discussions qu'ils peuvent entretenir avec leurs collègues proches ? De quoi parlent-ils ? Que s'échangent-ils ? Qu'y apprennent-ils ? En quoi leur participation contribue-t-elle éventuellement à leur développement professionnel ? Comment identifier des conditions d'entrée, de participation et d'apprentissage pour les participants ?

Une recherche exploratoire (Daele, 2004 ; Daele 2006) nous a permis de construire un modèle théorique du développement professionnel et de le valider au

travers d'une analyse de fils de discussion dans une communauté virtuelle d'enseignants et d'interviews menées auprès de plusieurs membres de cette communauté.

En conclusion de cette recherche, la question principale qui apparaissait était celle des conditions d'émergence et de résolution du conflit sociocognitif au sein d'une communauté virtuelle d'enseignants et plus particulièrement parmi ces conditions, la sociabilité : « la sociabilité pourrait être aussi étudiée en tant que condition pour l'émergence d'interactions sociales positives et suivies favorables à l'émergence de débats et de conflits sociocognitifs » (Daele, 2004, p. 123). La question centrale de notre recherche doctorale est donc « En quoi la sociabilité construite au sein d'une communauté virtuelle constitue-t-elle une condition pour l'émergence de conflits sociocognitifs et pour la résolution de ces conflits à un niveau cognitif ? ».

Pour répondre à cette question, la collecte et l'analyse des données se focalisera d'une part sur les représentations personnelles de l'expérience d'apprentissage à travers la participation à une communauté virtuelle, en portant une attention particulière à la condition « sociabilité » et d'autre part sur des fils de discussion qui « font débat » au sein de la communauté. Le terrain d'étude est une liste de discussion par courrier électronique à laquelle sont inscrits environ 300 instituteurs et institutrices, issus pour la plupart d'écoles francophones belges.

Interactions sociales et expérience d'apprentissage en formation hybride

Nathalie Deschryver

Les dispositifs de formation « hybrides » sont une des nouvelles modalités de formation dans l'enseignement supérieur. Ils articulent des phases présentielles et à distance et sont soutenus par un environnement technologique (plate-forme, portail, etc.). Il existe différentes configurations de ces dispositifs que nous tentons avec des collègues de mettre à jour dans des travaux en cours (Charlier, Deschryver, Peraya, 2007, à paraître).

Impliquée dans ces dispositifs depuis 1997, nous avons pu constater des contraintes fortes pour les étudiants imposées par des situations impliquant une interaction sociale à distance, et plus particulièrement dans des situations d'activités de groupe. Nous nous sommes ainsi régulièrement interrogée sur le sens que prenaient les situations d'interaction dans ces dispositifs pour les étudiants, quel rôle elles prenaient dans leur apprentissage. Parallèlement, une recherche sur notre pratique de tutorat dans un dispositif de formation collaboratif à distance nous a permis de mettre en évidence l'importance de l'accompagnement soutenant ce type d'activité. Cependant, la situation habituelle de l'enseignement à l'université fait le plus souvent montre de ressources limitées en matière d'accompagnement.

Ainsi l'objet de cette recherche en cours (Deschryver, 2004) consiste à interroger le rôle que prennent les interactions sociales dans l'expérience d'apprentissage des apprenants. Quelles interactions vont-ils privilégier dans leur expérience d'apprentissage : des interactions socio-cognitives ou socio-affectives, à distance ou en face à face, avec les formateurs, les pairs ou d'autres personnes ressources, des interactions formelles ou informelles ? Est-ce que ces modes privilégiés d'interaction peuvent se comprendre à travers certaines variables individuelles (motivation, expériences antérieures d'apprentissage, contraintes ou ressources de l'environnement social) et la perception du dispositif de formation (présence sociale, charge de travail, etc.) ?

Les réponses à ces questions de recherche devraient nous permettre de formuler des hypothèses quant aux conditions d'efficacité des dispositifs de formation hybride pour le support des interactions sociales : les variables individuelles importantes à prendre en compte, les caractéristiques des environnements technologiques, les interactions à privilégier à distance, celles à privilégier en présentiel, etc.

Nous avons étudié les expériences d'apprentissage d'étudiants impliqués dans deux dispositifs de 3^e cycle universitaire. Les modes d'interactions privilégiés sont étudiés à travers ce qu'ils disent de leur expérience d'apprentissage, à trois moments de leur formation sur une période d'un an : « Décrivez une situation dans laquelle vous avez le sentiment d'avoir appris ? Décrivez une situation dans laquelle vous avez le sentiment de ne pas avoir appris. »

L'expérience d'apprentissage d'une situation d'apprentissage collaborative à distance est également interrogée en cours de formation : « dans cette situation, qu'avez-vous le sentiment d'avoir appris ? que s'est-il passé ? ».

Pour comprendre ces expériences d'apprentissage, les variables individuelles (motivation, expériences antérieures, facteurs sociaux) et la perception du dispositif de formation sont également interrogées.

Ce questionnement des interactions sociales dans l'expérience d'apprentissage peut être intéressant et pertinent dans le domaine des communautés : quelles situations font sens pour les membres de la communauté en termes d'apprentissage et quelle rôle y prennent les interactions sociales ? quel lien avec leur perception du lien social dans la communauté ?

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« Du réseau à la communauté d'apprenants.

Quelle dynamique du lien social pour *Faire œuvre* ? »

Mélanie Ciussi-Bos

Cette thèse vise à éclairer les conditions et les processus à l'œuvre dans l'actualisation d'un réseau en une communauté d'apprenants dans les espaces de-territorialisés que sont les campus virtuels.

Elle s'interroge sur les questions suivantes :

- Comment distinguer les réseaux des communautés, et comment identifier les facteurs d'émergence des communautés d'apprenants ?
- Quelle est la place des échanges socio-affectifs et socio-cognitifs dans la construction de l'identité qui forge une communauté d'apprenants, au sein d'un dispositif de formation intentionnellement crée l'enseignant?

Nous avons choisi d'aborder ces questions par l'étude du lien social médiatisé (porté par le lien technologique) qui unit les membres d'un collectif en ligne (réseau ou communauté). Plus précisément, il s'agit d'étudier les conditions de *passage* d'un *réseau* à une *communauté* d'apprenants selon la *force du lien social médiatisé* noué au sein des dispositifs de formation à distance. Plus le lien est faible, plus les échanges sont de type fonctionnels (FAQ¹). Ils sont majoritairement présents dans les réseaux sociaux. Plus le lien est fort, plus les échanges portent une charge émotionnelle intense (échanges socio-affectifs et socio-cognitifs) qui semblent favoriser le développement d'une identité commune, d'une «micro-culture» (Audran et Daele, 2006), caractéristique essentielle d'une communauté.

Dans une première partie, une modélisation des liens selon deux axes bipolarisés est proposée (lien faible vs lien fort d'une part, présence vs distance d'autre part). Elle permet une première approche typologique des liens sociaux ainsi qu'un

¹ Foire aux questions

positionnement relatif du réseau et de la communauté. Dans la seconde partie, le cadre conceptuel théorique s'est orienté, au delà des conceptions traditionnelles de l'apprentissage, vers la compréhension d'un « faire ensemble », et plus particulièrement d'un « faire œuvre » qui semble être au coeur des processus d'apprentissage autant individuels que collectifs vécus par les membres d'une communauté. En effet, les membres partagent des valeurs jusqu'à la *création* d'une identité culturelle commune. *Faire œuvre* étant entendu comme ce processus de création (« *action de donner existence, organiser une chose qui n'existait pas* »²) individuel mais aussi collectif qui anime les participants d'une communauté. La communauté est également entendue comme une œuvre collective, l'œuvre étant le « *résultat sensible de l'action* »³. Dans une troisième partie, la démarche méthodologique ethnologique a été choisie pour favoriser l'insertion du chercheur dans la culture locale. Les *actions* et *interactions* des apprenants ont été étudiées à travers une enquête en ligne et une étude de contenu sur un corpus de 591 messages (forum de discussion et chat). Les rites d'*interaction* qui traduisent les phénomènes culturels de construction identitaire des communautés ont été analysés selon les phases d'évolution socio-discursives décrites par Audran et Daele (2006). Dans la dernière partie, l'interprétation des résultats et les perspectives de recherche ont notamment mis à jour le paradoxe de l'émergence des communautés d'apprenants en terme de « dissonance dispositive ». La dissonance, déséquilibre entre le *dispositif* intentionnellement créé par l'enseignant et la *situation* pédagogique vécue par les étudiants (Audran, 2006), dévoile en effet le caractère auto-organisé et informel des communautés qui sont avant tout autopoïétiques (Varela, 1989) .

Les nouvelles pistes de réflexion au coeur de notre étude sont:

- Comment atteindre l'équilibre entre le lâcher-prise nécessaire à l'émergence communautaire et le contrôle exercé par l'enseignant?
- Comment éviter des dissonances dispositives trop importantes pour se recentrer sur le coeur des communautés: les tâches collectives orientées vers des débats socio-cognitifs?

Ceci signifie qu'au delà de la structure émergente, il est important de se recentrer sur les tâches de nature collaboratives, car « *peut-être, sous-estime-t-on la difficulté qu'il y a à travailler de manière productive et à plusieurs, en particulier dans les communautés d'apprentissage formel* » (Baron, 2006, page 193).

² Définition du Littré : processus de création

³ Définition du Littré



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TEL-CoPs'07

2nd International Workshop on Building Technology Enhanced Learning Solutions for Communities of Practice

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Edited by

Nikos Karacapilidis* and Frans Van Assche**

* University of Patras & RA Computer Technology Institute, Greece

** European Schoolnet

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Individual Learning Characteristics in Web-based Communities of Practice

Nikos Tsianos¹, Panagiotis Germanakos¹, Zacharias Lekkas¹, Constantinos Mourlas¹

¹ Faculty of Communication and Media Studies, National & Kapodistrian University of Athens, 5 Stadiou Str, GR 105-62, Athens, Hellas
{ntsianos, pgerman, mourlas}@media.uoa.gr

Abstract. The Knowledge Management paradigm of Communities of Practice can be efficiently realized in web-based environments, especially if one considers the extended social networks that have proliferated within the internet. In terms of increasing performance through the exchange of knowledge and shared learning, individual characteristics, such as learners' preferences that relate to group working, may be of high importance. These preferences have been summarized in cognitive and learning styles typologies, which also define implications that could serve as personalization guidelines for designing collaborative learning environments. This paper discusses the theoretical assumptions of two distinct families of learning style models, cognitive personality and information processing styles (according to Curry's onion model), in order to explore the possibilities of personalization at the group level of CoP.

Keywords: Collaborative Learning, Learning Style, Cognitive Style, Personality Theories

1 Introduction

Traditionally, the social aspect of learning from a psychometric point of view has been correlated to personality traits. For example, a widely used personality psychometric tool is the Myers Briggs Type Indicator (MBTI) classification of types [1], that separates the way people perceive and learn in mutually exclusive preferences that involve (or not) social interaction (specifically, orientation to people: Feeling vs. Thinking types).

Moreover, major factor analysis approaches to personality [2] refer to extraverted and introverted persons, whose behavior is more or less socially oriented, with consequent effects to group dynamics. It must be stated that this extraversion-

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introversion scale is not the equivalent to MBTI extraverted/ introverted types, which are derived from the work of C.G. Jung and refer to the conceptualization of the outer world.

However, personality traits and their integration in an adaptive mechanism might seem rather vague in terms of quantifying and optimizing possible implications; still, the role of social interaction in learning has already been summarized in a number of cognitive and learning style theories, providing a useful personalization guideline for web-based CoP designers.

The term Communities of Practice obviously emphasizes on collaborative learning processes that are conducted horizontally within groups of people. The three elements that comprise a Cop are [3]:

- Domain – the area of knowledge
- Community – the group of people
- Practice – body of knowledge, methods and tools

The concept of incorporating individual characteristics in the context of a web-based environment could fit both in the Community and Practice elements, since:

- The usage of adaptive tools and methods (Practice element) can increase the level of comprehension by matching the learning material to the cognitive style of the learner, or by providing different types of knowledge resources to groups of participants with common cognitive characteristics.
- Collaborative learning processes can be optimized by assigning equally distributed different types of individuals in groups. Such an allocation would increase the number of problem solving approaches, since different types of learners approach problems in distinct ways (e.g. rely on others or work alone, theoretical vs. practical etc).

At the generic level of learning, web-based environments need to integrate individual and group characteristics in order to facilitate effective learning for every single user. It has been argued that the distribution of learning material in ways that match learners' ways of processing information is of high importance, since it "can lead to new insights into the learning process" [4]. Regarding these individual differences, there have been many attempts to clarify cognitive and learning parameters that correlate to the effectiveness of learning procedures, often leading to comprehensive theories of learning or cognitive styles [5].

Amongst these theories, some deal with the most intrinsic individual cognitive characteristics, such as Riding's CSA [6] or Witkin's Field Dependence [7], whilst some also take into account group interrelationship characteristics, such as Kolb's Learning Style Inventory [8] or Felder/Silverman's Index of Learning Style [9], regardless of their theoretical classification. As a result, the selection of the appropriate cognitive or learning style theory to be integrated in a web-based application should be in accordance to the context or the goals of each environment, and of course the availability of between learners' interactions.

Communities of Practice are essentially based on participants' interactions and socializations [10], which subsequently seem to favor personalization on the basis of a theory that emphasizes on the social aspect of learning. In any case, an effort to personalize the way an individual learns through a web-based CoP environment could follow two distinct approaches:

- a) By incorporating a theory such as Kolb's LSI, different types of learners that have a different approach in problem solving could be equally distributed in web-based CoPs, in order to avoid the possibility of one-sided approaches to the building of knowledge. Thus, this leads to personalization at the group level, since the CoP web-environment allocates users according to their profile.
- b) By choosing a more individually focused theory (e.g. CSA), application designers could offer to users learning material that matches their cognitive preferences; at a second level, the exchange of similar material between same types of learners could be enhanced. It could also be hypothesized that interactions between same types may increase comprehension or performance, which is the case of i-Help [11].

The issue of personalizing content for each single user has already been under the scope of Adaptive Hypermedia research, and relevant functional applications have been developed [12,13,14,15], while the significance of cognitive/ learning styles and intrinsic individual parameters in hypermedia environments constitutes a main research question [16,17]. The authors have already conducted experiments that demonstrate that matching web-based learning environment to a number of cognitive characteristics increases learning performance [18].

On the basis of Adaptive Hypermedia and cognitive/learning styles research, this paper examines how these theories describe distinct ways in which individuals could fit in collaborative working groups, setting a corresponding strategic context for personalized participation in web-based CoPs.

2 Theoretical background

The hypothesis that learning styles provide web-CoP designers a useful tool for incorporating individual and group characteristics can be supported by the argument that as implied above learning styles are a link between cognition and personality [19]. It is a fact that it would be extremely ambitious to construct a model of users or groups that involve numerous personality and cognitive traits combined together, not to mention the psychometric challenges; therefore, learning style typologies could be the "next best thing". Learning styles, on the other hand, are widely varied, and some of them fail to exhibit satisfactory reliability and validity [20]. However, as research often demonstrates, learning style is an important factor in computer mediated learning processes [21], though not always in an expected way [22, 23].

Curry's 3-layer onion model [24] classifies learning styles in a way that they are not mutually exclusive, but co-exist at different levels of learning processes. Specifically, moving from the inside to outside, the innermost layer is called *cognitive personality style*, and is the most stable trait. The middle layer is the *information processing style*, whilst the outermost consists of *instructional preferences* (see table 1).

Theories that fall into the inner layer are mostly related to cognition or traditional personality research, while more learner-centered approaches fit in the middle layer. The outer layer is more unstable, and it should be mentioned that according to Sadler and Riding [25] it is affected by the inner layer. However, the Dunn & Dunn model that belongs to the layer of instructional preferences exhibits high reliability and validity, but its implications are not discussed here, since they are not easily related to web environments.

Learning style theories are classified by Atkins, Moore and Sharpe (2001) on the basis of this onion model [26] as shown in table 1.

Table 1. Classifications of Learning Style Theories according to Curry's onion model

Cognitive Personality Style	Information Processing Style	Instructional Preferences
Witkin's FD/FI	Kolb's LSI	Dunn & Dunn Model
Riding & Rayner's CSA	Honey & Mumford Model	
MBTI	Gardner's Multiple Intelligences	
Felder & Silverman ILS	McCarthy's 4MAT model	
	Gregorc's Learning Style Types	

In educational settings, all of these well-known theories have been tested; still, most hypermedia research focuses on theories that fit in the inner layer (with the exception of INSPIRE system [27]). We believe that is strongly related to the fact that inner layer theories usually include scales of terms easily represented in hypermedia applications, such as preference for visual or verbal information, and structural organization of the presented content. On the other hand, middle layer theories provide a less cognition-based approach, since they focus on behavior and style in traditional learning environments, from a wider perspective.

2.1 Inner Layer Theories

Between theories that belong at the same layer, there are great similarities. At the inner layer, Witkin's construct of psychological differentiation (Field Dependency vs. Field Independency) is strongly correlated with CSA's Wholist/Analyst Scale, since the latter is derived from the former [28]. Felder Silverman's ILS adds to CSA's two scales (Visual-Verbal, Wholist- Analyst) the similar to MBTI scales of Extraversion-Introversion and Sensing-Intuition.

It would seem that Felder Silverman's ILS could be a very inclusive theory, but it needs yet to provide further evidence for its theoretical and statistical grounding [29]. The long history of MBTI certainly guarantees for its grounding and wide acceptance, but its extended questionnaire and personality rather than learning orientation are somehow impractical for web settings.

In our opinion, though there are still reliability and validity issues to be resolved [30], Riding & Rayner's CSA seems to be the appropriate representative of the *cognitive personality style* layer, and its individual and group implications will be further discussed.

2.2 Middle Layer Theories

With the exception of Gardner's Multiple Intelligences, all theories that have been classified in the middle layer of Curry's onion model, share common characteristics in the way they define types of learners [31, 32, 33, 34] (see table 2).

Table 2. Types of learners as defined by information processing style theories

Kolb's LSI	4MAT Model	Gregorc's Learning Styles	Honey & Mumford Model
Converger	Dynamic Learning	Concrete-Random	Pragmatist
Assimilator	Analytic Learning	Abstract-Sequential	Theorist
Accommodator	Common Sense Learning	Concrete-Sequential	Activist
Diverger	Imaginative Learning	Abstract-Random	Reflector

Each horizontal row of Table 2 shows types of learners that share common characteristics, according to their theoretical description. We should mention at this point that these similarities haven't been unnoticed by Gordon and Bull who have proposed a meta-model that combines multiple similar learning style models [35], taking also under consideration theories that are not mentioned here.

These middle layer models directly refer to learners' attitude towards collaborating and working in groups; speaking in terms of personality theories, some types are people oriented and some are more logical (feeling vs. thinking). This is especially true for the case of Kolb's LSI, where convergers and assimilators are thinking types, while accommodators and divergers are feeling types, according to correlations with MBTI scores. We should clarify that these types (regardless of specific theory) are not absolutely stable, but one person can gradually change style; it is possible that a learner can alter his type as years go by. Moreover, belonging to a type doesn't necessary exclude the possibility that at instances a person can perceive information in any of these four styles, even though his persistence on a specific style is relatively stable.

For the purpose of exploring the possible integration of middle layer learning styles into CoP environments, we believe that Kolb's LSI is the most appropriate representative of the aforementioned models, due to extended research on its implications and correlation with other psychometric constructs (such as the MBTI) [36]. However, analogous considerations can be projected on other models that share the same theoretical assumptions.

3 Individual Characteristics Considerations for CoPs

According to our rationale, there are two distinct ways to group users in CoP applications:

- I. Learners with common cognitive styles (as classified by Riding's CSA that we use in our paradigm), could be grouped together and collaborate in an environment that serves better their preferences- this is the case with i-Help that we mentioned above. Learners, in general, prefer to send information the way they receive it, and vice versa.
- II. In addition, each group of people should consist of practitioners of all different types of learners (according to LSI taxonomy that will be further discussed), in order to increase the variety of proposed problem solving approaches (with regards to social interaction) and to promote more efficient Knowledge Management practices.

These two ways of integrating cognitive and learning style typologies in web-CoPs are not mutually exclusive: the first case refers mainly to the material used and its structure, whilst the second paradigm deals rather with group composition.

3.1 The Paradigm of CSA

The CSA taxonomy is consisted of two independent scales, Imager/ Verbal and Wholist/ Analyst. The Imager/ Verbal scale affects the way learning resources are presented, and is probably less important in terms of overall CoP grouping; it is important though in web-content presentation. Within adaptive web architectures, users who have been identified as Imagers or Verbals, could be presented with the corresponding learning resources (e.g. images or text).

The Wholist/ Analyst scale, though, is about organizing and structuring information (see table 3), and is consequently related to navigational patterns. It would make much sense that users with common navigational route and structural approach would work collaboratively more efficiently, the same way that matching teaching and learning style is expected to increase performance.

Table 3. Wholists/Analysts Characteristics

Wholists		Analysts	
View a situation and organize information as a whole	Organize material in loosely clustered wholes	View a situation as a collection of parts and often stress one or two aspects at a time	Organize information in clear-cut groupings (chunking down)
Proceed from the whole to the parts	Exhibit high assertiveness	Proceed from the parts to the whole	Exhibit low assertiveness

Otherwise, a radically differentiated approach on behalf of learners could hamper communication and the way tasks are perceived, since wholists move from the whole to the parts, while analysts follow the exact opposite route. Intermediate learners are expected to perform equally well in both structural settings.

Additionally, to the extent that the wholist/analyst scale coincides with Witkin's FD/FI scale, it can be argued that wholists are little more oriented towards other people, whilst analysts are more introverted. Moreover, wholists exhibit higher assertiveness than analysts.

Safe conclusions could be drawn only after this hypothesis is tested in a web-CoP environment, and the aforementioned matchmaking is proven as important as the matching of teaching and learning style.

3.2 The Paradigm of LSI

On the contrary, the aforementioned middle layer theories (as represented by Kolb's LSI) describe learner types also in terms of collaboration. In other words, working in groups is perceived differently by each type; some types rely on others whilst some simply do not.

As in Riding's CSA (and the rest of the middle layer theories), Kolb's 4 types are drawn from two independent scales: Concrete Experience vs. Abstract Conceptualization, and Reflective Observation vs. Active Experimentation. People-oriented types are those that tend to Concrete Experience rather than Abstract Conceptualization, which in terms of personality theories are rather Feeling than Thinking.

More specifically, by focusing on group collaboration preferences according to Kolb's LSI [37], learners' characteristics are summarized in table 4.

Table 4. Learners' Characteristics in terms of group working preferences according to LSI

Divergers	Accommodators	Convergers	Assimilators
Are oriented towards people	Learn by teaching others	Prefer usually to work alone	Prefer working alone
Excel at brainstorming and working in groups	Excel at influencing others	See group work as a waste of time	Will work in groups if assigned
Learn by sharing ideas and feelings	Rely on others for information in solving problems	Appear bossy and impersonal	Prefer the instructor/leader to be an authority
Prefer the instructor/leader to be a motivator	Work well in groups		

As it is clearly defined by theory, diverger and accommodator's individual characteristics demonstrate a strong preference in group working, since collaboration may be a necessary prerequisite for maximizing learning performance. It also could be argued that the present modus operandi of web-learning in general favors types of learners that prefer working alone (convergers and assimilators), than those who are people-oriented.

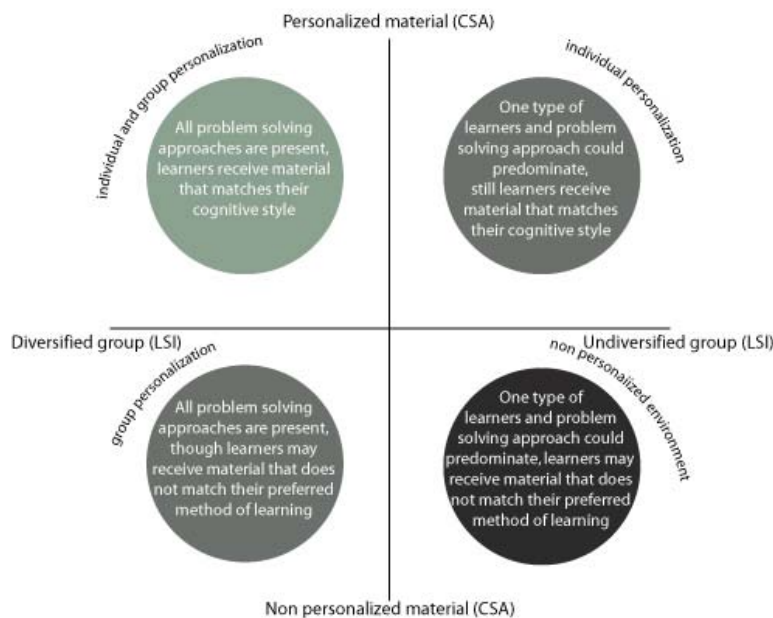
Implications for designers of CoP applications can be summarized in the equal distribution of the different types of learners, and in further motivating convergers and assimilators to participate. For example, if for any reason a group consists only of these latter two types, then the CoP's functionality may be impaired.

3.3 A Combined Approach

Whether should an information processing style theory be chosen over a cognitive personality style theory (e.g. LSI vs. CSA), and which would that theory be, is still a matter of debate. Practical and convenience reasons, as much as reliability and validity scores, determine at some extent the final selection.

On the other hand, since these theories are not mutually exclusive, it is possible that they could be combined in a unified model that separates the practical implications of each theory according to the CoP element they relate to. Theories such as the CSA focus on the individual (practice methods and tools), while theories such as the LSI can be applied on group composition (community). Ideally, the concept of personalization in a web-based CoP should address both these levels (see figure 1).

Figure 1. Unified approach to personalization in CoPs



It should be clarified that the term “problem solving approaches” refers mainly to learners’ preference (or not) to work with other people to promote efficient learning through practice, since this is of relatively higher importance in the context of CoPs. Moreover, some people tend to “lead” others in collaborative learning processes, while some tend to “follow”. Therefore, it is of importance to mix these types within a group.

This model demonstrates how cognitive and learning style theories may serve as well-defined guidelines for designers that are interested in expanding their center of attention to individual characteristics and their implications on group considerations, the same way that CoPs have changed the way Knowledge Management is conducted.

4 Summary and Future Work

The number and types of group interactions that learners are involved in a Community of Practice are strongly related to individual characteristics, which determine the degree of preference to group working, or at least common ways of structuring information.

Even if these social preferences are directly linked to personality factors, personality theories have far too complicated implications for CoP environments that focus on Knowledge Management, while theories that address low-level cognition processes are often too individualistic to consist a basis for user grouping.

Learning style theories could be described as a much needed link between personality and cognition; still, one must not be too optimistic until issues of reliability and validity of psychometric instruments are resolved. Nevertheless, at theoretical level, these constructs provide useful insights for Knowledge Management applications that intend to explore the integration of learning methods of group working into web-based CoPs.

As shown above, not all learning style theories address issues of group interaction at the same extent. Therefore, web-CoPs designers that wish to incorporate individual learning characteristics should distinguish that each cognitive/learning style theory addresses issues of different elements of a CoP:

- *cognitive personality style* theories relate to the Practice element, since their implications may lead to a personalized approach to methods, tools and material.
- *information processing style* theories are relevant to the Community element, in the sense that different types of learners should be combined together in order to assure the occurrence of interactions at the level of shared learning and the building of coherent knowledge.

Subsequently, this leads to the need of experimentally evaluating the positive effects of a) matching content to practitioners according to their cognitive style (personality cognitive style models like CSA), and b) assigning to each group equally distributed different types of learners (information processing style, such as Kolb’s LSI).

In any case, collaborative working is not a mere result of random real-time dynamics, but also the resultant of learner characteristics that individuals carry along, whatever the circumstance. Therefore, taking into account their preferences may promote efficient cooperation, or at least alleviate difficulties that occur from widely varied methods of learning between practitioners in CoPs.

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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

Denis Gillet¹, Chiu Man Yu¹, Sandy El Helou¹, Amagoia Madina Berastegui¹,
Christophe Salzmann¹, and Yassin Rekik¹

¹ École Polytechnique Fédérale de Lausanne (EPFL), CH-1015 Lausanne, Switzerland.
{denis.gillet, chiuman.yu, sandy.elhelou, amagoia.madina, christophe.salzmann,
yassin.rekik}@epfl.ch

Abstract. eLogbook is a Web-based collaborative environment designed for communities of practice. It enables users to manage joint activities, share related assets and get contextual awareness. In addition to the original Web-based access, an email-based eLogbook interface is under development. The purpose of this lightweight interface is twofold. First, it eases eLogbook access when using smart phones or PDA. Second, it eases eLogbook acceptance for community members hesitating to learn an additional Web environment. Thanks to the proposed interface, members of a community can benefit from the ease of use of an email client combined with the power of an activity and asset management system without burden. The Web-based eLogbook access can be kept for supporting further community evolutions, when participation becomes more regular and activities become more complex. This paper presents the motivation, the design and the incentives of the email-based eLogbook interface.

Keywords: Community of practice, email-based system, activity management.

1 Introduction

eLogbook [8] is a Web-Based collaborative environment particularly adapted to the needs of communities of practice (CoPs). It is developed at the Swiss Federal Institute of Technology in Lausanne (EPFL). It relies on three fundamental entities: *Actors*, *Activities* and *Assets*. An actor is any entity capable of initiating an event within the eLogbook workspace. An asset is any kind of resource (e.g. text documents and images) shared between community actors. An activity is the formalization of a common objective to be achieved by a group of actors. *Events* related to these three entities are governed by *Protocols*. eLogbook supports management of invitations, roles, and deliverables for the activities; and supports access rights management for the assets. It provides personalized and context-sensitive awareness information crucial in collaborative environments [4,5]. The features of eLogbook are useful to any kinds of CoPs.

The original interface of eLogbook environment relies on Web 2.0 technologies for enabling effective Web-based user interaction. It can be considered as a flexible and adaptive Web-based collaborative activity and asset management system or service that could easily be adopted by communities of practices.

As pointed out by Moor in [7] and confirmed in the framework of the Palette project (<http://palette.ercim.org>) through a participatory design approach [2], it is difficult for a community to select and adopt new environments and services for enhancing their practice without inducing disturbances. For the communities which have been using email as the main communication tool, email-based interface environment may be more acceptable than Web-based one. It is desirable for enabling communities to choose their suitable environments. Therefore, there is a need for solutions that facilitate the introduction of advanced collaboration services in CoPs. Our assertion is that, by providing an email-based interface to eLogbook, its further adoption can be strengthened and further evolutions of CoPs can be better supported. To validate this assertion, an email-based interface is designed as described in the next section. Its acceptability will then be investigated in the framework of the Palette project with pilot CoPs.

The email-based eLogbook interface enables users to manage their activities, assets, and awareness by sending emails directly to eLogbook and to receive requested information. Additionally, users can trace occurring events by receiving automatic notification emails from eLogbook. The advantages of providing an email-based interface to eLogbook are the following:

- To use the email-based interface, the users' devices only need to have email client installed. It is very common for computers, pocket PCs and even smart-phones to integrate built-in email clients.
- The communication cost induced by using an email-based interface is cheaper than the Web-based one. This is still an important factor for mobile users.
- The users can store emails on their devices. Afterwards, they can manage joint activities, share related assets and get contextual awareness without connecting to the Internet. The mail-based eLogbook interface provides offline information management and relies on standard email synchronization solutions.
- The users can send and check emails at a time of their choosing.
- As pull scheme, email access is intrinsically context-oriented.

The rest of this paper is structured as follows. Section 2 describes work related to email-based collaborative environments. Section 3 introduces the specifications of the email-based eLogbook interface. Section 4 ends with concluding remarks.

2 Related Work

Email systems are widely deployed in workflow, task and activity management systems [3,6,9,10,12]. Workflow systems specify and monitor evolution of business processes. Email usually does not require real-time interactions. It is a convenience means for offline communication between users and systems. *Lynx* [11] is an email extension for workflow systems based on Web Services. It provides a Web service

through which a workflow application can interact with human partners via an email-based forms interface without requiring a specialized client. Its server side is composed of a BPEL execution engine, an outgoing email Web service and other partner Web services, as well as an incoming email gateway. The client side is composed of a standard email client application and an XForms player component. *Taskmaster* [1] is an email-based task management system. It uses an email system that can embed task management information directly in the email inbox. The information includes warning bars (which show task deadlines), action clusters, and task-specific contact lists. This solution enables management of emails and tasks in single application.

EDI (Electronic Data Interchange) systems are used in commercial organizations for trading partners to exchange information with each other. The systems have been using email as a means of exchanging messages. Each trading partner needs to provide an email address for EDI messages, and an email address for personal communications related to EDI. Typically, the MIME encapsulation specification would be used to enclose the EDI data within the email message. The trading partners would need to agree upon an encryption method for secure email.

3 Email-Based Interface to eLogbook

The email-based interface to eLogbook allows invocation and information requests via email. The users are authenticated by their registered email address that is hence required to send requests. The requests must follow a number of predefined rules to be interpreted by eLogbook properly.

First, this section presents the system flow for the email-based interface to eLogbook. Second, it states the syntax of the email requests. Third, it describes how notification mechanisms can be controlled via email and how particular information can be requested. Finally, it presents how two kinds of eLogbook actions can be triggered via email.

3.1 System Flow for the Email-Based Interface to eLogbook

Fig. 1 shows the system flow for the email-based interface to eLogbook. The email address for accessing eLogbook is *action.elogbook@epfl.ch*.

Every time eLogbook receives an email from a user, it handles the request according to the following steps:

- Step 1: *Sender Identification*. In this step, a check on whether the email sender is indeed a registered eLogbook user is performed. If this is the case, step 2 is initiated. Otherwise, the mail is ignored.
- Step 2: *Email Dissemination & Action Identification*. The content of the mail is parsed (subject and body), and the action to be performed is identified. In cases of ambiguous requests, an error message is sent back to the user.
- Step 3: *Protocol Checking*. A check is performed in this step to make sure that the sender is allowed to perform the requested action based on the access

rights s-he has been granted over the entities involved. For example, if the user wishes to create a sub-activity of another already existing activity, s-he must have administrative rights over the latter.

- Step 4: *Confirmation Request*. If the sender is allowed to perform the requested action, then an email is sent back for requesting a confirmation. This step is important for two reasons. First, it is used for security purpose in order to make sure that the corresponding eLogbook user was indeed the one who actually sent the request. Second, it ensures that the user indeed wishes to perform the action based on what s-he had sent and how it was interpreted by eLogbook. Each confirmation request has an expiration time, e.g., 24 hours from the sending of the confirmation request.
- Step 5: *Action Execution*. If the user confirms by replying to the email from eLogbook, then the requested action would be executed.

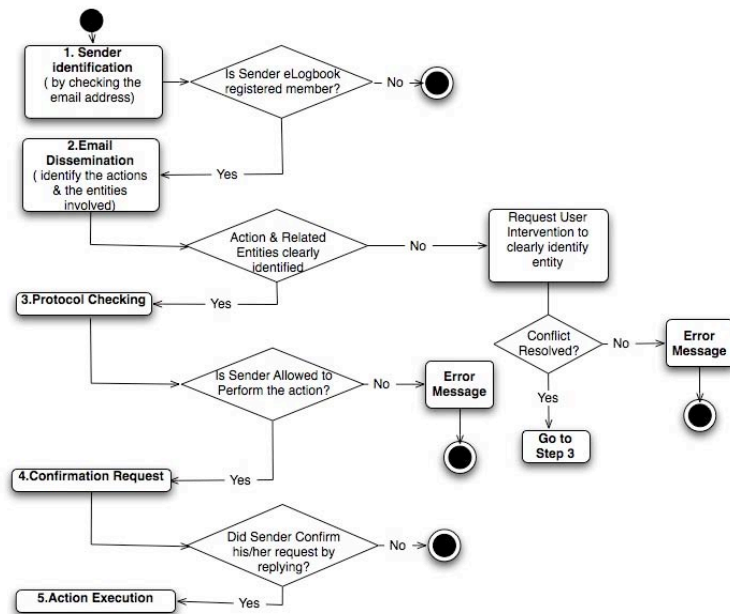


Fig. 1. System flow for the email-based interface to eLogbook.

3.2 Syntax of Emails

The lightweight email-based interface to eLogbook allows users to write email in simple syntax to request for actions or information. Figure 2 shows the syntax of the request email from a user, and that of the confirmation email from eLogbook.

A request email contains four parts. The *email recipient* states the email address of the eLogbook server. The *email sender* states the email address of the requester. The

email subject states the type of requested action, e.g., “create new activity”. The *email attachment* is used for attaching file for “create new asset” action. The *email body* states the information related to the requested action. It is formatted in plain text such that any actor can compose its request email using simple text editor. In addition, plain text format is compatible with all email clients.

```
Email recipient: <eLogbook email address>
Email sender: <actor email address>
Email subject: <type of action>
Email attachment: <File>
Email body:
'Name: <string>'
'Description: <string>'
'Public tags: <strings>'
'Private tags: <strings>'
'Public role: <string>'
'Relation: <type of relation>'
'Destination: <name of activity or user>'
```

Fig. 2. Syntax of a request email.

The *command tags* used in the email are in the format ‘<command string>’. Currently there are seven command tags for defining names, descriptions, tags, roles and relations of activity/asset/deliverable. Among them, only the *Name* field is compulsory; other fields are optional.

```
Email recipient: <actor email address>
Email sender: <eLogbook email address>
Email subject: Confirmation of the <type of action> action
Email body:
<information of the requesting action>
'Reference: <reference number>'
Access link: <URL>
```

Fig. 3. Syntax of a confirmation email.

The confirmation email is sent by the eLogbook server to the sender in order to authenticate her/his identities (Fig. 3). The actor needs to reply to the confirmation email to invoke the action stated in the email subject. The detailed action information is also listed in the email body. The confirmation email contains a unique *reference number* for each particular action request. The eLogbook server also generates and stores a hash value of the email for integrity check. The email contains an access link for the actors to access their new activity/asset/deliverable through the Web interface after confirmation or at a later stage if s-he deems it appropriate.

3.3 Requesting Information and Tuning Default Notification Mechanism

By default, an eLogbook user can be notified of several events via email, e.g., the reminder of the submission or validation of deadlines, and the invitation to join a new activity. The user can completely or partially disable the default eLogbook notification mechanism through the Web-based or the email-based eLogbook

interface. In the latter case, the email subject and body are interpreted in order to invoke the user's requested action.

- If the email subject is set to "disable all notifications", then the user will stop receiving all sorts of eLogbook notifications. An email with the subject "enable all notifications" induces the opposite action.
- If the email subject is set to "disable notifications", then the body of the mail contains the name of activities, assets and actors, in the format illustrated below. The requested action is to disable all notifications related to one of the activities, assets and actors listed in the mail.
- At any point in time, the user can "ping" eLogbook to get information related to a specific actor, activity or asset by setting the subject of the email in the form: "get info <entity_type>: <entity_name>" where the entity_type can be activity, actor or asset, and the entity_name can consist of the name of an activity, an actor or an asset. This feature is mostly suitable for people who prefer "pull" rather than "push" notifications means. eLogbook responds by sending to the user a report of the executed actions related to the stated entity since the last time the user visited the eLogbook site or requested related notifications via email.

3.4 Triggering Operational and Administrative Actions

eLogbook users can trigger two kinds of actions. First, *organizational actions* are related to administrating and structuring the activities of the community by defining common objectives, scheduling deliverables and managing the roles assigned to the community members. Second, *operational actions* enclose all other kind of non-organizational collaborative actions such as posting an asset in an activity, linking, tagging and/rating an actor, an activity or an asset.

By simply sending an email to eLogbook (action.elogbook@epfl.ch), members can invoke operational as well as organizational actions. Examples on how activities, assets and deliverables are created are given below in order to illustrate the interactions between eLogbook and users via email.

3.4.1 Creating an activity

Setting the subject of the email to "create new activity" creates an activity with its default administrator being the sender of the email. The body of the mail should contain the *name of the activity*, optionally the activity description and the following fields:

- *Public/Private tags*: Public tags will be shown to all the people who can see the activity; private or personal ones are only visible to their creators.
- *A public role*: If the email sender sets this field to "yes", then the activity is made public with default rights granted to everyone (allowing them to perform all non-organizational actions). The administrator can decide not to rely on default rights but define a new set of rights. This can be done via email as well. If the email sender sets the field to "no" or does not mention it at all, then

the activity is kept secret except for members who will be explicitly invited by the activity initiator.

- A relation to another already existing activity: The sender can define a relation between this activity and an already existing one. The most frequently used unidirectional relation type is “sub-activity of”.

Fig. 4 shows the body of an email example for creating an activity. The actor “amadina” wants to create an activity called “TelCoP07” which is a sub-activity of “Palette”. The email states two public tags, “email” and “usability”, for the activity. After the actor sends the email and before performing the requested action, eLogbook sends a confirmation email to the actor “amadina”, as shown on the Fig. 5. Once confirmed, eLogbook runs the action requested, and the new sub-activity called “TelCoP07” for the existing activity “Palette” will be created. Fig. 6 shows the new activity in the Web-based eLogbook interface.

```
'Name: TelCop07'
'Description: Workshop TelCoP07'
'Public tags: email, usability'
'Public role:yes'
'Relation:"sub-activity of" "Palette"'
```

Fig. 4. Body of the email for creating a new activity.

```
Confirm the following information:

'Name: TelCop07'
'Description: Workshop TelCoP07'
'Public tags: email, usability'
'Public role:yes'
'Relation:"sub-activity of" "Palette"'

'Reference: 12'
Access link: http://elogbook.epfl.ch/context/actor/42

Please, confirm this action by REPLYING to this email. Otherwise, the action
will be ignored.
```

Fig. 5. Body of the confirmation email.



Fig. 6. Context view for the new activity “TelCoP07”.

3.4.2 Creating an Asset

Setting the subject of the email to “create new asset” creates an asset with its owner being the sender of the email. In the body of the email should contain the *name of the asset*, and optionally the asset description and the following fields:

- *Public/Private tags*: Public tags will be shown to all the people who can see the asset; private or personal ones are only visible to their creator.
- *A public right*: If the email sender defines this field, then the asset is made public. The field can have three possible values: “owner”, “editor” or “reader”. If this field is skipped, the asset is kept secret except for members who will be explicitly granted access rights over the asset.
- *A relation to another already existing asset*: Any sort of predefined or user-defined semantic link can be used such as “reply to”, “complements”, “in favor”, “against”. For unidirectional links, the “of” preposition may be used.
- *A destination field*: If the user includes this field in the email body then access rights are granted to the stated entities which can be activities or particular actors. If an entity mentioned corresponds to an activity, then the asset is automatically posted in the activity. If it contains an actor’s username or email, then access right over the asset is granted to the actor.

Fig. 7 shows the body of an email for creating a new asset. The actor “amadina” wants to create an asset called “TelCoP07 paper v1” for the activity “TelCoP07”. The email states two private tags, “change chapter1” and “read conclusion”, for the asset. The asset is stored in the email as an attachment. After the actor sends the email and before the requested action is performed, eLogbook sends a confirmation email to the actor “amadina” (similar to the one we have seen in Fig. 5). Once confirmed, eLogbook runs the action requested, and an asset called “TelCoP07 paper v1” is created. Fig. 9 shows the created asset for the actor “amadina” in the eLogbook.

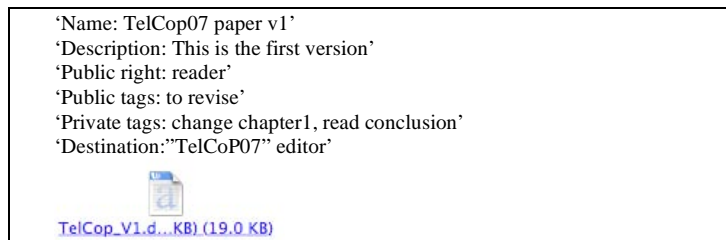


Fig. 7. Body of the email of creating a new asset.

3.4.3 Creating a Deliverable

Setting the subject of the email to “create new deliverable” creates a deliverable inside an activity. In the body of the email should contain the *name of the deliverable* as well as the *name of the activity* in which the former should be posted. Optionally the deliverable description and the following fields can be appended:

- *Public/Private tags*: Public tags will be shown to all the people who can see the deliverable; private and personal ones are only visible to their creator.

- The validation and submission deadlines.
- A relation to another already existing deliverable: It is mostly used to define the order of deliverables submission with an activity (using “precedes” or “exceeds”).

Fig. 8 shows the body of an email of creating new deliverable. The actor “amadina” wants to create a deliverable called “del07-07” for the activity “TelCoP07”. Fig. 9 shows the created deliverable in eLogbook after the email request.

'Name: del07-07'
'Activity name: TelCoP07'
'Description: This is the deliverable for the 7 July'

Fig. 8. Body of the email for creating a new deliverable.



Fig. 9. Context view of the activity “TelCoP07”. A new deliverable is created.

4 Conclusions and Future Work

The email-based eLogbook interface enables users to manage their activities, assets and awareness through email. It provides an alternative lightweight non-Web interface to ease eLogbook access when using smart phones or PDA and to facilitate eLogbook acceptance for community members hesitating to learn an additional Web environment. It also has other advantages over Web-based access, such as low communication cost and offline information management.

The email-based eLogbook interface is under development. The user-friendliness, security and efficiency of the system will be further investigated. In addition, the comparative acceptability of the Web-based and email-based systems for communities of practice users will be assessed.

The email-based eLogbook interface not only provides a lightweight solution to the members of communities of practice, it can also be considered as a high-level interoperability mechanism for other services that can benefit from eLogbook features. For example, a semantic analysis service could request an asset stored in eLogbook via email, process it, generate semantic tags associated to the chosen asset, and finally send the semantic tags to the eLogbook via email.

From the view of users, the email-based eLogbook interface provides activity management, asset management, and awareness features. From the view of other

services, the email-based eLogbook interface provides workflow support for collaboration. Therefore, this interface integrates the features of legacy email-based systems to support both CoP users and services.

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Using a Semantic Wiki in Communities of Practice

Adil El Ghali, Amira Tifous, Michel Buffa, Alain Giboin, and
Rose Dieng-Kuntz

Edelweiss - INRIA Sophia Antipolis
2004 route des Lucioles, 06902 Sophia Antipolis, France
{adil.elghali, amira.tifous, michel.buffa,
alain.giboin, rose.dieng}@sophia.inria.fr
<http://www-sop.inria.fr/edelweiss>

Abstract. In this paper, we present a new wiki engine: SweetWiki, offering the capabilities of a wiki together with some knowledge management features. And we give preliminary results of its use by some Palette CoPs.

Key words: Semantic Web, Wiki, Social Tagging, Knowledge Management

1 Introduction

The Communities of Practice, in particular during their emergence, need workplaces that enable the creation of knowledge, and facilitate the exchange. Wikis appear to be a suitable tool for these tasks, they allow CoP members to create pages, to share resources and to work collaboratively. However, many observers [1, 2] argue that it is complicated to convince users to use new tools, particularly those they are not used to, and the development of wikis is quite recent. It is then necessary to have an easy-to-use wiki, and to offer a visible added-value. On the other hand, the management of the produced knowledge *i.e.* structuring, searching, ... is a key issue for the CoPs since the amount of information and knowledge produced grows rapidly. The importance of the semantic dimension for learning using wikis is discussed in [3–5].

These observations allow to consider an easy-to-use semantic wiki, *i.e.* a wiki that offers the flexibility of wikis, an intuitive interface, together with knowledge management features, as a suitable tool for CoPs.

In this paper, we present a new wiki engine: SweetWiki [6], that combines an intuitive interface, the flexibility of wikis, enhanced with semantic web technologies, in order to facilitate collaborative work and to allow incremental construction of structured knowledge, thanks to social tagging. An experiment was initiated, in the context of the Palette project¹, with some CoPs using the wiki, we give some preliminary results of this experiment and present the further developments of SweetWiki, to make it more usable by CoPs.

¹ <http://palette.ercim.org>

2 What is Sweetwiki?

SweetWiki is a wiki engine developed at INRIA and used in the context of Palette. It implements some common features of the wikis, such as the mechanisms of “WikiPages” that are materialized into a hyperlink structure. In addition, SweetWiki relies on semantic web technologies, thus providing additional and powerful structuring mechanisms. Indeed, SweetWiki makes use of:

- An *ontology* of the wiki structure formalized in OWL Lite. This ontology describes SweetWiki concepts, properties and relationships, such as “Page”, “Web”², “Keyword”, “Link”, “Author”, “Version”, “Attached file”, “Attached picture”, etc. The corresponding meta-data are embedded in the wiki pages themselves. Making this structure and its ontology explicit allows to reason on it to generate widgets for helping the navigation (e.g. list of the related pages). This ontology can be modified and maintained by the wiki developers, letting us re-engineer the wiki structure or enrich it.
- A *folksonomy* of the topics (the Domain ontology) which enables the realization of the “social tagging” principle provided by SweetWiki. The pages and their attached documents (pictures, videos and attached files) can be tagged [7] from within the editor, using the folksonomy formalized using RDF/S. Thus, in the context of Palette, a CoP member can indicate that a page covers a particular field of knowledge of the CoP and that it is related to a particular activity handled in the CoP, for example. This mechanism is very simple to use and, at the same time, eases the navigation by reasoning on it (e.g. for finding the pages that are tagged with a concept, finding the semantically close concepts, formulating complex queries). This ontology can be modified by the wiki users (enriched directly by them and may be restructured by members having a particular role – since in general, CoP members may not have the skills, or not be interested in managing the folksonomy – in the CoP, so as to improve the navigation and querying capabilities) through the ontology editor that comes with SweetWiki. Moreover, if a CoP needs a specific additional ontology that is already available in RDF/S or OWL Lite [8, 9], this ontology can be loaded into the underlying semantic web server of SweetWiki and then, becomes directly accessible to the users.

2.1 Architecture

From the users’ point of view, SweetWiki is a web application that can be accessed in two modes: the first one is navigation, following different types of links³. The second is an edition mode based on Kupu⁴, an open source WYSIWYG XHTML editor. Since editing directly produces XHTML, we decided to use

² A “Web” is a sub-space of the wiki.

³ In each SweetWiki page we have static links, links associated to WikiWords, and dynamic links generated on the fly, according to the page tags.

⁴ <http://kupu.oscom.org>

it as a persistence format. Thus, once saved, a page stands ready to be served by the Web server.

To address structuring and navigation problems in wikis, we wanted to include tagging at the core of the wiki concept, thus we integrated four new web technologies:

- RDF/S and OWL are W3C recommendations to model metadata on the web;
- SPARQL is a recommendation for a query language for RDF;
- RDFa is a draft syntax for embedding RDF in XHTML;
- GRRDL is a mechanism for getting RDF data out of XML and XHTML documents using explicitly associated transformation algorithms, typically represented in XSLT.

With RDFa, we have both page data and metadata in the same standalone XHTML file. Therefore, the pages can be crawled by external applications or saved by users using their browser without any loss of information. Besides the topic tags, metadata include contextual information (e.g. page author, last modification on the page, etc.).

The implementation relies on the *Corese* semantic search engine [10] for querying and reasoning and on *SeWeSe* [11], its associated web server extension that provides API and JSP tags to implement all the web-based interfaces that use ontologies, as well as a set of generic functionalities (security management, ontology editors, web application life cycle, etc.).

2.2 Offered functionalities

SweetWiki offers many traditional wikis functionalities, in addition of a performant WYSIWYG editor, the easy-to-use editor is important for CoPs, since many users are not used to WikiML.

In this section, we focus the semantic functionalities of SweetWiki:



Fig. 1. Tagging a page

Tagging To tag a page or parts of it *e.g.* included pictures or attached files, the user is provided with a form to add tags. The form has an auto-completion

mechanism (Fig. 1) that suggests existing keywords by issuing SPARQL queries to the semantic web server in order to identify existing tags with compatible labels in the folksonomy. It also shows the number of other pages sharing these tags as an incentive to use them. Furthermore, related categories are also displayed in order to address the ambiguity of homonymy. With this approach, tagging remains easy (keyword-like) and becomes both motivating and unambiguous. Unknown keywords are collected and associated to the category “new concept” to enrich the folksonomy.

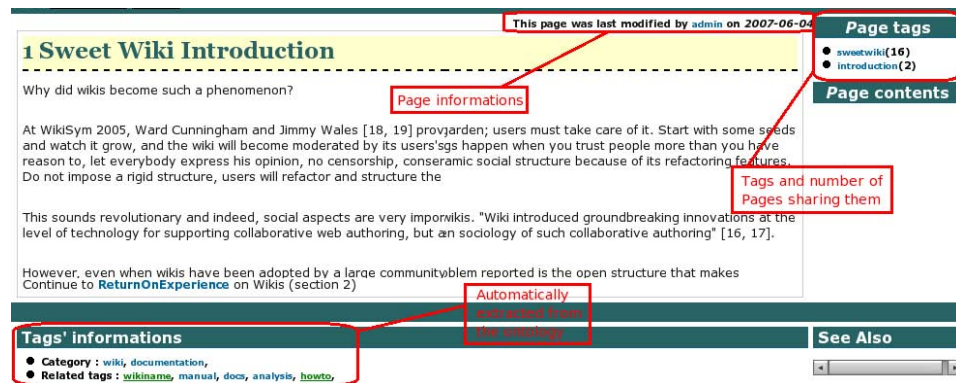


Fig. 2. Generated links from Page tags'

Tags supported navigation Tagging enables to find easily the tagged resource when searching for it, but it also enables to have access to other resources tagged with concepts related to the one(s) used to tag the resource. Indeed, when a page is saved, an RDF version of its metadata is extracted using GRRDL and feeds the Corese engine, which generates faceted navigation widgets (Fig. 2). In these widgets, the semantics of the tags is used to derive related topics.

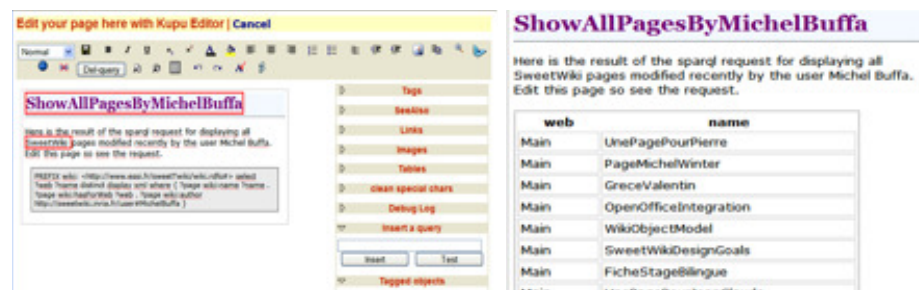
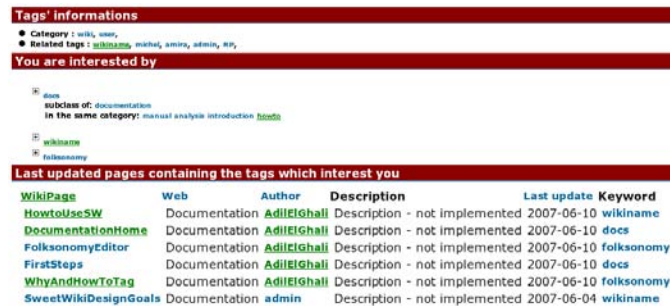


Fig. 3. Dynamic content in pages using queries

Querying SweetWiki offers a set of predefined queries to help users searching the wiki. Moreover, users can embed SPARQL queries into a page. SPARQL queries can be tested and validated in the editor before being inserted in the page, as illustrated in Fig. 3. Embedded queries allow users to incorporate dynamic content in the pages. In addition, those queries can be directed to other SPARQL servers than the one of SweetWiki, thus allowing users to include results from external sites.

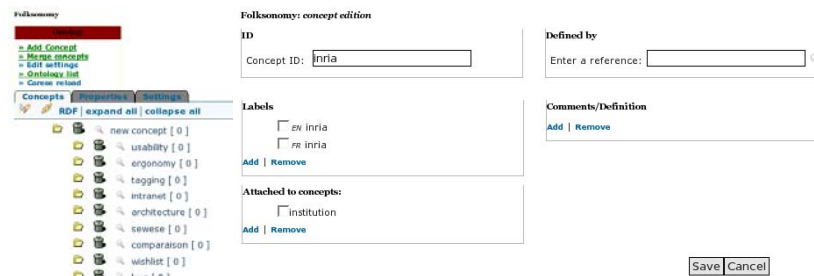


The screenshot shows the 'Tags' information section with a category of 'wiki, user' and a list of related tags. Below this, it shows 'You are interested by' with a list of tags including 'wiki', 'wiki:wiki', and 'wiki:wiki:wiki'. At the bottom, there is a table titled 'Last updated pages containing the tags which interest you'.

WikiPage	Web	Author	Description	Last update	Keyword
HowtoUseSW	Documentation	AdilElGhali	Description - not implemented	2007-06-10	wikiname
DocumentationHome	Documentation	AdilElGhali	Description - not implemented	2007-06-10	docs
FolksonomyEditor	Documentation	AdilElGhali	Description - not implemented	2007-06-10	folksonomy
FirstSteps	Documentation	AdilElGhali	Description - not implemented	2007-06-10	docs
WhyAndHowToTag	Documentation	AdilElGhali	Description - not implemented	2007-06-10	folksonomy
SweetWikiDesignGoals	Documentation	admin	Description - not implemented	2007-06-04	wikiname

Fig. 4. Semantic awareness

Awareness Users are provided with a semantic awareness capability. They can be noticed on recent modifications on pages corresponding to a set of tags they have already chosen. The results are displayed at the bottom of their home page as shown in Fig. 4.



The screenshot shows the 'Folksonomy: concept edition' interface. It includes a sidebar with a list of concepts (e.g., 'new concept', 'usability', 'ergonomics', 'tagging', 'intranet', 'architecture', 'sewese', 'comparatson', 'wishlist', 'house f. n. 1'). The main area has a 'Concept ID' field with the value 'inria'. There are sections for 'Labels' (with checkboxes for 'zv inria' and 'ra inria') and 'Attached to concepts' (with a checkbox for 'institution'). A 'Defined by' section has a text input field. A 'Comments/Definition' section has a text input field and 'Add' and 'Remove' buttons. At the bottom right, there are 'Save' and 'Cancel' buttons.

Fig. 5. Folksonomy Editor

Folksonomy edition In order to maintain and re-engineer the folksonomy, SweetWiki reuses web-based editors available in SeWeSe. Using these editors, the folksonomy and the annotations may be updated. For instance, one can add/remove/edit concepts, community experts can pick a couple of tags and declare semantic relations between them such as subClassOf. They may also merge concepts when two tags are synonymous, etc. Enhancements

of the ontology seamlessly improve content sharing: search and faceted navigation benefit directly from the updates. If a concept is suddenly missing from the folksonomy, it still remains as a tag for the pages it has been used to tag before being deleted, and it re-appears in the folksonomy, where it is just treated as a new tag. Fig. 5 shows the hierarchy editor and the form allowing the edition of a concept.

3 Use of SweetWiki by CoPs

Independently of the use that the CoPs can make of SweetWiki, this tool enables them to formalize simply and easily the knowledge they create. Indeed, SweetWiki relies on the “social tagging” approach which consists of allowing any CoP member to tag its content. Thus, everybody can participate to tag the wiki pages and create knowledge. Besides, the organisation of the tags in the folksonomy can also be performed by any CoP member and anytime; it can be performed progressively when adding a new tag to the folksonomy, or *a posteriori*.

In the context of the Palette project, in addition to the participatory design approach, we observe the use of SweetWiki by the CoPs by relying on some statistical data. These data on the activity on SweetWiki give clues on how to enhance some of its functionalities, such as the awareness functionalities, by providing the users with more suitable awareness queries to subscribe to, for instance. Moreover, these observations can be available to some members who might want to have access to a statistical report describing the “life” of the CoP on SweetWiki.

3.1 Preliminary observations about Palette CoPs

Many Palette CoPs use SweetWiki (e.g. ePrep, @apretic, ADIRA, Learn-Nett, ...). We have the opportunity to observe these CoPs. Unfortunately, at the moment, many of them are emergent CoPs with a limited activity. Fig. 6 shows the visited pages in the wikis of some of the pre-cited CoPs compared with those of the test instance of SweetWiki (Wiki in the figure).

As mentioned above, the activity of the CoPs is not yet huge, and the gathered statistics are not enough to make observations on these CoPs, but we expect the activity of the CoPs on the wiki to become more and more important, we can then use this information both for studying these CoPs and for providing their members with useful awareness information.

3.2 Observing CoP activity: The case of STE-CRIFA

SweetWiki is also used by some researchers of STE-CRIFA⁵ to manage the different projects on which they work. As they cannot often exchange and discuss

⁵ STE-CRIFA (<http://www.stecrifa.ulg.ac.be>) is a research team at Liège University that acts as a CoP, and tries to use the wiki to collaboratively produce new knowledge and to share information within the team.

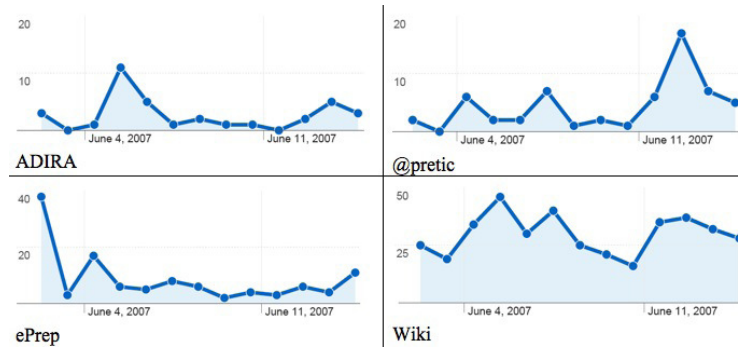


Fig. 6. Visited pages of the wikis of ADIRA, @pretic, ePrep and the public test instance

altogether synchronously, they use SweetWiki to work⁶ collaboratively, each one providing knowledge and correcting the others. The community is composed of 13 members using SweetWiki. The observations of the activity on the wiki for STE-CRIFA extend from June 2nd till June 14th. The information gathered can be used as a tool to study the community, by analysing its activity on the wiki, and are also useful to learn how its members use the wiki, in order to improve it and to identify issues to study with CoPs during future training sessions.

Distribution of the number of visits Fig. 7 illustrates the number of sessions opened on SweetWiki during the observation period. We can see that the community is quite active with a total number of 197 sessions: from 4 to 29 visits per day on the wiki (from 3 to 15 distinct visitors, which means that there have sometimes been more visitors than the number of registered persons).



Fig. 7. Distribution of the number of visits

Time on Site The average time spent on the wiki is around 9 min. Furthermore, we notice (see Fig. 8) that the average time spent on SweetWiki by the STE-

⁶ Diverse topics are discussed through SweetWiki, such as the structure of STE-CRIFA Web site, brainstorming on the vocabulary used, the questions or problems met with Palette tools, etc.

CRIFA members is not due to a sudden and punctual activity on the wiki, but rather to a continuous and regular activity. As the target of using a wiki is to



Fig. 8. Average time spent on the wiki



Fig. 9. Average visited pages per session

enable and motivate people to work and learn collaboratively, we can consider that this target is on the right road to be attained. Regarding the curves that describe the activity of STE-CRIFA researchers on SweetWiki, we conclude that these users often connect to SweetWiki and, when they do so, they spend time navigating through its content (the sessions are not limited to one-page visits); indeed, as shown in Fig. 9, there is an average number of 6.19 pages visited per session. This means that the visitors are interested in the content they find in SweetWiki, which is the knowledge that is being built by their “colleagues” or that they collaborate to build.

Top content During the observation period, 159 URLs have been visited (at least once). Among these URLs, the “Recent changes” page of SweetWiki is the most frequently visited since it has been viewed 124 times. Then, several pages belonging to the WikiWeb “Private” are also often accessed. The navigation track shows that the more accessed WikiWeb is the “Private” Web. The explicit links put on some pages to refer to others are frequently used, whereas the faceted navigation using the tags is not used a lot; on the other hand, the pages are not always tagged. It seems that pages tagging is not systematic for all the users. The “Advanced search” functionality is not often used too. This is probably due to the fact that, at the moment these observations are made, the wiki is very active, the pages are constantly updated and thus, it is very easy to find a page by viewing the “Recent changes” page, and this is why this page is the most frequently visited.

Summary From the point of view of the “aliveness”, there is no doubt on the involvement and participation of the STE-CRIFA researchers subscribed to use SweetWiki. However, there is not a general and full use of the functionalities provided by SweetWiki, maybe because the greatest part of the activity is handled within the “Private” workspace which is dedicated to a restricted group of researchers, and then it’s easy for them to find the needed information. But, if this information is to be made accessible to a wider group, it would be worthy

to “teach” the users to provide more knowledge by tagging the pages they create/update by reflex. In fact, the number of participants is not the only reason why information should be made more explicit; the information itself, becoming huger and huger, it would be more and harder to access it even with a very restricted group of participants.

4 Further developments

The first analysis of the use of SweetWiki by CoPs shows the necessity to improve the following functionalities:

Tagging considering the importance of tags in SweetWiki, and the wishes of users we plan to:

- Improve tagging and tag-based search by enabling the users to tag the wiki pages without imposing them to activate the pages editor. As for the tag-based search, improve it by enabling the submission of complex tag-based queries ;
- Offer a Semi-Automatic mechanism of tags organization. The idea behind is to help the users in charge of maintaining the ontology by providing them with assistance for re-organizing it, based on the use of the tags in the wiki (webs and pages), their use amongst other tags, or by some users (relying on their profiles). The issue concerning these criteria has to be deepened so as to provide an efficient way to suggest an organization of the tags that will enhance the search and thus, the learning through the use of SweetWiki.
- Enhance tags management, by making the ontology edition more user-friendly (ergonomics, drag & drop mechanism for structuring the ontology, enabled multiple inheritance, etc.).

Awareness functionality Enabling the users to subscribe to the set of predefined queries that meet their respective needs, so as to receive notification mails with information about the changes on the wiki content and the statistics that they are interested in. The gathered information on the usage of the wiki could also be used.

5 Conclusion

SweetWiki gives the users the opportunity to create content and annotate it semantically (using tags) using semantic web technologies. Moreover, community members can access the model behind this semantic organization, and some of them (“Wiki volunteers”) can re-organize it, in order to facilitate and improve the navigation and knowledge retrieval in the wiki. In that, SweetWiki can support the issue of incremental formalization of knowledge, addressed in [12].

The first experiments of the use of SweetWiki by CoPs, show many interesting possibilities for communities, mainly the possibility given to members to

share and collaboratively build annotated knowledge. A knowledge that can be re-organized at any time, to fit the needs of the CoP.

Another reason of satisfaction is the numerous feedbacks of the users about the usability of the wiki [13], which, as advocated in [14], is a key argument to facilitate the adoption of a the tool by CoPs.

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Using Graphs in Developing Educational Material

Thanassis Hadzilacos, Dimitris Kalles, Dionysis Karaiskakis, Maria Pouliopoulou
Hellenic Open University
Laboratory of Educational Material and Educational Methodology
Patras, Greece
{thh,kalles,karaisk,mpouliop}@eap.gr

Abstract. Distance learning institutions need to find a way to transplant the benefits of conventional tutoring practices into the development of digital content that is conducive to students' learning needs. Therein lie two great challenges: promote real distance learning effectively and, at the same time, try to accommodate the ability of humans to learn via collaboration. We have proposed the development of Learner's Open-and-Distance-Learning courses as both a theoretical model and an applied methodology to be one of our key priorities and describe how this concept co-evolves with web mining and institutional infrastructures.

Keywords: distance learning, interactive learning and teaching tools, authoring tools, modelling

1 Introduction

Developing an educational experience for a learner has at least two cornerstones: the existence of educational material and the organization of activities with that material. For example, a textbook is a repository of educational material. Reading it chapter by chapter is an educational activity. Consulting selected book parts when trying to solve an exercise is a totally different activity.

Meaningful educational experiences are usually based on the organization of carefully designed activities on quality educational material. The shrewd organization and the careful design necessarily cover some aspects of resource planning, such as how much time the learner is supposed to dedicate to the activity or, what is the sequence of activities that will best attain the educational goal. They also cover conventional aspects of design, such as the target audience and, the combination of tools to attain the goal. Detailed planning of learning activities, apart from the significant effort needed by the course designer, reduces the control students have over their own learning [1]. Learner support services [2] were proposed to provide individualized advice, but usually at a significant cost, especially in large scale applications and in ODL. Also note that educational experiences can be turned into educational material themselves. For example, watching a fellow student carry out an experiment in chemistry certainly produces an educational experience.

Furthermore indirect collaboration (based on observation, for example) can also significantly enhance the learning experience. Social Navigation [3] can be direct but

also indirect based i.e. on the traces of others. Those are quite significant in ODL where learners are supposed to have control on planning and implementing their learning but also in more informal learning settings like Communities of Practice.

In this contribution, we present a conceptual artefact, termed a **Learner's ODL course**, which, we claim, is a generic model that is suitable for accommodating the practices of the educational process, both solitary and collaborative, while still allowing room for developing new abstractions. Its real importance is in that it serves as a conceptual framework around which we attempt to integrate the technologies that are available to us, at any given time point.

We are careful to note that the educational process comprises of observable and explicitly initiated activities, as opposed to the learning process which is ad hoc and may or may not be a direct or indirect outcome of the educational process. After all, education does not necessarily result in measurable learning.

The rest of this paper is structured in five sections. We first briefly review the key stakeholders of the educational process. We then move to present a theoretical model of that process and argue why this model is a good springboard for the deployment of sophisticated data analysis applications (in the web mining context) that can spur the development of personalization services. We then discuss the practical issues of tool deployment and relate these issues to a large on-going application, before concluding by highlighting the context of an organization that is heavily investing in integrating its ICT infrastructures.

2 Background

Depending on how one views the educational process there are distinct components of it which become eminent during the observation. Even if each observer does in fact glimpse all components of the process, the emphasis is always on some key ones, which in turn may be different across observers.

A teacher, for example, usually views the educational process as a set of lectures to be delivered to an audience. Peripheral aspects of this view concern the distribution and grading of assignments and examinations. Another peripheral aspect, but also an easily overlooked one, is the personal improvement of a teacher's ability to deliver the same content over time, either by reflecting on the feedback of students or by collaborating with fellow tutors who are delivering the same course in parallel.

A learner, on the other hand, may or may not attend lectures. Attending lectures is only one of the activities that the learner has at his disposal. Studying, experimenting and collaborating are all activities that help hone a skill or develop knowledge about a subject. Informal communication and collaboration among peers is a key aspect of a learner's activities that a teacher may have little, if any, influence. In such collaboration views and homework solutions can be exchanged. Unless the teacher

has explicitly designed an assignment to stimulate such communication, the indirect learning effects of the peer collaboration arrive by luck rather than by design.

Appreciating the difficulty of directly designing in detail such communication (and, then, by monitoring its implementation), one cannot fail to hypothesize that the a posteriori analysis of the peer collaboration process may lead to the identification of information nuggets of this process. Such nuggets can, as in any decision context, lead to the formulation of concise design advice for future exploitation. That, in turn, will be easier to disseminate to tutors for assistance and feedback purposes.

If we consider teachers and learners to operate at roughly the same level of education, we can move up one level and consider the educational system view. At that view, one deals with providing the educational material at a suitable scale for the student population and setting and monitoring quality issues in the delivery of education (i.e. scope of educational activities, depth and breadth of material, academic prerequisites across subjects, attendance logistics, etc.). Note that, at that level, the delivery mode of education (on-line, physical presence, etc.) is simply another component of that view.

Going a level down from teachers and learners one deals with educational material per se (books, instruments, software, etc.) and the development of blueprints or guides for using that material (solution manuals, demo software activities, etc.). At that level one would also address infrastructure issues.

For each of the above four views (and it should be obvious that the list is not exhausted here), it would be difficult to argue that they are unrelated. These views are not (and should not be) orthogonal, but they help focus the attention of people active in each level towards a common background of experience, expectations, and norms that allows for the smooth exchange of information within the boundaries of that view and across views. Still, with today's environments, it is easy to see that the two middle layers are the ones that offer the most potential for the emergence of communities of practice, mostly via the explicit sharing of experiences and via collaboration on the same task.

3 A Learner's ODL Course as a Model for the Educational Process

A graph-theoretic model of a Learner's ODL course is a computational model. It builds on top of some basic components which are elaborated below and it involves, at several points, activities of the stakeholders as described above.

A *learning object* is any piece of (multimedia) data or program whose purpose (intention) is to be used for learning. A learning object can be recursively defined as a set of learning objects. Examples of *learning objects* are the following: the text of Odyssey, MS Word, Sketchpad, a video lecture, a set of multiple choice questions, a

Euclidean geometry high school textbook, an MS Powerpoint presentation of organic compounds.

A *learning task* is a task whose purpose is learning. Examples of learning tasks are the following: read, solve an exercise, write a program, practice a musical instrument, draw a picture, design a database, make a summary, think over, correct, argue for/against.

A *learning activity* is an ordered pair: (learning object, learning task). Examples of learning activities are the following:

- Write a program to add two numbers (learning task) using a C++ compiler (learning object)
- Write down (type to the computer) what you hear (the learning object is a digitized dictation) and then check the spelling errors (in fact the learning object is the set {word processor, soundtrack, speller}).

A *learning environment* is a directed labeled multigraph (LA, P) , where LA is a set (of vertices or, nodes) of learning activities and P is a bag (of edges) of labeled precedents. A multigraph is a “graph whose edges are unordered pairs of vertices, and the same pair of vertices can be connected by multiple edges” (Dictionary of Algorithms and Data Structures, National Institute of Standards and Technology (NIST), <http://www.nist.gov/dads/>). Examples of labeled edges are the following:

- From node LA5 to node LA15 “if you found LA5 very easy to do”
- From node LA5 to node LA100 “if you found LA5 very interesting”
- From node LA5 to node LA3 “if you did not manage to complete the task of LA5 satisfactorily”

A *reference node* is (a learning activity that is) connected to all other nodes via bidirectional (unlabeled) edges. Examples of *reference nodes* are the following:

- Dictionary (to look up a word or phrase)
- Calculator (to perform an arithmetic operation)
- On-line discussion (to communicate with a tutor or with fellow learners)

A *learning experience* (or, a *learning trip*) is a path (sequence of connected learning activities) on the learning environment graph.

A learner's note is a data structure attached to a specific node by a specific learner. A *learner's note* includes structured data fields (learner/user id, timestamp, access rights, etc.) and any (multimedia) data the learner chooses to attach (for example, files). Examples of *learner's notes* are the following:

- The list of adjectives asked for in example B1.
- A text that criticizes the effectiveness of the learning activity (node).
- A new soundtrack of the dictation (left by a student who found the pronunciation incomprehensible).
- A comparison or a synopsis of the past 10 notes left on the current learning activity (node).

A *learning environment communication system* is a communication system (such as email, discussion forum, etc.) with content consisting only of (pointers to) learner's notes. Examples of such content are the following:

- From a student to his teacher “Here is the list of adjectives asked for in LA5”.
- From a student to all other students “I found LA12 particularly useful, you can look up my comments in the note attached”.
- From a teacher to his students “Before attempting task LA112 read my note there”.

A *learning activity control block* is a snapshot of the usage of all the above in the context of a particular learner. It is a data structure containing (at least) the following fields:

- learner/user id
- timestamp
- (pointer to) learning object
- (pointer to) learning task
- (pointer to) learner's note

A learning experience may well be a single-session path; for example, a learner dedicates a good solid hour to navigating the educational material along a particular line. A learning experience may also be a sequence of such paths; for example, we usually “remember” where we stopped studying (for a short or long break), and can resume from that point. A (metaphorically speaking) concatenation of such paths delivers a longer path that can still be a learning experience.

The graph-theoretic model also allows us to build in temporal information in the navigation paths. As a matter of fact, relative temporal information is inherently available in a path (sequence of node visits). Furthermore, the annotation of edges in terms of actual time spent in an activity before moving on to the next is a straightforward enhancement.

The detour ends here by noting that the above considerations simply suggest that, after we get the initial graph-theoretic model fixed, there exist a set of computational processes that will allow us to define arbitrarily complex layers of information based on the ground data. We elaborate on that in a following section.

4 Tool Deployment Issues

We start by noting that the theoretical model can be in principle implemented using rudimentary technology, such as hyper-linked files of conventional office-type applications, where educational assets can be grouped together in repository-type worksheets. Assets can then be drawn to compile learning activities. Such tools offer relatively smooth short learning curves for data collection and web publishing too.

As an example, Figure 1 shows how MS Excel could be used to design a learning environment. A learning activity is composed by an asset and by a learning task (allowing, of course, for some terseness in representation: when no task is shown for a text asset, the implicit task is “read”). Indentation can be used to designate priorities and preferences; this allows transitions between activities to be tagged (potentially) by attributes such as “was it interesting?”.

The divide-and-conquer approach ...					
Learning Task	Learning Object				
read	2.3.1 The divide-and-conquer approach				
	... the first two paragraphs				
write	Think how you would apply the above principle to				
read	2.3.1 The divide-and-conquer approach				
	... the next paragraph				
write	You might want to rethink your previous answer				
	Think about the following details				
exerc	How do you split in two a sequence that has an odd number of elements?				
exerc	How do you decide that a sub-problem is "small enough"?				
exerc	Is there an optimal number of sequences?				
read	2.1 Insertion sort				
read	2.2 Analyzing algorithms				
observe	Presentation by MIT OCW Algorithms Lecture 01				
read	2.3.1 The divide-and-conquer approach				
	... the next three paragraphs				
programming	Write a program for mergesort (do not test it)				
exerc	What kind of input do you think you need for testing?				
WWW	See an applet that demonstrates the mergesort algorithm				
WWW	See a collection of sorting algorithms				
exerc	Can you argue which of the above algorithms are divide-n-conquer?				

Figure 1: A snapshot of a learning environment in MS Excel

After one settles on the issue of the implementation of the basic model, the issue of linkage with external resources must be addressed. Discussion rooms, and other related communication-oriented applications can be readily used to support the implementation of learner’s notes and of a learning environment communication system. At that point, one can opt to start integrating different technology offerings (having, of course, to address the overhead of inter-application communication) or adopting a generic platform approach that will allow for customization to retro-fit the implementation of the model as well [6, 16]. The latter approach can be more scalable (for example, portal offerings by commercial organizations) but the analysis to decide on such an investment may be too difficult to carry out effectively (hidden costs can surface quite easily and the steepness of the learning curve for developers may be expensive to estimate) [7, 10, 14]. Note that a need for development may be inevitable with any platform if one attempts to implement some relatively sophisticated objects (for example, the learning activity control block of the graph theoretic model earlier presented), even at the entry level.

However, there also exist some in-between approaches; in these approaches one may decide to use building blocks based on generic digital object identification schemes, such as DOI (<http://www.doi.org>) and expect that third-party providers (for example, a university) will supply the naming space, and couple these identification schemes

with generic object ensemble builders, such as Fedora [8] or SCORM [4], which accommodate a disciplined format of digital object creation and manipulation.

As a matter of fact this is exactly the development roadmap for LAMS [10], which expects that activities will be structured around a *lesson* plan and that the support tools to implement these activities will be increasingly supplied by third parties. Incidentally perhaps, LAMS also seems to be the closest implementation of our graph formalism concept and one that explicitly foresees the linkage of collaboration activities within the educational process; moreover it indeed structures activities as tasks to be done with some resources. See Figure 2 for an example, of how LAMS implements the workflow described in Figure 1 (but also note that, since LAMS does not yet fully support branching, the only graph node transitions available are the ones from one node to the next; i.e. a strictly sequential experience).

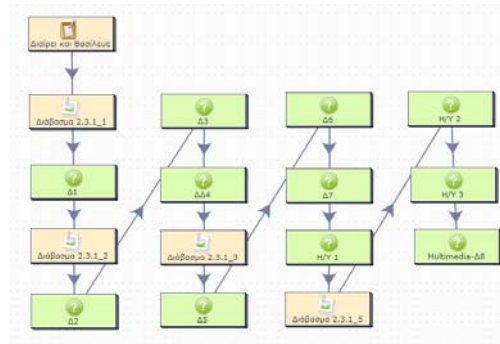


Figure 2: A snapshot of an activity workflow in LAMS

5 Web Mining With a Learner's ODL course

Cliques and connected components are usually employed as a means of demonstrating graph properties that are related to localization; here, we use *localization* as a metaphor to show that some *areas* of a graph may be very close neighbours in the sense that one has to venture explicitly outside this area through very specific paths. This is not a new concept and has been used in a very similar context in web site adaptation [13]. Automatically improving the organization and presentation of web sites based on data mining usage logs is a burgeoning scientific field and one of the approaches is based on the PageGather algorithm [12]. Therein, a clustering method, called *cluster mining*, is employed, which works on an input of user sessions, represented as sets of visited web pages (note the correspondence with learning experiences). PageGather then builds a graph by linking nodes (pages) with an edge whenever co-occurrence of these pages is detected across some user sessions. Page clusters (or, similar learning experiences) can then be defined using either cliques or connected components, with cliques considered to be more coherent and connected components considered to be faster to compute and easier to find.

There exist legitimate arguments about the computational cost of graph-based algorithms for inferring usage patterns [13]. However, if we can agree that our *a posteriori* analysis of the usage (by various users) of a Learner's ODL course will be used to improve its presentation and organization in a future version (thus, we do not focus on providing immediately customizable content), then these arguments are not related to our employing of the graph-based representation. Nevertheless, web usage mining is a complicated, of course, as it involves data pre-processing, pattern discovery and pattern analysis [15]. Data used for these procedures can be related to *content* (the real data in the Web Pages), *structure* (data describing the organization of the content), *usage* (data describing the pattern of usage in web pages) and *user profile* (data providing demographic information) [15]. Industrial reports (also based on anecdotal data) suggest that the data pre-processing can easily take up 80% to 95% of a project's time and resources [5].

The technical challenge is how to relate the relatively flat structure of web log files with the apparently deep structure of learning experiences (therein, we note again the introduction of cycles in experience paths). Our approach is to specify the course multi-graph in advance (*php* scripts interfacing to a *mysql* database were embedded in the course's *html* code). This approach is supported by the published experience in a similar project [11], where the difficulties of developing a data pre-processing environment are set out for a case study in a distance learning educational domain.

A coarse example of these concepts is shown below. Figure 3 demonstrates the course multi-graph structure, as specified by the course designer (actually, it is a view of the multi-graph where, for the sake of conciseness, we have only included learning activities). Figure 4 shows a learner's path during a single learning session in the course, with nodes being numbered according to the relative order of visit.

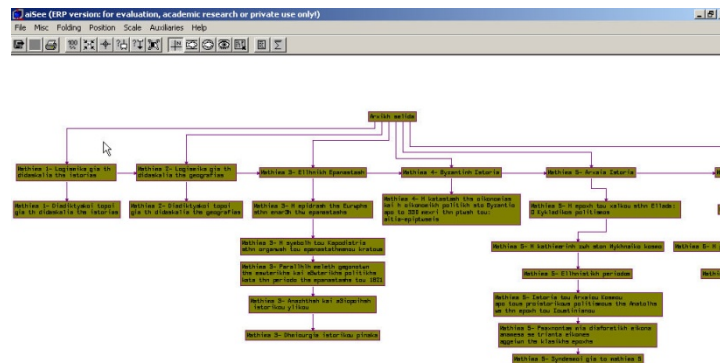


Figure 3: A view of the course multi-graph

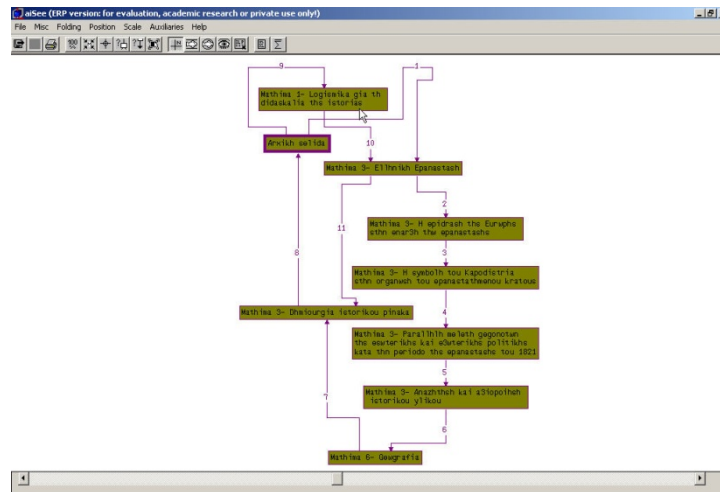


Figure 4: A visitor's path through the course

We also used a slight variant of the above mechanism to implement the note-passing mechanism between students and tutors (as described in Section 3). However, for this particular aspect of the Learner's ODL course, we are investigating the usefulness of open-source asynchronous discussion forum systems (and the extent to which they might accommodate the multi-graph specification as opposed to programming it from scratch).

The generalization of the above implementation to compute shared paths between collaborative (or non-) co-workers (students, tutors) is relatively easy. However, the visualization of those shared paths necessarily raises the issue of how to accommodate in the relatively limited estate of a computer screen the individual interactions of team members with the same material. While web usage mining applications are close to this problem, understanding which shared paths are meaningful and which are not will initially entail the close scrutiny by knowledgeable experts.

6 Conclusions

Like many other open universities, the Hellenic Open University (HOU) has gradually embarked on e-learning initiatives, spanning from virtual classrooms, to discussion forums and to the mass-scale development of complementary on-line material.

The HOU has lately completed a major transition to a common commercial portal platform and has initiated the installation and operation of an open-source digital asset management system as well as a commercial SCORM-compliant authoring tool. Deploying the newly-developed courses on that platform will allow for the production

and sophisticated analysis of log files, according to the principles (and, mostly, to the ideas) outlined above. We are also experimenting with the possibility of developing path detection as a web-service to be provided by a third party at the course deployment level as opposed to on-line log file analysis.

The graph model was a necessary tool in our design approach because it helped model important aspects of the educational process and, then, seamlessly supported the semantic annotation of student activities while allowing us the convenience of knowing that graph-processing algorithms and software are available as a commodity.

Why did we *not* use a different model? Actually we did. The MS Excel example was our first implementation attempt at attracting fellow tutors to the didactical merits of explicitly stating learning tasks and expected time for related activities. Note that these very tutors may well be excellent when addressing an audience; it is their skills at developing distance learning material that we aim to further develop. So, the tabular Excel model was the easiest to communicate.

Thus, taking into account that we need to also address the needs of tutors with limited IT skills, the careful selection of tools for the initial compilation and development of learning activities is a key factor in our decisions. It turns out that we must really first lower the entry threshold for tutors in order to be able to realize benefits for the students. That threshold, in turn, has to do with both the development of content as well as the development of a collaborative conscience. The latter is necessary to reinforce the sense of belonging to an academic environment that our students (and, sometimes, our tutors) seem to desperately need and that our tutors may sometimes find difficult to re-invest in, since most of them are already part of a conventional environment.

In that sense, we believe that our key contribution is the bridging of design richness and implementation practicalities in the context of a very large scale project of distance learning digital educational material. We feel that similar situations will be common in the context of almost all organizations developing similar content.

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Don't Value the Valueless: Toward a Model of Evaluation of Knowledge within E-Communities of Practice.

Pierre-Jean Barlatier, Géraldine Vidou, Stéphane Jacquemart, Thibaud Latour

Centre de Recherche Public Henri Tudor,
Centre d'Innovation par les Technologies de l'Information,
29, avenue J.F. Kennedy, L-1855 Luxembourg
Luxembourg

{pierre-jean.barlatier, geraldine.vidou, stephane.jacquemart, thibaud.latour}@tudor.lu

Abstract. The work presented in this paper aims to elaborate a model of knowledge evaluation within ICT solutions-supported Communities of Practice (e-CoPs). It is placed in the context of Knowledge Management (KM) services that are developed in the PALETTE project dedicated to enhance learning dynamics within e-CoPs. Building upon a study of participation and reification processes within e-CoPs, we distinguish between e-CoPs potential and realized value of knowledge. We then propose a model of knowledge evaluation dedicated to e-CoPs outlining the conditions of knowledge value creation able to support the different dimensions of knowledge creation, diffusion and storing.

Keywords: Community of practice, ICT solutions, Knowledge Management, Knowledge Value, Knowledge Measures.

Since its genesis in the precursory works of [1] and [2], the CoPs concept has been quickly identified as a powerful social vector for individual and collective learning enhancement.

The evolution of this social phenomenon has faced during the last decade an exponential need of communication tools sustained by the ICT development. However, despite the rapidly increasing potential offered by new technologies, recent research points out the lack of adequate KM tools and services to efficiently support this “progressive virtualization” of CoPs [3].

From this perspective, one of the main objectives of the PALETTE project¹ is to design effective ICT-based KM solutions fostering knowledge creation, exchanges and storing within CoPs. Thus, such KM solutions require a knowledge evaluation service, in order to estimate the usefulness of a given knowledge (or piece of knowledge) for the individual and the community.

¹ The PALETTE project (Pedagogically sustained Adaptive Learning Trough the exploitation of Tacit and Explicit knowledge) aims to design information, knowledge management and mediation services in order to facilitate and enhance individual and organizational learning within CoPs. For more details, please consult <http://palette.ercim.org>.

However, not knowledge but “good” knowledge is to be chiefly valued. Hence, the aim of this task is to develop a comprehensive PALETTE model for evaluating knowledge within e-CoPs. So, given the complex and multifaceted character of the notions of knowledge and value (and even e-CoPs...), we think it is necessary in this context to define and fix our comprehension of the concepts and the context in which we propose to develop this model.

About CoPs, Knowledge and Learning

Knowledge is a protean concept (tacit/explicit; individual/collective...) that has become prominent during these last years in the organizational learning literature [4; 5]. The realization of knowledge as embedded and created from and through social relationships and interactions [4; 5; 6] has led some KM researchers to focus on the importance of communal resource [7] and the notion of evolving communities within an without organizational boundaries. Resulting from a social and situated perspective of learning and cognition, the concept of CoP has been certainly one of the most developed and used ones. As noticed in [8], a large body of literature has developed concerning CoPs since Lave and Wenger’s original use of the term in 1991. In May 2006 their search for the term ‘Communities of Practice’ in the EBSCO Business Source Premier database provided 425 references to papers. This shows that since 2001 there are more than 40 publications per year concerning CoPs, indicating its increasing popularity in Knowledge Management’s academic discourse.

The importance of these practice- and person-based networks has been acknowledged in a number of seminal works on: sensemaking [9], CoP [1; 2], storytelling [10], knowing in practice [11], and communities of knowing [12].

However, this social conception of situated learning and cognition has its own set of assumptions and focus [13; 14; 15]. From this perspective, we put forward some premises about the underlying conception of knowledge, knowing and knowers in the CoP concept:

- Individuals are social beings, and even if this fact appears as being trivial, it represents a central aspect of learning [13];
- We must distinguish *knowledge* from *knowing* [11]. The noun “knowledge” draws a static concept that implies knowledge as a *thing* that can be located and manipulated as an independent object or stock; it seems possible to “capture” knowledge, to distribute, measure and manage it. The gerund “knowing” suggests instead a *process*, the action of knowers inseparable from them and from their context. If it may be possible to promote, motivate, nurture or guide knowing, the idea of capturing, distributing or even measuring it seems difficult, if not senseless... [16];
- The activity of learning must produce meaning, *i.e.* the (changing) ability of individuals to experience the world and their engagement [13].

Furthermore, from a socio-constructivist point of view, to learn means to participate to a process of co-construction of meaning [14]. In a CoP, knowledge and its articulation are social and contextualized. Cognitive productions resulting from interactions between members of a CoP are not only attributed to individuals but also to the group itself [17].

Challenging Knowledge Value Measurement Issues

Even if during these last years knowledge has been widely recognized as a vital (if not the vital) source of competitive advantage and of production, both academic and practitioners seems to fail in developing acknowledged efficient methods for measuring knowledge. According to Siesfeld [18]: *“Measuring knowledge is still a whole new area of development. It is clear that the traditional input/output approach to determining whether and to what extent a firm’s assets are working do not work with knowledge”*. Moreover, KM experiences show that good knowledge measures integrate qualitative and quantitative elements: *“Milestones and metrics define what you are trying to accomplish and whether you are succeeding, but ‘crude and fuzzy’ measures capture knowledge value more effectively than inappropriately precise ones”* [16].

The nature of our issue of knowledge measurement leads us to adopt a socio-organizational view instead of an economy-level view. Hence, we focus our analysis on specific aspects of knowledge value. In the e-CoPs framework, we can associate “knowledge value” to the proxy concept of utility, as used in economics. Indeed, knowledge generates value when it is used to satisfy a need; it represents here inputs for CoPs member’s actions [19]. So the aim is not to determine the exact “objective” value of specific knowledge, but rather a “subjective”, i.e. community-related value of knowledge within the CoP. For instance, in knowledge-intensive organizations such as CoPs, great importance is attached to the perceived value of knowledge by the community members (value of knowledge for individuals) as well as stored knowledge, as a collective good, element of the socially shared cognition (value of knowledge for the CoP). We consider then knowledge getting into the community (which implies clear representations of CoPs boundaries) that flows within the community and its benefits for the CoP and / or its members. As a consequence, we will focus our attention on a model able to provide indicators that provide information about a perception of the “value-added” by the knowledge of the CoP and its members (perceived outcome for members), instead of ex post or ex ante value indicators of knowledge.

Proposition 0: Given our highly contextualized, specific nature of knowledge and value, traditional input/output models of value measurement are not relevant. Both qualitative and quantitative indicators must be used.

Commitment, participation and exchanges are important concepts intervening in a CoP. They occur in face-to-face meetings, but are also supported by ICT solutions. Nowadays people exchange a lot of information by mails or via forums, using a lot of different means to communicate, and consequently participating in the CoP’s life.

Considering our objective of giving elements for measuring CoPs knowledge value supported by ICT tools, we will use the term “knowledge” as an umbrella term gathering explicit knowledge and information. For e-CoPs, inputs of knowledge are

pieces of explicit knowledge and information (able to circulate via ICT solutions), brought by CoPs members from CoPs environment *via* different exchange objects as tools, rules, methodological support, demonstrations, references and vignettes or cases [20]. Then, the CoP will act as a system, i.e. as a method for collecting and processing knowledge inputs idiosyncratic to each CoP, and as a consequence, giving different results for different CoPs.

Hence, we consider CoPs as self-organized, autonomous systems, with strong identities, creating their own values and references system as well as their own sensemaking. In other terms, CoPs are autopoietic systems.

Proposition 1: CoPs are autopoietic, self-referencing systems. CoPs members provide inputs of knowledge to the community. These inputs are required to perform a task, to answer a need and to effect a change in members' daily activities.

The primary focus of the CoPs conception is on learning as social participation [13]. Participation represents in Wenger's conception of CoPs a core element since it is through participation that communities' characteristics and practice are developed: "*Participation here does not just refer to local events of engagement in certain activities with certain people, but to a more encompassing process of being active participants in the practices of social communities and constructing identities in relation to these communities*" [13]. Therefore participation can be linked to the commitment to the group [13]. This commitment is seen as an affective and psychological aptitude, thus reflecting the active participation of the CoPs members. It includes the fact of being part of the group. CoPs members have to know the individual roles of the members to appreciate the effort of the others and to measure the quality and quantity of the work performed by the group and to feel that commitment is mutual. Commitment also includes cohesion and productivity [21].

Moreover, thanks to ICT tools, some people feel more encouraged to give their opinion. Indeed, these tools allow people to communicate and to express their opinions, in an anonymous way. People feel more free and less observed or tracked. Tools can inhibit fears of people of expressing oneself in public. For instance, within the PALETTE project framework, some ICT solutions, such as CoPe-it!, facilitates collaborative work and helps CoPs' members to share their knowledge by structuring and handling an argumentative discussion and also by leveraging an evaluation of various opinions [22].

Participation is an active process that conveys the possibility to mutual recognition and the ability to negotiate meanings, but does not necessarily entail equality or respect, or even collaboration [13]. If CoP's members have repeated exchanges about knowledge freely flowing within the community, we can consider that the most collective exchanges a piece of knowledge generates, the more potential value it has. If knowledge cannot be measured, its impact always can be. Indeed, knowledge lies here in the flows, and it is in these flows, i.e. in the mingling of community member's experiences and insights, that knowledge is created and applied [18].

Proposition 2: High levels of knowledge exchanges and interactions within the CoP strengthen the participation process and reveals knowledge with high potential value.

CoPs facilitate an environment of ‘structured informality’ supported by knowledge, knowers, and CoPs infrastructure. CoPs own a vast base of knowledge ranging from theoretical concepts to practical experiences; they are the engines of learning for its members. Socially, CoPs are the fabrics of knowing as members of CoPs acquire communal identity around a shared passion, relationships, roles and ways of intermingling common knowledge, practices and approaches [23]. From this perspective, and from a socio-constructivist point of view, if CoPs members have identified potentially useful knowledge during their interactions, they will integrate it, modify their “cognitive framework” and try to use it in their daily practice activities.

We can also note here some socio-psychological effects that affect the level and the number of interactions between CoP’s members, such as, for instance, groupthink, which is a type of thought exhibited by group members who try to minimize conflict and reach consensus without critically testing, analyzing, and evaluating ideas [24]; as well as reputation effects about the knowledge provider, i.e. if this member is acknowledged as an expert, the knowledge provided will be estimated as high-potential value knowledge and as a consequence, will create a high level of exchange.

Within an e-CoP, it is easy to determine levels of interactions (number of mails exchanged around a subject, number of clicks on a link...); nevertheless, it is more complex to determine their interest. Indeed, people can interact around knowledge with low value, in order to demonstrate that this is not interesting or not proved. By contrast, high value knowledge that could be very interesting for CoP’s members, can be overlooked due to the important number of information contained in such tools (lots of topics in forums, too many mails exchanged with not enough time to read them...). Anyway, thanks to these interactions, CoP’s members may be able to anticipate the created value by the use of this knowledge, integrating and combining it [5] in order to mobilize it in a personal knowing process.

Proposition 3: The potential value of knowledge circulating within CoPs depends on both the quantitative and qualitative interaction levels and simultaneously on the members’ ability to anticipate, integrate and deploy the created value. From this perspective, the potential value of knowledge may fluctuate, i.e. co-evolve with the Cop’s interaction level.

After having appreciated the potential value of knowledge, it is now relevant to examine how this potential value can be realized. Knowledge is not separable from its context, especially within CoPs (which origins is rooted, let’s not forget, to situated learning [1; 13]). Knowledge is here a lever for action, and its value is very context-dependant. In addition, CoP’s members use CoP’s knowledge in the framework of their practice. Therefore, this process of knowing is a human act.

From this perspective, using CoP’s knowledge refers to the personal knowledge-creation abilities of the CoP’s member (i.e. his abilities to detect, assimilate, combine and experiment this knowledge). As McDermott noticed: “... professionals piece information together, reflect on their experience, generate insights, and use those insights to solve problems” [25].

Proposition 4: The value of CoP's knowledge in practice relies on the "knowing" capabilities of CoP's members, i.e. their personal abilities to detect, assimilate and use knowledge in their daily practice.

But for all that, the (personal) use of knowledge circulating within CoPs would be valueless for the community if members do not share and exchange it. These outcomes of knowledge in motion have to be "crystallized" by CoPs members and re-injected in the community in order to be shared, evaluated and acknowledged by the whole CoP. This refers to the concept of "reification" defined by Wenger as: "*the process of giving form to our experience by producing objects that congeal this experience into 'thingness'*" [13]. According to this, applied knowledge generates value if e-CoPs members formalize their experiences, i.e. give a form to their own understanding of their practice by writing and exchanging e-mails and messages, or producing electronic documents and books.

Hence, e-CoP's members produce objects, shaped by their experiences. But, as Wenger emphasized: "*these objects... are only the tip of an iceberg, which indicates larger contexts of significance realized in human practices*" [13]. Once produced, these objects can be introduced to the e-CoP by different ways: either directly to some other e-CoPs members or put in the e-CoP electronic document memory, i.e. the e-CoP knowledge base. Nevertheless, these objects represent as many points of focus around which the negotiation of meaning becomes organized [13]. In most cases, less-formalized objects are directly submitted to other members, and then the negotiation of meaning process will be collective and often achieve the articulation of the object. But more formalized objects can be placed by e-CoP members directly in the e-CoP knowledge base. In this case, the collective negotiation process is rather focused about the pertinence of the existence of this document within the e-CoP's knowledge base instead of the collective achievement of its formalization. Once again, if this newly re-injected knowledge generates interesting interactions within the e-CoP, it will then generate value for the whole community itself. We propose to label it "realized value", i.e. value from knowledge experience feedback.

Proposition 5: The e-CoPs member's capabilities of reifying outcomes of knowledge in motion and of diffusing them within the community generate value for an e-CoP.

Anyway, the reification of "realized" knowledge leads e-CoPs members to use collective knowledge storing ICT solutions, such as a shared database, in order to make it available to other e-CoPs members. Afterwards, these objects of knowledge are submitted to the judgment of the other e-CoP members, which validate or not the considered object. Once validated, knowledge can be stored and being accessible to the e-CoP. In order to be an efficient ICT solution, the knowledge base must be organized and indexed so as to be convenient to usual requests as well as specific demands. In addition, the base must propose links between tasks and roles to pertinent documents or knowledge objects. This structured the presentation and storing of knowledge to e-CoPs members.

Moreover, the accumulation of the same knowledge yields no extra value [18]. Indeed, if there is value in reproducing knowledge, there is no value in acquiring the same knowledge again: "*More is not better, new is better*" [18]. When members adopt

a symmetric relation, minimizing their differences by simply adding new knowledge without trying to interact; then they will come to what Martin [26] calls “escalation of neutrality”. Knowledge value may reside more in trying to discover relationships among distinctive ideas, via argumentation and negotiation of points of view, than in embracing sameness [16].

Proposition 6: The e-CoP knowledge base, as a knowledge repository, must structure and present knowledge efficiently, allow an easy access to e-CoPs members and avoid to propose accumulation of the same knowledge.

Once knowledge has been reified and proposed to the e-CoP, members exchange, share their experiences and debate about it. If knowledge is acknowledged as useful for the group, it is henceforth implemented in the e-CoP knowledge base. The process of negotiation of meaning will collectively evaluate, validate and attribute categories to the stored knowledge. This collective process will also update the e-CoP knowledge base.

However, utility is difficult to evaluate. Some documents, e.g. a basic process, may be very useful for a novice member and have less value for an expert. Moreover, for an e-CoP gathering of members from different organizations some knowledge may also be evaluated as very useful for one, and have less value for another. In this context, utility refers to the subjective value of knowledge. It depends on the potential use of the stored knowledge object [27]. From this perspective, great importance is dedicated to stored knowledge that generates high levels of interaction and experiences accumulation within the e-CoP.

Evaluating the utility could be done after having described the different groups of members composing the e-CoP: novice *versus* expert, intra-organization *versus* inter-organization, etc. Sometimes, e-CoP’s identified sub-groups can evaluate the utility of an e-CoP’s knowledge. As knowledge captured by a CoP is an element of the collective construction, linked to exactly defined social situations, it is normal that this knowledge and its utility evolve with the continuous collective interactions.

Furthermore, knowledge is a specific resource that has a specific life cycle and degree of obsolescence. Actually, knowledge can have a great value at a certain time, and can drop to zero if this stock of knowledge becomes obsolete. This means that, as the timing of obsolescence is highly uncertain, there are no schedules of depreciation. In this case, a maintenance service could be useful to sort knowledge contained in mails for instance, or to sort the old posts or documents contained in a forum.

Proposition 7: The e-CoP, through a collective process of negotiation of meaning, evaluates, validates and attributes categories to the stored knowledge. Hence, the knowledge base may be dynamic and updated in order to prevent the e-CoP from inertia.

Some people use ICT tools in their work, at home... They aren’t aware of using these solutions in their daily activities, while others are. A risk exists for people without access to this kind of tool, because they could feel excluded.

An optimized use and knowledge about ICT tools allow members to be at ease and not limited within the exchanges and interactions taking place within the e-CoPs. As we talk about e-CoPs, we can consider that the appropriation of ICT tools will play an important role in the assimilation and the access to knowledge circulating within the e-CoPs [27]. Members can be discouraged to transmit information or knowledge, if they are not in the habit of using such a tool. However people react differently face to new practices, fortunately behaviors faced to ICT tools change. Thus, whatever the technical problems and the complexity of use of the technology, the appropriation of a tool is facilitated by personal investment, the goal to reach and the utility perceived by the user [28].

ICT tools are becoming more and more sophisticated and are aiming to be as less intrusive as possible, but continuous efforts are made to improve their ergonomics.

Proposition 8: Good working knowledge and appropriation of the ICT solutions by e-CoPs members could be considered as levers for the circulation of knowledge within e-CoPs, and therefore for leveraging its value.

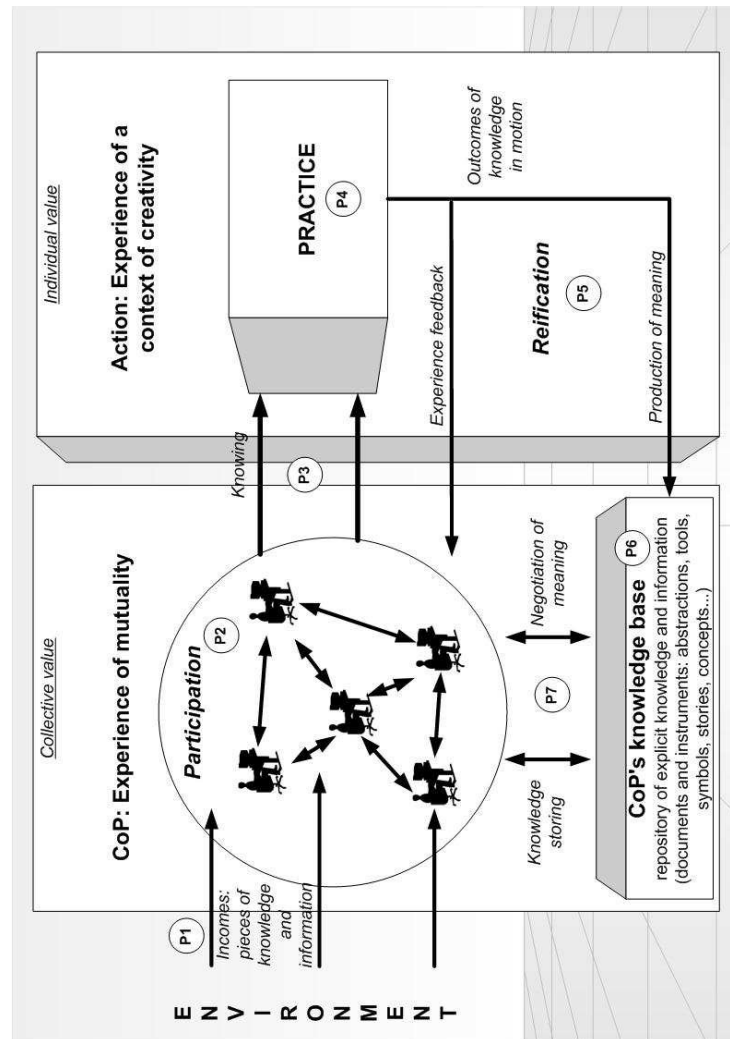


Fig. 1. The Knowledge Evaluation Model

The above Figure 1 synthesizes our theoretical construction through a model of knowledge evaluation within e-CoPs. This model reveals insights about knowledge evaluation within e-CoPs through the analysis of the participation / reification dialectic. The comprehension of the participation / reification duality appears as the key to analyzing knowledge value creation within CoPs. Moreover, participation and reification are self-feeding processes. Indeed, participation implies interactions, identifiable commitment in CoPs activities that leverage actions in CoPs' members practice. Then, reification gives form to these actions, and generates interactions within CoPs through mainly the negotiation of meaning processes. Hence, reification strengthens commitment and participation within CoPs, with the negotiation of meaning as catalyst.

As the dual system participation / reification is relatively less explored in the literature, our research about reliable measures of knowledge value within e-CoPs must then identify and analyze knowledge value creation vectors within this system. If the previous model allows this identification, its analysis should reveal pertinent knowledge measurement indicators.

Dealing with measures...

In management sciences, talking about measurement leads irremediably to consider performance measurement. If we have seen that developing an effective system for measuring and managing knowledge performance will require new ways of thinking, we cannot nevertheless ignore general properties of all measures. Meyer and Gupta [29] think that effective management requires multiple, uncorrelated and changing measures of performance. Applied to the e-CoPs, this means that simple and static measures loose information contents over time – the knowledge useful today will not be so tomorrow, and unless the e-CoPs change the measure, the value of knowledge is likely to decay. We note five general properties:

- **Reliability:** a reliable measure is one which returns the same value for the same performance, regardless the time of measurement, the form or nature of the observation (or observer), and the conditions under which these observations are made;
- **Validity:** a valid measure measures what the measurer intends it to measure. For a measure to be valid, we need to be clear on what the objective of the measure is and what the assumptions about the relationship between the phenomenon and the measure are.
- **Comparability:** a single measure conveys little information in and on itself. The information comes when the single measure is compared to some other standard, like a base line. Providing information for comparison (if necessary) allows knowing whether a measured value is good or bad.

- **Variability:** a lack of variation among measurements makes it impossible to tell whether something is good or bad.
- **Time:** performance measures tend to run down over time. Indeed, through learning (homogenization of human behavior and performance to maximize the measure), perverse learning (opportunistic appropriation of the measure in order to maximize it, but with diminishing performance) and selection (if over time individuals who perform well are retained and others are not, then the measure will no longer convey any new information as the pool grows in homogeneity).

Of course, measures should not be frozen. When a measure does run down, it has to be replaced by another; as well as the more the phenomena we study are complex, the more measures we need.

Within the framework of the PALETTE project and its multiplicity of ICT solutions for e-CoPs (please consult <http://palette.ercim.org/content/view/13/30/2>) it will be necessary to designate an e-CoP's member (with a profile of e-CoP's animator) in charge of the deployment of the evaluation service. This service must be adjustable and flexible considering the different e-CoPs objectives and the different ICT solutions used. The e-CoP's animator should decide on a series of e-CoP's KM objectives that will be declined in criteria able to define elements that contribute to reach these objectives. Then these criteria will be declined in parameters, i.e. quantitative and qualitative factors. Finally, these parameters will be combined in order to bring out indicators.

Once again we would like to insist on the fact that there is no consensus on what the right knowledge measurement is, and this is the reason why we propose to use the previous model about CoPs knowledge performance, according to the issues we have pointed out and to our own specific aims, in order to define appropriate indicators.

Implications for future research

Our model provides a starting point for future research on how to measure knowledge within e-CoPs. Through this articulation of theoretical propositions we have highlighted key processes of knowledge value creation within e-CoPs, i.e. participation as enhancing e-CoP's potential knowledge value and reification as enhancing e-CoP's realized knowledge value.

² PALETTE's ICT solutions gather mediation services (such as Cope-it! and e-Logbook...), KM services (such as SweetWiki, Generis and Bayfac...) and information services (such as Limsee3, Amaya and DocReuse...). Altogether a dozen of ICT Solutions dedicated for e-CoPs are developed in the framework of this project.

The next step to this work is the construction of a knowledge evaluation service dedicated to e-CoPs. Indeed, we advance in this paper testable theoretical propositions that enable the elaboration of key indicators. These indicators will then allow allotting a dynamic, quantitative and qualitative value to knowledge.

This service will allow to attribute a value of a knowledge circulating within an e-CoP, according to the context presented above. This value could be integrated in other services provided via PALETTE, for instance to help the maintenance (help in sorting archived mails for example), or to support classification or ranking in a research objective.

The criteria taken into account will be based on and related to the meta-models developed in the project, in order to reinforce and make them evolve. The inputs needed for the calculation of the value could be obtained via the other services proposed in PALETTE. This could be the meta-data or annotations of documents, based on PALETTE models.

The evaluation of these criteria will be based on declarative methods (feedbacks given by the users) and by automated calculations.

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Advancing Knowledge Management and Exchange between Collaborative Environments: A Tool Integration Perspective

Anna De Liddo¹, Grazia Concilio¹, and Simon Buckingham Shum²

¹ Dipartimento di Architettura ed Urbanistica, Politecnico di Bari, Bari, Italy

² Knowledge Media Institute, Open University, Milton Keynes, United Kingdom

Abstract. This paper focuses on supporting knowledge management and exchange between web-based and traditional collaborative environments. In particular we discuss the integration between a tool (*CoPe_it!*) supporting collaborative argumentation and learning in web-based Communities of Practices and a hypermedia and sense making tool (*Compendium*) acting as a personal and collective Knowledge Management (KM) system in traditional collaborative environments. We focus on the general applicability of this integration for supporting Communities of Practices and, more generally, collaborative works, and discuss the main objectives and challenges to be addressed.

Keywords: Knowledge Management, Knowledge Works, Collaborative Environments, Knowledge Exchange, CoP, VCoP.

1 Introduction

Communities of practices (CoPs) naturally generate and act in real world settings like work contexts, leisure and family or familiar places [1]. Contextual and contingent situations can bring people to discover common aims, desires, needs or problems and then trigger new unpredictable ways of collaboration towards shared objectives. Starting from these objectives people communicate and organize their actions towards a common goal. In this process of community definition, specific roles, tasks, and expertises start emerging within the group [2]. Eventually, the different roles are legitimated by social relationships of trust among the community members, forging the overall identity of the group as a whole [3].

This complex process of transition from a group towards a CoP is determined by the simultaneous occurrence of personal actions, choices and attributions of value. This transition is strictly related to the individual knowledge of the community members (often tacit knowledge) and to the contextualization of this knowledge to different environments, situations and times [1].

Defining the prototypical transition from a group towards a CoP is, therefore, highly challenging; it is particularly sensitive to the environment and highly dependent on the specificities of involved actors which can be only temporarily

involved. What happens to this complex dynamics when we look at web-based, i.e. virtual Community of Practices (VCoP)?

We could assume that acting in virtual environments, like web-based environments are, with fixed and predetermined protocols for information exchange, language and communication roles represent a significant help to analyse the VCoP dynamics. In VCoPs knowledge objects and communication rules are pre-structured and then we can monitor and control some of the social implications and influences that in traditional CoPs would make the problem more complex. Despite this we cannot consider VCoP members as isolated entities with no social (external to the VCoP) life, environment and relationship, separated from their personal histories which indeed affect their actions and positions within the VCoP.

Then the question is: In the global village does it make sense to distinguish traditional (real-world) CoPs and WCoPs? We should rather start thinking about a hybrid version of CoPs (HCoPs) whose community members act and communicate in both virtual and traditional modes in a way that is continuously shifting from one mode to the other one [4]?

When we think about virtual and traditional collaborative spaces we mainly refer to the web and to real-world environments; we mainly refer to activities performed on-line and off-line. In this sense we can consider computer supported works as real-world activities when they are performed off-line. The focus is on communication modalities rather than on the specificities of the communication space: traditional spaces are spaces in which humans communicate by real-world means, whereas in virtual spaces humans (or agents) communicate by artificial means.

Knowledge based works are increasingly looking for tools and environments able to manage and to integrate knowledge created and exchanged within and between virtual and traditional environments.

What integration method and tools should be envisioned and provided in order to take into account the influence and impact of hybrid knowledge in order to enlarge individuals and community networks?

Our aim is twofold: i. enhancing virtual interaction networks by exploiting social relationships in traditional spaces and, vice versa, ii. enlarging the social and real-world networks by exploiting links and knowledge from virtual communities.

Knowledge from virtual community networks is a key feature in the real-world environment for CoPs in order to make them able to leverage internal debates to a new way of communication: not only face-to-face but also remotely (i.e. distance and asynchronous interactions as they can be supported within virtual environments). At the same time knowledge from real-world communities is a key feature for VCoPs [5] to exploit social networks of members (in real-world settings) in order to enlarge participation and attract new individuals into the VCoP.

To cater for this we propose the integration between *CoPe_it!*, a tool to support collaborative argumentation in VCoPs, and *Compendium*, a hypermedia and sense making tool acting as a personal or collective KM system in physical CoPs.

CoPe_it! is the tool to gather knowledge from virtual communities. It helps VCoPs in discussing and making collaborative decisions about common issues. On the other hand *Compendium* is the tool to gather and manage knowledge from real world collaborative environment. It helps traditional CoPs: i. to gather and represent knowledge coming from face-to-face meetings taking trace of argumentative

discussions about common issues; ii. to manage and reuse this knowledge in diverse environments making sense of them in a personal way (using *compendium* as a personal KM tool); iii. to manage and reuse this knowledge in diverse environments making sense of them in a CoP perspective (Using *Compendium* as a collective KM tool). The integration of these tools allows to exchange knowledge and to enlarge the field of discussion between web-based and real world environments, several advantages and potentials of this integration will be discussed in the paper that is organized as follows. First we briefly present both *Cope_it!* and *Compendium*. Next, we show their functionality by outlining their complementarities and identifying potential mutual benefits of their integration. We then discuss the integration proposal focusing on possible technical solutions and finally define future steps for their integration focussing on the objectives and challenges to be addressed.

2 *Compendium* and *CoPe_it!*: a Brief Description

2.1 *Compendium*: a Hypermedia and Knowledge Management Tool for Individual and Collective Sense-making

Compendium is the result of over 15 years of research and development. It is difficult to give one comprehensive definition of the software because different uses are already carried out and new uses are continuously envisaged emerging from the practice and creativity of the users.

From the analysis of the recent state of the art [6] we can group the diverse *Compendium* uses in two main families : i. *in-real-time* and ii. *post-hoc* uses. This distinction mainly refers the work the user needs to do on-the-fly or post-hoc (during and after the meeting).

In the first family we count Dialogue Mapping (DM) and Conversational Modelling (CM) techniques. These techniques require high moderation skills either on-the-fly (for DM) or both on the fly and post-hoc (for CM techniques).

The first is mainly adopted in face-to-face meetings and *Compendium* is used for arguments' visualization and meeting moderation: the moderator (possibly assisted by an experienced *Compendium* user in charge of the mapping) maps the meeting (captures and displays discussion) in order to reach shared understanding about a problem. The process consists of both an incremental negotiation of meanings and the micro-agreements about problem representation [7].

Conversational Modelling (CM) has a balance between users' skills in mapping and modelling and the work in and behind the meeting room. In order to apply this technique a *Compendium* user needs to prepare templates, devoted to model the meeting evolution and to structure the discussions, in order to help and drive the group to decide about and define design variables (criteria, alternatives, priorities, list of actions, etc). In this phase the user applies process modeling skills and he works behind the meeting room. In order to manage such meetings the CM practitioner needs to be experienced in meeting moderation and mapping, nevertheless the

template driven moderation is a valuable support and makes the moderation work less dependent on the moderator skills.

Dialogue Mapping and Conversational Modeling are two techniques for collective sense making and these are ‘real time techniques’ for capturing meeting discussions and involving people in collective definitions and collaborative argumentation about problems.

In the second family, i.e. the post-hoc techniques, we count Knowledge Management oriented uses of *Compendium*. In these cases *Compendium* provides users with diverse features for managing knowledge, making sense of knowledge contents and using and reusing information in disparate knowledge works (hypermedia files and documents can be linked and enriched with comments, ideas, tags, etc).

KM oriented applications range from managing a PhD research [8] to political debates representation [9; 10]. In these latter cases *Compendium* has been used as a Computer Supported Argument Visualization tool oriented to represent a debate, making it easily exportable and eventually open for public discussion on the web. The main objective is to enlarge participation and deliberation about public policies. In these case studies *Compendium* has been used for post-hoc analysis and representation (mainly mapping) of political arguments. Contents are first gathered by interviews and/or public forums and then structured into argument maps (mainly following an IBIS model of argument representation). A different attempt has been carried out in the Participatory Planning domain and considers the use of *Compendium* as a multimedia project memory. In this application a post-hoc analysis of videos, interviews, documents, graphs, photos, and other material has been conducted to map the memory of a participatory urban planning project [11].

In all post-hoc applications the work on information structuring is committed to a Knowledge Manager who has to organize the contents according to specific objectives (i.e. how to trigger participation? What are the topics to focus on?, etc).

In the light of the examples reported above, *Compendium* can be defined as an hypermedia and knowledge management tool for individual and collective sense making. In the literature it is referred to not only as a software tool but as an approach to gather, structure, represent, and manage knowledge for individual or collaborative knowledge intensive works. In a *Compendium* approach knowledge objects (ideas, multimedia documents, artifacts, etc) are represented as nodes of a graph like structure; afterwards nodes are linked so as to organize contents and make-sense of individual and/or collective concepts and concerns.

2.2 CoPe_it!: a Web-based Tool for Collaborative Argumentation and Learning

CoPe_it! is a young software developed in the context of a EU project, Palette (Pedagogically Sustained Adaptive Learning through the Exploitation of Tacit and Explicit Knowledge) started last year. Mainly it is a web-based tool supporting collaborative learning in VCoPs [12].

CoPe_it! has been designed according to what the research group describe as an incremental formalization approach (for references see [13]); it is based on the idea

that different levels of formalization of the argumentation contents need to be provided in order to support collaborative decision making.

CoPe_it! supplies members of VCoP with different features in order to deal with argumentative discussions. The software supports i. definition of alternative solutions and ii. analysis and evaluation of the discussion contents in order to drive groups throughout decision making processes. *CoPe_it!* is more than a web tool for collaborative argumentation, it is rather a tool supporting learning processes in VCoP. It supports i. the first step of problem setting, ii. the definition of alternative solutions, iii. the discussion and negotiation of meanings, pros and cons of each alternative, and finally iv. the analysis of content and the definition of solutions priorities.

CoPe_it! offers basically three levels of formalization corresponding to different representations of argumentative discussions, each of them associated to one of the following views:

1. *Desktop view*: it consists in the lower level of formalization; the community members can add contents in the most user friendly way (in a Compendium like approach). This is an intuitive way of gathering contents from the users without forcing them with pre-defined communication rules.
2. *Formal view*: this view consists in a machine readable version of the previous one. Predefined algorithms of conversion are applied to the desktop view contents in order to convert them in a IBIS-model like argumentative discussion.
3. *Forum view*: this view represents contents in a temporal sequence showing contents and node types (statement, argument, document type, etc).

Future developments include the support for simultaneous posting from all the tree views. Another important improvement to be implemented concerns the possibility to define and negotiate with the community members the specific algorithm of conversion between the desktop view and the formal one. This opportunity will couple a tool for collaborative argumentation with a valuable support for decision-making processes.

CoPe_it! provides members of communities with a common workspace where they can post and share ideas, resources, and arguments in a way that makes sense to them. Community members are registered and have specific names, roles and privileges within the community. Each user is assigned his personal workspace and he can make it private and organize his/her own ideas and contents to be eventually shared with the group in a second moment.

Knowledge items can change during the discussion (free interchange between node types: idea, comment, and note) and they can be linked with personalized links (of specific thickness, colors, and labels). Nodes can be arranged and moved freely in the workspace, and they can also be clustered using adornments (colored rectangles used to group together nodes). Other interesting features are i. the possibility to open a new browser for searching information by Google and Wikipedia, ii. the possibility to subscribe to RSS feeds, and define and manage a list of bookmarks.

This synthetic overview of *CoPe_it!* main features is not intended to be exhaustive and is the result of the testing of the most recent up-dating of the tool.

3 Why an Integration?: Discussing Similarities and Peculiarity of the Tools

Although addressing different tasks, *Compendium* and *CoPe_it!* show high integration potentials mainly because, they share similar communication principles and visualization means. Starting from the analysis of peculiar features of the software, (see the following table) we want to make visible the complementarities of the tools.

Table 1 shows in light-grey features which are similar (or will be similar referring to the future planned versions of *CoPe_it!*) like: export and import formats, source code distribution policy, administrator rights (registration and download), visualization and structure of contents (supported file types, IBIS model of argumentation, tagging etc).

Dark-grey rows identify the features in which both systems complement each other. The first feature refers to the communication mode (on-line/off-line use). Since we are interested in knowledge exchange between virtual/non-virtual spaces, candidate tools for the integration need to be complementary with regards to this feature.

Other key aspects where the two systems show complementarities are: at distance synchronous and asynchronous collaborations; users' roles, rules and privileges; hypertext features; personalization and revision of contents; Decision Making support.

Starting from the software analysis and focusing on the complementary aspects, we can identify the main mutual advantages of the envisaged integration.

In the following tables (Table 2 and 3) we analyze complementary features trying to link each of them to the relative additional feature it would provide both to *Compendium* and *CoPe_it!* users, in the case the integration is successfully implemented.

Table 1. *Compendium* and *CoPe_it!* main features.

Main Features	Compendium	CoPe it!
Export formats	It supports 5 formats: XML, Jpeg, Html - web-maps and web-outline, power export.	It will support XML files and Jpeg format (not yet delivered)
Import formats	It supports XML imports, images and image folders, Quest Map files, Flash-Meeting files	It will support XML files and Jpeg format (not yet delivered)
Free download/access	YES	YES
Source Code Distribution Policy	Open source	Source code is intended to be released
WEB-BASED	NO	YES
Software download	YES (you need to download Compendium in order to access the full functionality)	NO (you don't need to download any software)

Registration	Needed the first time for the software download.	Needed the first time to get the User ID and Password and to get the administrator acceptance
Members attributes	There are no roles, rules and privileges imposed to the members not even any administration control on contents	There are roles, rules and privilege within a community
At distance asynchronous collaboration	YES - only on local networks	YES (through the web)
At distance synchronous collaboration	NO (yes - only slow performances)	NOT YET (it intends to be)
Structure of contents	No contents structure are pre-imposed	desktop view: flat; formal view: rules of communication and contents have a pre-defined structure
References: supported file types	drag+drop in any document, website, email, image	At the moment you can upload any kind of local file type, not yet any kind of file on the web
Support IBIS model of argumentation	YES	YES Partially (it doesn't support 'question' nodes, each question is supposed to be addressed in a separate workspace)
Tagging	You can choose between default tags and assign your own keyword 'tags'	NOT YET (it intends to offer some tagging features)
Personalization and customization of icons, backgrounds, colors, links, etc	You can create your own palettes of icons, links types, colors	At the moment no personalization features are present. Some features are under consideration for future versions: e.g. links color)
Hypertext features: Transclusion	You can place/edit a given knowledge object in many different views (supports transclusions)	Does not support transclusions, objects of different workspaces cannot be copied or linked
Contents revisions	Allows continuous changing and reviewing of contents and their organization	Does not support contents modification and revision (just erasing or adding new contents)
Information overload	It supports maps with large numbers of nodes	Not suitable for large number of nodes (very slow)
Support Decision making	NO (yes, only when paired with human assisted techniques)	YES (Support automatic generated view for different purposes)

Table 2. Additional features that the integration can provide to *CoPe_it!*

Compendium -----> CoPe_it!	
Additional features	Complementarities
1. Enlarges the advantages of real time capturing and integration with different materials, information, documents and hybrid files so that the face-to-face meeting memory can be shared in and out the meeting group	Compendium complements CoPe_it! offering real time capture of meeting
2. Provides CoPs with a hypermedia environment in which community members can use, correlate and manage contents of different collaboration spaces (contents raised in different workspaces can be discussed and transcluded in new contexts)	Compendium complements CoPe_it! offering transclusion features
3. Offers a KM tool in which community members can organize, structure and define information and resources also being off line on their machine, but always giving them the possibility at any time to publish content on the web and to share them with a list of community members or making it public for the whole VCoP	Compendium complements CoPe_it! offering an off-line KM tools
4. Toward un Organizational Memory System	Exports CoPe_it! discussions in an off line environment without no problem of information overload (Compendium support maps with thousands nodes)
	Allows to customize organization and archiving of knowledge objects in larger organizational databases (linking and referring discussion contents to any other off-line and private data sources)
	Compendium complements CoPe_it! supporting maps up to large number of nodes
	Compendium complements CoPe_it! offering customization of knowledge object and hyper textual environment running on your machine

Table 3. Additional features that the integration can provide to *Compendium*.

CoPe_it! -----> Compendium	
Additional features	Complementarities
1. Opens Compendium face to face meeting to a wider community on the www	CoPe_it! complements Compendium offering a web-based argumentation environment
2. Gives the possibility to trigger online discussions on specific topics (this is particularly useful in Public Policy cases)	CoPe_it! complements Compendium offering the possibility to modify and enrich Compendium maps directly on the web
3. Provides at distance Compendium users with an environment of asynchronous discussions that can easily be imported in their Compendium maps	CoPe_it! complements Compendium offering synchronous interaction for real time at distance discussions
4. Gives to Compendium based Project memory system the possibility to update results of at distance meeting and consultation forum on the web	CoPe_it! complements Compendium offering the possibility to import, in forms of Compendium maps, contents of at distance meeting and consultation forum
5. Offers support for Decision Making	CoPe_it! complements Compendium offering automatic analysis of Compendium maps, with customized algorithms

4 Integration Proposal

In the previous section we gave evidence of the mutual advantages when integrating *Compendium* and *CoPe_it!* In the following we'll discuss the integration proposal describing three possible scenarios:

First scenario: Importing *CoPe_it!* workspaces in *Compendium* maps (from virtual to real world settings – from VCoPs to CoPs).

Second scenario: Importing *Compendium* maps in *CoPe_it!* workspaces (from real to virtual world settings – from CoPs to VCoPs).

Third scenario: both side import.

In the first scenario the main goal is to enlarge to communities on the web discussions and collaborative knowledge works performed in real world communities. In order to make *on* and *off line* discussions completely complementary and to allow the on-line discussions to evolve together with the face-to-face process, we need to transfer into *Compendium* the contents gained in *CoPe_it!* workspaces. Contents can be imported in *Compendium* and then re-organized, linked and discussed within the same community or in different ones during ad-hoc face-to-face meetings.

The second scenario aims at:

- importing *Compendium* Dialogue maps in order to discuss within the virtual communities the results of face-to face meetings;
- importing single-user concept maps used as a reference for arguing something in the virtual discussion
- importing *Compendium* templates and models in order to trigger, organize or moderate the discussion in new workspaces.

The third scenario is the bi-directional integration between both tools, and it exhibits the benefits gained by performing the two scenarios already described. An additional advantage is envisaged: the results of virtual meetings can be submitted to the discussion in traditional communities (scenario 1) and the results of face-to-face discussions can go back to virtual environments (scenario 2) closing the cycle and allowing further contributions from the virtual community. This possibility provides means for continuously validating and revising contents from virtual to real world settings and vice-versa.

For the envisaged scenarios diverse technical solutions are possible. In figure 1 three options for implementing the three scenarios are synthesized: one manual and two automatic options.

In the first option a knowledge manager is in charge of the knowledge integration and exchange between both systems. This option offers three positive opportunities: i. to select specific knowledge contents according to specific needs, ii. to control and avoid knowledge redundancies, and iii. to locate imported and exported maps in their original position (spatial positions in the two-dimensional canvas) that is crucial for contents' interpretation. On the other hand, this option enhances external influence on knowledge interchange (knowledge manager interpretation) and the time and effort required to be implemented.

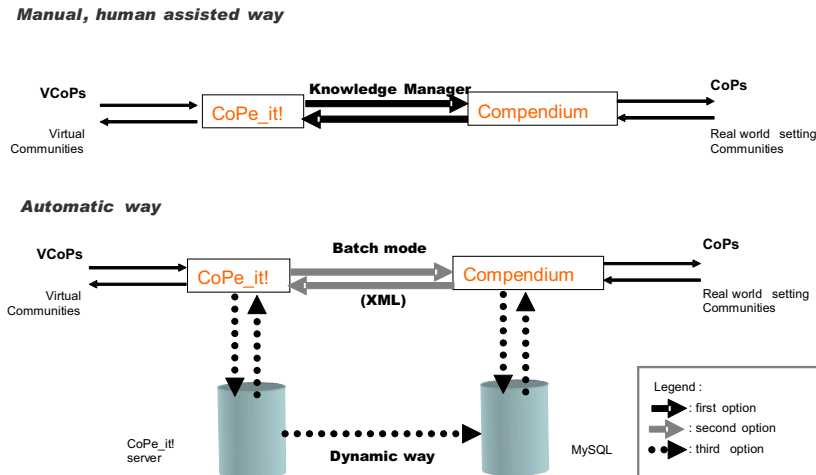


Fig. 1. Technical options for the proposed integration.

In the second option the knowledge exchange is performed in batch mode, allowing XML export/import. This option has the advantages to be transparent and fast but it presents several theoretical and technical criticalities in the definition of conversion rules. Therefore efforts have to be devoted to:

- defining conversion rules for contents export for *CoPe_it!* – *Compendium* objects: i.e. nodes types (each one with its features - title, descriptions, reference files, etc), links (with colors, thickness, texts labels, etc), adornments (with colors and titles), documents and reference objects (addressing compatibility and equivalence of document formats);
- building a XML export/import readable in both systems (compare and integrate XML schemas, detect information and decide how and which ones of them can or have to be converted, etc).

In the third option the integration is obtained connecting *Compendium* and *CoPe_it!* databases. This option offers additional capabilities by allowing synchronous update of both *Compendium* and *CoPe_it!* spaces. In this scenario, virtual and traditional communities can work together in synchronicity on the same project or collaborative knowledge work, with different means but in a unique hybrid environment. This is a suitable environment for HCoPs, hybrid communities of practices in which members can:

1. shift continuously between virtual and real world environments
2. simultaneously discuss, modify and produce knowledge objects in a whole hybrid space of collaboration.

This type of integration provides HCoPs' members with a new collaboration space in which they have the opportunity to perform argumentative collaboration at various level and in diverse (virtual/non-virtual) groups and contexts.

5 Conclusions

In this paper we focus on the integration of knowledge coming from different collaborative environments, virtual and traditional, thus leveraging CoPs to a truly collaborative environment with no communication boundaries. This is the environment in which HCoPs perform. HCoPs are an emerging kind of CoPs where users are no longer constrained to a particular communication environment may it be virtual or real. HCoP is a novel approach to CoP providing users with diverse environments for collaboration in knowledge works. In this perspective, we have proposed the integration of *Compendium* and *CoPe_it!* and we have explored three scenarios and possible technical solutions for this integration. . As a following step, we'll try to define feasibility and priorities of implementation, but some other considerations can be made.

Considering that knowledge generated in CoPs is highly context dependent, we argue that for knowledge exchange it is relevant to preserve knowledge from manipulation or mediate interpretation.

Regardless of the technical solution to be implemented, some operational goals need to be addressed:

- to keep trace of the social context: who made explicit this knowledge, during which discussion with whom;
- to maintain the conceptual relationships: why that knowledge emerged and in what context of discussion;
- to keep trace of the dynamics of cognitive events: when the knowledge emerged, is used, assessed, or shared during the discussion process;
- to represent knowledge with a similar visual language in both environments (virtual and traditional);
- to make knowledge easily reusable in both environments.

These points define some of the key constraints (requirements to fulfil) for the knowledge integration proposal for the knowledge exchange to be transparent, and ready for community validation. Further research effort will be devoted to implement a batch mode integration (bi-directional XML import/export), then moving to the point in which the two systems can be used and up-dated in a dynamic way.

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Exploiting Social Software to Semantically Enrich Multimedia Content for Online Communities

Christina E. Evangelou and Ioannis Kompatsiaris

Multimedia Knowledge Group, Informatics and Telematics Institute,
Centre for Research and Technology Hellas
1st km. Thermi-Panorama Road, Thessaloniki, Greece
{chriseva, ikom}@iti.gr

Abstract. Today, the emergence of social software technologies transforms the Internet to a medium of mass social interaction and collaboration, also promoting the formation of massive online communities. On the other hand, huge amounts of multimedia content, provided by and shared among individuals and community members, are constantly accumulated in content sharing enablers. This position paper presents research work towards the exploitation of social software applications for understanding, semantically enriching and delivering multimedia content, our ultimate goal being to support online communities.

Keywords: Online Community, Multimedia Content, Social Software, Social Tagging.

1 Introduction

The Internet has long been the aid of various kinds of web-based collaboration and virtual teamwork [1]. Today, the emergence of several technologies such as wikis, blogs and content sharing enablers, transforms the Internet to a medium of mass social interaction and collaboration, also promoting the formation of massive *online communities*. Such technologies are commonly referred to as *social software* technologies, and perceived as a particular type of software that concerns itself with the augmentation of human social and/or collaborative abilities [2]. Especially as regards to content sharing enablers, these are applications that allow users to store, search for and display user-contributed content also referred to as *social content*.

Huge amounts of social content, provided by and shared among individuals and community members, are constantly accumulated in content sharing enablers such as YouTube (see <http://www.youtube.com>) and Flickr (see <http://www.flickr.com>). The principle characteristic of these technologies is that they enable users to share content they have created themselves. It is a fact that media recording devices and editing tools have become widely popular, allowing for amateurs and home users to produce huge amounts of multimedia content. Furthermore, social software technologies

enable users to annotate the provided content with comments of their own, a practice commonly referred to as *social tagging* (or *social bookmarking*).

Considering the continuously increasing availability and accessibility of multimedia content via social software applications, our research addresses how the user communities can be assisted with more efficient multimedia content management and delivery mechanisms. Acknowledging that multimedia content sharing and social tagging are both common practices of online communities, our approach aims at producing meaningfully annotated multimedia content utilizing the content's user assigned tags. More specifically, our goal is to support online communities in sharing their experiences and common interests in a context sensitive manner, enabled by Internet communication and Web 2.0 services and applications. Towards this aim, this paper presents research work towards the development of a framework for improving the analysis and understanding of multimedia content exploiting social tags, so as to generate and handle efficient mechanisms for the intelligent consumption of multimedia content.

The remainder of this paper is structured as follows. In the following section we highlight the issues that motivate our work. More specifically, we present in brief online communities and social tagging, as well as an overview of issues related to multimedia content sharing via social software. In Section 3 we present the conceptual foundations of our approach, as well as issues related to the understanding, semantic enrichment and delivery of multimedia content to online communities. Finally, the concluding section provides a synopsis of our contribution and sketches future work directions.

2 Online Communities and Social Tagging

In general, the concept of online communities refers to the online communication spaces where individuals develop a sense of belonging, usually through interacting with other users on topics of common interest. Early online communities were mostly formed through the use of emailing lists, or bulletin boards. Today, most communities are formulated around some kind of a web-based interface that allows them to exchange their personal ideas, opinions and beliefs, such as blogs or multimedia content sharing applications. Information sharing and exchange is an ongoing process among community members. As characteristically stated in [3], in a focused community it is the member-generated content that adds stickiness to a site encouraging people to stay, participate and revisit.

Web 2.0 can be defined as a set of technologies that allow easy content sharing on the Web and enable social software. Social software, *i.e.* software that supports activities in virtual social spaces, comprises a wide range of different types of applications such as web logs, wikis, social tagging sites, content sharing enablers, and contact sites. Social tagging is the process of informal and personal association of a keyword or term or tag to a piece of information (usually for online resources such as computer files, web pages, digital images). This type of item description enables keyword-based classification, thus improving the "searchability" of content [4].

Several sites enabling social tagging facilitate users to store, classify, share and search links through the practice of folksonomy techniques on the Internet or Intranets.

The availability of social software applications has also resulted in the phenomenal growth of user embodiment in virtual spaces and the constant emergence of online communities. Users play a significant role beside content in Web 2.0 [5]. As clearly stated in [6], the increased user contribution leads to the growth of “collective intelligence” and reusable dynamic content. Digital media such as images, video and audio are broadly used for sharing of ideas among community members that engage in collaborative activities. However, the current approaches have several limitations regarding the efficiency of user generated tags. For example, in many cases the keyword list is incomplete or contains a lot of mistakes and irrelevant terms. These issues constrain a more extended usage of current applications. In order to solve these problems, the presented research approach suggests the use of multimedia content understanding towards improving the consistency of the user-generated annotation, suggesting new terms and eliminating irrelevant tags.

3 Exploiting Social Multimedia Content

Our approach aims at developing an efficient and effective framework of representations and mechanisms for the social-oriented structuring and analysis of user created multimedia content. Knowledge representation and analysis of multimedia content, especially regarding image and video, are research areas with a of plethora contributions [7]. These mostly focus on technological aspects, providing a great amount of methods, tools and techniques for the management of multimedia content. Still, it is a fact that existing approaches do not exploit the social aspects related to the end users for understanding the media.

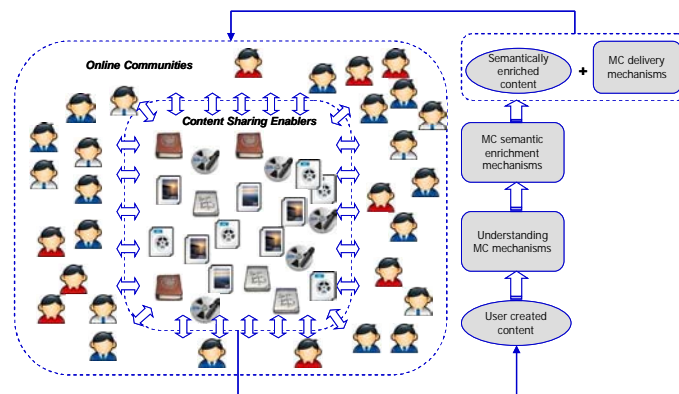


Fig. 1. Our content analysis approach based on the user-generated tags.

Our work exploits the social software approach for developing a robust conceptual model as well as for developing the necessary mechanisms for the semantic enrichment of multimedia content in meaningful ways. Towards this, we make use of

social tagging for the semantic enrichment of multimedia content. More specifically, our work concerns the development of ontologies based on concepts that derive from the user defined tags and can be of aid to the semantic interpretation and enrichment of the content [8]. This also involves the development of mechanisms for the automatic generation of tags, as the user assigned tags are not always sufficient, as was explained before. Furthermore, another important aspect of our work concerns the consistency checking and amendment of social tags. Fig.1 schematically depicts our content analysis approach based on user-generated tags (where MC stands for Multimedia Content).

3.1 Ontologies for Content Understanding

Knowledge extraction from multimedia content is generally considered as a very intrinsic task in multimedia processing, and one of the most crucial steps towards content understanding. A variety of tools and techniques such as low-level feature extraction, image segmentation, object classification, tracking and recognition, image annotation and indexing have already been used towards this [7, 8]. These utilize at some extend some kind of knowledge and their performance depends highly on the broadness of the application and the specific type of the media. On the other hand, the role of social entities such as individual and community users empowers new opportunities for efficient multimedia knowledge extraction and content management. Especially social tagging where tags assigned by the users to the multimedia content can be exploited for the extraction of knowledge. The social role of users forming user communities and groups, who are the ones tagging content in the first place, is crucial in the process and has a direct effect on the available tagging information. In other words, it is the contextual effect of socializing users that directs the tagging process and influences their semantic interpretation. Taking the above into account, and in the context of modeling knowledge for multimedia understanding, we propose the use of enriched ontologies within a specific domain, which include relations among the following: (i) formal representation of the domain, (ii) concepts that derive from the user defined tags and (iii) visual concepts that can be extracted with multimedia analysis techniques. These ontologies together with the user-generated tags can be used as a-priori knowledge (incorporating the social knowledge) in order to drive the content analysis and understanding procedure. Social tags can be used as context that drives and constrains the content analysis algorithms. For example, using image pattern recognition techniques, with location information and taking into account the user tags, it will be possible to recognise that a photo really depicts the Eiffel Tower and not a person in front of the Tower.

3.2 Semantic Enrichment of Multimedia Content

Semantic descriptions of content are of great importance as regards to the speed and ease of navigation through multimedia content repositories. Recent research efforts in the area of semantic video annotation try to derive the semantics from the videos' low

level features or from any other available basic metadata. It is a fact that various efforts towards this prove to be effort and time consuming, while the outcomes are not considered to be satisfactory. Our approach proposes the creation of meaningfully annotated multimedia content exploiting the user assigned tags. Tagging information can provide a unified semantic interpretation of the multimedia content. Based on the ontologies described in the previous subsection, both user and automatically assigned tags to the content can be managed according to the properly developed ontologies. Furthermore, we propose the use of advanced semi-automatic social tagging approaches, where the automatic tagging results could be presented to the user, so that the user could be able to interfere with them in a meaningful way, and provide his feedback about them. For example, reasoning and consistency checking mechanisms could be applied in order to either suggest new keywords or eliminate irrelevant ones. We also propose that the multimedia content provided by the users could be enriched with three main types of information, i.e. spatial, thematic and temporal information. In this way, tags could be mapped to high-level semantic concepts defined by a spatiotemporal and a domain specific ontology. In this way, social tagging could be enhanced with extra user-oriented functionalities, such as the ability of users to interact with content tagging. This could also be used for future training/learning of tags, with respect to the specific content types.

3.3 Delivering Semantically Enriched Multimedia Content

Data storage and data access technologies change the way people interact with their data and each other. Delivering the semantically enriched multimedia content should take into account all available social and contextual information. On the other hand, social software is about personal services on the web, and consequently it is about personalization. Taking that into account, we propose the delivery of content to the online community members according to user related information. More specifically, in our approach we exploit the user profiles and preferences, ratings and user and automatically provided tags, profiles of the users who share this content, community profiles, spatial and temporal information, like user/event location, time of the event, etc. Furthermore, reasoning techniques could further assist the matching of content and users. Following the “affinity systems” paradigm that allow people to register their membership of groups (e.g. old school friends or work colleagues), individuals could enter personal details that are either matched against the profiles of others or searchable by others. In this way, the enriched content could be mapped onto any user or community of a particular profile and deliver to them content of their interest.

4 Conclusions and Future Work Directions

Social software enables the sharing of huge amounts of content via the Internet. Sharing of content can be perceived as a collaboration activity resulting in the formation of online communities of various sizes and types. Exploiting social software enabled collaboration practices can help us understand both social aspects of online communities’ behavior, as well as multimedia content. In this work, we

attempt to explore this Internet enabled social activity towards the abovementioned aim. We can exploit ontology-based mechanisms to enrich the content in meaningful ways integrating social tagging and content analysis approaches, in order to support online communities in sharing more efficiently and effectively their experiences and common interests. Towards this aim, our future work directions concern the full development of the proposed framework. Furthermore, our efforts comprise the development of all necessary mechanisms for understanding, semantically enriching and delivering multimedia content to the online communities.

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Designing services for CoPs : first results of the PALETTE project

Bernadette Charlier¹, Aida Boukottaya¹, Amaury Daele¹, Nathalie Deschryver¹,
Sandy El Helou², Yannick Naudet³

¹University of Fribourg, Centre de Didactique Universitaire, Bd de Pérolles, 90, 1700 Fribourg. Bernadette.charlier@unifr.ch

²EPFL, Ecole Polytechnique Fédérale de Lausanne

³CRP-HT, Centre de Recherche Public Henri-Tudor

Abstract: In this contribution, we specify and categorize CoPs' needs (this includes the analysis of CoPs practices, resources and environments) in order to identify specific functions that meet these needs. This enables the efficient identification of possible interactions between PALETTE services' categories that will be used as the basis to refine functional specifications of PALETTE services and enhance the development guidelines.

Keywords : functional specifications, CoP's needs, services integration.

1. Introduction

The writing of functional specifications for PALETTE services are grounded on previous work done in collaboration with CoPs and PALETTE partners. The most important source has been the scenarios elaborated in collaboration and validated by the ten Cops involved in the project until now. However, these scenarios present two main characteristics:

- They are CoP specific: each scenario is dedicated to one specific CoP; but, some similarities between scenarios can be observed (e.g. the use of the same services in the same manner and under the same conditions, the same need expressed differently, etc).
- Scenarios describe the use of PALETTE services within CoPs; however we notice that some points regarding the integration of the services in CoPs environments are

not addressed. During virtual and face-to-face meetings developers, as well as mediators, have the same questions about integration issues (e.g. which repository CoPs will use? What to do with existing resources? , How to switch from existing tools from Palette services?, etc). Moreover, other questions are asked regarding the interaction of services (When do the services interact? How do they interact?).

To go beyond these documents and suggest new functional specifications, we have tried to:

1. Categorise CoPs needs: this categorization offers a global view of CoPs needs that permits to generalise the use of PALETTE services in order to produce generic scenarios.
2. Refine the categorization of PALETTE services: through the analysis of the produced scenarios, we also noticed that the specification of PALETTE services could be refined in order to answer efficiently identified categories of CoPs needs. This enables the developers to better identify the offered services (e.g. a specific function of a tool is offered as an end-user service).
3. Study the different types of PALETTE services interactions (at conceptual level) which will be a helpful input to enhance the technical guidelines regarding the integration of services.
4. Suggest future strategies for the development of PALETTE services.

In order to achieve these goals, we have proceeded in several steps:

- We first design a common template for CoPs. The template summarises the needs of the CoP as well as the PALETTE technological services (expressed in terms of functions) that could meet these needs. For each need, the template describes existing resources, environment and practice. Each adopted service is described in terms of changes in existing resources, environment and practice. The latter templates have been designed collaboratively by developers and mediators during face-to-face meetings. Moreover, interactions between services are also presented as well as questions related to the use of services (individually or with other services).
- The produced templates were analysed and generalised, namely, to refine the categorization of PALETTE services and categorization of PALETTE services interactions.

In the remaining of this contribution, the different obtained results are detailed.

2. Categorization of CoPs' Needs

One of the objectives of PALETTE is to develop “configuration of services” (technological and learning ones) which meet the developmental and learning needs of CoPs. This means that it is important to firstly represent patterns of needs that orient configuration of PALETTE services. In order to find these needs patterns we developed a categorization of the PALETTE CoPs' needs. In order to produce this categorization we used two models. First, we used the model of professional development within a community of practice, developed by Daele [1]. This model constitutes one of the “conceptual” bases of the PALETTE project. Second, we used the model of CoPs' actions proposed by Künzel, Charlier & Daele [2], a model which is anchored in observations of several CoPs in different domains of actions.

Daele's model represents different processes involved in the larger process of professional development, starting from the formalisation of professional practice: the exchanges, experience sharing, analysis, debate and creation of new methods and practices. All of these processes occur following a number of conditions linked with: the engagement, the participation (in the various modes of social interactions) and the learning (supported notably by the formalization of the exchanges) in the CoP. The first two conditions “engagement and participation” appeared in the PALETTE CoPs needs.

As illustrated beyond, the need for supporting participation is largely expressed and covers some modes of participation defined in the Daele's model (exchanges, debate and confrontation). We mean by ‘participation’ the extent to which members are involved in the activities of the CoP more or less actively and the extent to which they interact with other members of the CoP. Consequently to support participation means to support social interactions. De Montmollin [3] defines ‘social interaction’ as the effects resulting from the presence, the words and action of a person on the responses of another to his environment. So for supporting social interaction we consider as important to support verbal exchanges (from single exchanges to richer one like debate-confrontation) as the awareness of the presence of the participants. Some other conditions could be associated with the participation like: to give social and technical training for members, to enable them to truly participate.

Table 1 – Categories of needs of some CoPs

Categories of needs	PALETTE CoPs Needs
<p>1.To support participation :</p> <p>To support social interactions : verbal interactions (exchanges, experiences sharing, analysis, debate, confrontation, creation of new methods and practices) and presence</p>	<p>Learn-Nett</p> <ul style="list-style-type: none"> • encourage the tutors to share about practice • task sharing, analyzing the project, assessing the project, managing different opinions at a distance, support argumentation <p>Did@cTIC</p> <ul style="list-style-type: none"> • to support exchanges in discussion groups (f/f meetings) • to support the communication within the communities of practice during distance work periods <p>Adira</p> <ul style="list-style-type: none"> • to create documents through debates in f/f and at a distance
<p>2. To constitute common resources:</p> <p>To formalize tacit knowledge, to archive common resources and to make them retrievable and reusable</p>	<p>Learn-Nett</p> <ul style="list-style-type: none"> • to reuse students' research papers and other documents for the design of tutors' tools and for the work of the coordination team. <p>Did@cTIC</p> <ul style="list-style-type: none"> • to capitalize discussions and documents shared during f/f meetings about teaching practices • to reuse illustrations of teaching practices
<p>3. To support commitment:</p> <p>To develop the membership, to help members to clarify their own project and see how it can interact with the project of the CoP, etc.</p>	<p>Learn-Nett</p> <ul style="list-style-type: none"> • develop resources to better welcome new partners (the charter)
<p>4. To support realization of the activities:</p> <p>To support organization, follow-up and to have a common environment for all the activities of the CoP</p>	<p>Learn-Nett</p> <ul style="list-style-type: none"> • to propose a way for the coordination team to have a "context aware view" about what happens in collaborative groups in terms of activities of the actors and use of documents • to decide for a new workspace for all the activities • a tool that integrates forum and email messages for tutors.

Concerning the dimension of “engagement” in Daele’s model, we prefer the term “commitment”, which we define in terms of members clarifying their own project, seeing how it can interact with the project of the CoP, being actively involved in the activities of the CoP, and being personally committed to development of the membership. This is clearly linked with the welcoming of new members. It supposes some other conditions like the definition of the project of the community (and the regulation of it), the formalization of the project and the history of the CoP, and having a common knowledge of the participants (their competencies, interests, activities in the CoP, etc.). The need to support commitment is not often expressed by PALETTE CoPs (see need 3 in the table) but constitutes a potential need, which could be important. This potential need is observed in the practices of mature CoPs and could be interesting for new ones.

When we try to match Daele’s model with CoPs needs, it’s difficult to situate the dimension of exploitation of “produced resources” which is most expressed by CoPs. The formalization of the resources produced during the various forms of exchanges is contained in the conditions of learning (see above). So in our categorization of the needs we decided to dedicate one category for the constitution of the “common resources” (formalization, retrieval and reusing). These “common resources” belong to the CoP and can be appropriated by each member to support their own development. They represent the “wealth” of the CoP including its “memory”. It is similar to Wenger’s concept of “shared repertoire” [4].

Finally, a fourth need appears within CoPs: the need to support the realization of the activities. It means the support of the organization, follow-up and management of activities (the work of the coordinator(s), animator(s) or moderator(s)). This need is common across all CoPs. It could concern each of the previous needs. We include here the need expressed by some CoPs to have a common environment for all the activities of the CoP.

We also make the connection between the CoPs’ categories of needs developed and the model of CoPs’ actions proposed by Künzel, Charlier & Daele [2]. This allows us to explicitly relate CoPs’ specific identified needs with possible actions. This can orient the elaboration of actions expressed in the CoP scenarios. This model is anchored in observations of several CoPs in different domains of actions. It depicts five groups of actions in order to highlight questions relating to the CoPs’ development: towards which organization or project does a CoP intent to develop? How to support it throughout its development? The five types of actions are:

- Projects: they are actions oriented towards a specific and well-identified goal, possibly organised in the long term and requiring a high degree of coordination between the members.
- Social: they are actions oriented to promote community cohesion; they can be spontaneous or consist in specific and organized events.
- Sharing actions: they are short term actions, integrated in the day-to-day life of a CoP; they are not necessarily coordinated at a high level and can be more spontaneous than projects.

- **Management:** they are actions oriented towards the organization and the facilitation of the CoP as a whole such as distribution of roles, meetings organization, management of the work process, etc.
- **Metacognition:** these actions are related on CoP's self understanding and self-direction; they can be spontaneous or coordinated; their purpose is to get feedback about the functioning of the CoP and to develop new actions taking into account the feedback.

So we make the connection between the CoPs' categories of needs and their actions in order to illustrate what kind of actions are privileged by CoPs in order to fulfil their needs. This can orient the actions outlined in the CoP scenarios. For example, CoPs organise social actions to support commitment, sharing actions (FAQ) to elicit the constitution of common resources, management actions to support the efficient realisation of CoPs activities and projects to constitute common resources. In the table 2 the categories of needs are matched with the categories of services that could be offered in PALETTE.

Table 2 – Categories of needs and adapted services

Categories of needs	Categories of technological services
1. To support participation	Collaboration and awareness services (CoPe_It and eLogbook)
2. To constitute common resources	KM and information services : Production, Restructuring, Metadata, Retrieval, Reusing, Awareness
3. To support commitment	Collaboration and awareness services
4. To support realization of the activities	Collaboration and awareness services

Each category of technological service represented different services which can interact to meet CoPs needs. We attempt in the section 3 to analyse these interactions between services.

3. Interaction between PALETTE Services

Our analysis of CoPs scenarios has shown that the interaction between services is a commonly expressed need among PALETTE CoPs. Thus, the feasibility, requirements and implementation of the interaction of services need to be examined. This section starts by describing the expressed CoPs' needs requiring services

interaction. Afterwards, the different types of services interaction are classified and then the problems related to each required interaction type are tackled.

3.1. Addressing CoPs Needs through Services Interaction

In order to fully answer the needs of CoPs, PALETTE services need to be able to communicate with each other or to be integrated. As a matter of fact, CoPs have explicitly expressed specific needs requiring interactions between PALETTE Services. In particular, problems linked to resources storage seem recurrent: for example, some CoPs would like to store their documents in one or more repositories and be able to access them transparently from one particular service; or to annotate documents stored e.g. in eLogbook environment, using other services offered by e.g. Amaya or SweetWiki. Another example would consist of calling CoPe_It! functions from eLogbook in order to sustain argumentation for a community of practice using eLogbook environments, at a time where the latter does not offer this feature. Alternatively, CoPe_It! users could benefit from the eLogbook context-Aware View, a rendering service not supported by CoPe_It!, but however important in collaborative environments supporting mediation and argumentation, because it provides seamless embedded awareness information crucial for decision-making. Moreover, more examples can be found in Table 3 which provides a summary of the expressed CoPs needs and specifies for each case, which technical services should interact to satisfy those needs.

Table 3 – Examples of PALETTE services interaction¹

Category of needs	CoPs	Technological services	Examples of Interactions of services
1. To support participation	Learn-Nett Adira	CoPe_it! Services and eLogbook services (mediation services)	CoPe_it! should call eLogbook services.
2.To constitute common resources	Learn-Nett Did@ctic Adira	Document Production: services offered by Amaya, Limsee3, Sweetwiki tools Restructuring service (to produce structured documents from existing ones) Metadata production: eLogbook and, Sweetwiki tagging services. Amaya, Linkwidget, Generis, BayFac annotation services Information Retrieval: Generis, Corese (Linkwidget and Sweetwiki), eLogbook search engines Reusing of structured documents: DocReuse matching service	Documents produced by Amaya should be consumed by DocReuse and restructuring services. Documents tagged within Sweetwiki could be retrieved using Corese

¹ The reader will find the description of all PALETTE services on <http://palette.ercim.org/content/view/13/30/>

		Awareness : eLogbook services	
3.To support commitment	Adira LN	eLogbook	eLogbook services could interact with external services (e.g., calendar)
4.To support realization of the activities (common environment)	Learn-Nett Adira	eLogbook	eLogbook services could interact with external services (e.g., calendar)

3.2. Classification of Services Interaction

From a general point of view, there are different levels of interaction between services:

1. Information Exchange: transmission of data and metadata between two or more services;
2. Integration: direct call to a service function from another service;
3. Composition: strict composition refers to a service, which is built from a composition of other services' functions.

Allowing information exchange between services requires the adoption of a common protocol including a common understanding of the exchanged messages. This is also the case with integration, which requires the calling service to know how to actually call the function it wants to use, being able to input information to the function in the good form; and being able to retrieve and understand returned information so as process and integrate it. Composition requires all that is needed for information exchange and integration, plus orchestration; service orchestration dealing with the composition of services or their functions and the management of the information flow between these services.

The examples listed in the previous section show that until now the CoPs needs require services integration (call of a service's function from another service) and information exchange (data and meta-data access and sharing among services). To start with, we will tackle the issues related to the exchange of information between services supposed to satisfy the expressed CoPs needs to access data and metadata stored in different environments by interfacing one particular environment or some kind of cross service. Then, we will address the questions related to the need for integration.

3.3. Challenges with Information Exchange

PALETTE services are implemented based on different partners' tools. They have their own data and meta-data storages, and specific ways to handle these data and meta-data, using their own vocabulary and data structures. From a pure service composition point of view, we are in a context where independent peers need to

exchange and share information, which is technically related to service choreography [5].

The way data and meta-data will be shared and accessed by services is an important issue that raises several questions. In particular, is a common data repository needed? Do metadata and data need to be replicated in the different storage environments a CoP uses? Should all data and metadata be stored on the web to improve accessibility and sharing? For example, when a user wishes to tag a document initially stored in eLogbook, using Amaya, where should the tags or other metadata be stored? Moreover, if a community member using a particular service, wishes to see the tags and other metadata associated with a document should the annotations done through this particular service only be shown, or should the service automatically send a request to other tools in a transparent way, asking them for metadata related to the document in question? Or should this be done only based on a user's explicit request, to go and search in other tools? The same applies when a user wishes to retrieve documents stored in different places based on specific selection criteria. Should he/she use some kind of cross tool responsible for bringing together documents stored in different locations and relate metadata and awareness information gathered from different places, or should every service be capable of directly addressing other services for such purposes? Last but not least, right and access management issues should also be addressed, as exchange information stored in a specific environment is usually governed by right management policies, which are application or service-dependent. To solve this issue, common policies concerning the access to data and metadata need to be defined.

Some elements of solutions can be given, but agreeing on the best policies will require further and deeper investigations. Concerning data storage and access to data (most often multimedia or textual documents), a possible policy would be to consider that such data is stored in only one place, and any service that needs it works by reference (e.g. for adding metadata), or on a local copy of the data, that is serialized back to the original storage when the service has ended its processing. This however requires handling access rights on data, so as to avoid concurrent modifications; this can possibly be done by a specific orchestration service. Concerning metadata, annotations inside a document are de facto available to any service that can read them. Then, any service that does not annotate inside a document can work by reference, but references between a document and its public metadata needs to be kept somewhere in e.g. a specific awareness technical service, so that any service can have access to any metadata made public by other services.

From these reflections, it appears that as soon as a CoP will use multiple services, additional orchestration and awareness technical services will be needed, whether working in a centralized way or in a peer-to-peer architecture.

The second identified issue concerns the needs in term of interactions between services and the complexity of these interactions.

3.4. Challenges with Services Integration

Looking at the examples with CoPe_it! and eLogBook, we can derive the following generic scenario: “A CoP making intensive use of a given service, ‘A’, offering multiple functions, wants to benefit from additional functions offered by other services and use them in A”.

The integrations considered so far address interoperability very locally, as problems of integration have been often discussed between two tools offered as PALETTE services. A first step to reach a better interoperability level might be to agree on a standard for calling services’ functions and a common syntax to specify input and output information. However, even if this standardizes the external access to services’ functions, the logic necessary to allow actual integration remains on the calling service’s side. In particular, the integration at the user interface level will require specific coding, and semantic alignments between the terms and data structure used by both parties. Reaching a high interoperability level between PALETTE services, to avoid as much as possible specific coding could possibly be solved by securing interoperability at the semantic level. In other words, an adequate solution might be to define a common meta-model or ontology defining the concepts used by all the services, create mappings between this model and the vocabulary used each service, and modifying each service so that it can handle this model. The benefits would be that any service would be able to use any function of any other service, without having to know this latter service and the specific vocabulary it uses. Nevertheless, at this stage, no complete feasibility study of such an approach has yet been undertaken.

3.5. Future considerations

The challenges mentioned above and the issues raised in sections 3.2, 3.3 and 3.4 will pave the way for a deeper examination of the problems related to services interaction, in order to find solutions, which on one hand, are feasible for PALETTE services in terms of implementation and on the other hand, are able to satisfy the previously stated CoPs needs.

4. Conclusions

This contribution will guide a next important phase in our participatory design of integrated technological and learning services to support CoPs learning and development. Grounded on the “Description of six scenarios and of the results of six validated trials” to be produced soon, we will be able to identify generic scenarios fulfilling similar needs of various CoPs with specific uses of integrated services and learning services. The technological challenges highlighted in this contribution will be addressed by the teams of PALETTE developers and mediators reorganised according to this identification of generic scenarios. With this methodological approach we intend to find solutions which on one hand, are feasible for PALETTE services in terms of implementation and on the other hand are able to satisfy CoPs’ needs.

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From ‘Collecting’ to ‘Deciding’: Facilitating the Emergence of Decisions in Argumentative Collaboration

Manolis Tzarakis, Nikos Karousos, Giorgos Gkotsis, Vasilis Kallistros, Spyros Christodoulou, Christos Mettouris, Panagiotis Kyriakou, Dora Nousia

Research Academic Computer Technology Institute,
N. Kazantzaki, University of Patras,
26500 Rion, Greece

{tzagara, karousos, gkotsis, vkallist, shristod, mettouris, kyriakou, nousia}@cti.gr

Abstract. Current tools aiming at supporting argumentative collaboration either provide means to successfully tame wicked problems or offer advanced reasoning mechanisms to support decision making. When CoPs need both kinds of functionalities for addressing issues this gap perplexes the process. We argue that a key factor in enabling the bridging of this gap is viewing argumentative collaboration as an *emergent phenomenon*. Addressing emergent aspects of argumentative collaboration would benefit the respective systems as that would permit them to support the evolution of the entire collaboration. We outline this approach by presenting CoPe_it! a prototype argumentative collaboration system. In CoPe_it!, an incremental formalization approach facilitates the emergence of individual and loosely coupled resources into coherent knowledge structures and finally decisions.

Introduction

Argumentative collaboration can augment learning in formal as well as in informal group settings in many ways such as in explicating and sharing individual representations of the problem, maintaining consistency and focus on the overall process, thus increasing plausibility and accuracy, as well as to enhance the group’s collective knowledge [1][2]. Over the years, a variety of tools supporting argumentative collaboration have appeared; they usually facilitate argumentative discussions among members of a group and range from simple ones such as e-mail, chat and Web based forums to dialogue mapping and argumentative collaboration tools, reaching even into the realm of sophisticated conferencing and formal argumentation systems [3][4][5][6].

Tools that facilitate argumentative discussion are of particular importance to Communities of Practice (CoPs); many CoPs have already integrated them into their processes. CoPs deal heavily with *wicked problems*, i.e. problems which are difficult to express, have no “correct solution” and exhibit a high degree of complexity [7]. A well known approach to address these kinds of problems is through discussing them

among the group members aiming at collecting available alternatives, elaborating them further and finally deciding on the proper solution. Given the many different technologies for assisting the process of discussing and decision making, the selection of the proper one that fulfills a CoP's collaboration needs and successfully matches its processes is in general a critical success factor [8].

However, in many cases, the basic building blocks for decision making, namely ideas and prospective alternative solutions do not exist beforehand and cannot be simply 'collected'. Ideas and prospective solutions usually do not arise spontaneously or instantly with clear conceptual boundaries. They are harvested as they gradually grow out of existing resources that may even at first bear no indication of their potential. This lack of clearly identifiable alternatives and ideas may hinder groups in using sophisticated decision support systems that would fit their purposes well such as [4]. These tools – which can play an active role during argumentative collaborations - require that alternative solutions have been already crystallized and are able to be clearly represented in an unambiguous way within the system.

In general, systems for argumentative collaboration support well either the “taming” of a wicked problem in an attempt to harvest and justify alternatives or they attempt to support actively the decision making process. The consequence of this gap for groups is rather severe: the group has to employ different tools during the same collaboration session, something that introduces problems and technical obstacles that harms ultimately the group's ability to solve problems.

In this paper, we present how CoPe_it! – a Web-based tool to support argumentative collaboration (<http://copeit.cti.gr>) – attempts to bridge the aforementioned gap. In particular, CoPe_it! builds on the assumption that argumentative collaboration environments are environments where *understanding occurs* through the emergence of the collaboration space. This emergence is characterized by small and incremental changes of the available items in the collaboration space that - although local in nature - when accumulated lead to global transformation of the collaboration space into something that is useful for the task at hand. In particular, CoPe_it! attempts to provide the framework to support the emergence of decisions in online collaborations. Within the CoPe_it! approach, the notion of emergence is conceived on two levels: *emergence within a shared collaboration space* where individual items are transformed into prospective solutions and *emergence between shared collaboration spaces* where the collaboration is transformed into a decision. In CoPe_it! these two forms of emergence are considered as related as *emergence between shared collaboration spaces is based on emergence within shared collaboration spaces*. To implement this framework, CoPe_it! introduces the notion of incremental formalization into argumentative collaboration research drawing upon approaches that have been well established in other related areas of research, such as hypertext [9][10] and knowledge management CSCW [11]. The rest of the paper is organized as follows: first we discuss the notion of emergence in argumentative collaboration and review existing systems with respect to their ability to support emergent structures and decision making. We then present the mechanisms provided by CoPe_it! to address the main concerns. The last section concludes the paper and identifies issues for future work.

Emergence in argumentative collaboration.

Ideas do not arise well formed [12]. In many cases of argumentative collaboration, they emerge as the discussion proceeds. This is mainly due to the nature of the related resources and how they are brought in into the collaboration space.

Resources may include explicit claims or questions that capture precisely the problem. Or, resources that constitute entire scientific articles (e.g. papers or books), where only a part of them is in some way relevant to the issue being discussed may be introduced. Alternatively, a set of such resources – as the result of a Web search – may be brought into the ongoing discussion. Even raw fragments of texts – of unrestricted size ranging from a single sentence summarizing an opinion to lengthy essays that reference additional problems and solutions – may appear. Any of the above kinds may be brought in into the discussion at any time. In addition, due to the collaborative nature of the medium, every resource made available is based on the subjective judgment of the user who admitted it into the discussion. This means that resources may at a later point be obsolete or characterized as unimportant by the group. The sheer diversity of the resource types requires from individual members of the group to engage into the process of information triage [9] i.e. sorting the available material, interact with the resources on the space in an attempt to interpret and recast them as well as organize them into larger structures. Some resources may even have to be filtered out or signified as unimportant. While individual interactions are small in nature (with local consequences), they have a global impact on the understanding of the collaboration space as they accumulated over time. This results in transforming individual resources to something that is consequential for the task at hand and is referred to as sense-making [11]. Hence, in argumentative collaboration sense-making does not happen automatically but rather *emerges naturally* as a consequence of the anticipated users interactions and modifications of the items available in the collaborative space. Research in CSCW has already outlined criteria with which collaborative environments can be characterized with respect to their ability to support emergence. These include [13]: (a) arranging and spatial reasoning, (b) implicit structuring and (c) sketching.

As the shared collaboration space emerges towards sense-making, the entire collaboration emerges towards the decision to be made. Hence, a second level of emergence is in action. This form of emergence occurs only if the collaboration activity reached a state where sense-making has been achieved. The recognition of this kind of emergence gives the ability to reconsider the outcomes of the sense-making process in new contexts, such as the formal exploitation of collaboration items patterns, and the deployment of appropriate formal argumentation and reasoning mechanisms.

Background work

All existing approaches supporting argumentative collaboration systems provide the means to support emergence within a collaborative activity. Yet, they differ to what degree they support emergence and in particular whether they succeed in making the emergent knowledge items of the collaboration explicitly within the system (and thus system understandable) or not.

E-mail, chat and Web based forums are representatives of the most basic argumentative collaboration environments as they support only a limited form of emergent structures. In those systems, emergence of sense-making occurs mostly in the head of the user rather than within the system. This form of emergence is characterized as implicit. These systems allow only trivial discourse moves that include uploading of resources and their (implicit) association. Even in cases where explicit relationships between items are possible (e.g. by quoting a post), the semantic of this association is implicit (i.e. understandable only by humans). Nevertheless, Web-based forums may exhibit a slightly higher degree of explicit emergence, as they can deploy visualization techniques; these techniques can to some degree express spatial placement and relationships between posts (e.g. threaded view). Implicit emergence is also exhibited by the majority of formal argumentative systems that attempt to provide advanced functionalities to actively support decision making such as Hermes. (see Fig. 1).

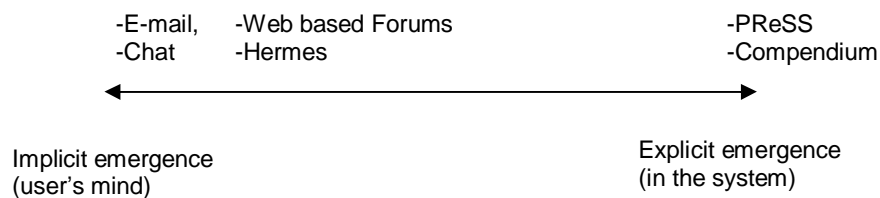


Figure 1: Levels of emergence supported by different argumentative collaboration systems.

On the other hand, systems like Compendium [6] and PReSS [11] facilitate explicit emergence i.e. allow the explicit representation of emergent knowledge structures within the system that can be shared between users. These systems provide a wide range of mechanisms facilitating emergence that include arbitrary relationships between items with their semantics clearly articulated, spatial arrangement of items to express tacit knowledge, changing the types of resources to convey their meaning, and mechanisms to build new abstractions such as specialization and generalization.

When considering the aspect of how well they support decision making another picture can be drawn. In these situations, systems that exhibit a high degree of support for emergence provide very little or no support for decision making. On the contrary, some systems with low degree of supporting emergence exhibit advanced support for decision making (see Figure 2).

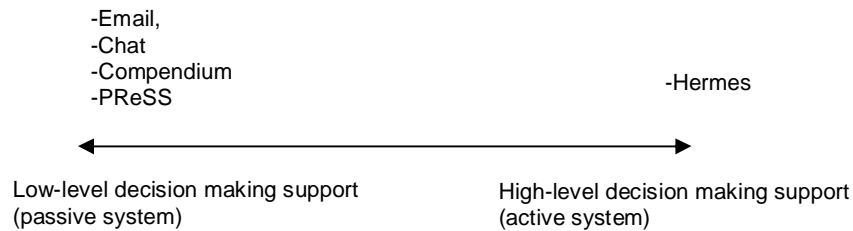


Figure 2: Levels of supporting decision making in different argumentative collaboration systems.

Both pictures above indicate a gap that exists in today's argumentative collaborative environments. Although they acknowledge the need to support emergence of individual resources into structures facilitating sense-making they fail to take the next step and in general neglect to support the emergence of the process towards making the decision. When groups need both functionalities, only burdensome solutions can be provided. In these cases, technology proves to be an obstacle rather than a solution. CoPs, in general, face many times such situations; hence, in this context, bridging this gap will immensely benefit their ability to address problems.

Argumentative Collaboration with CoPe_it!

CoPe_it! is a Web-based tool that facilitates argumentative collaboration emphasizing supporting emergent collaboration and in particular attempts to actively prolong the entire life-cycle of collaboration from gathering to decision. CoPe_it! permits semi-synchronous collaboration among group members. The term semi-synchronous denotes that synchronous as well as asynchronous collaboration is possible; hence, the emphasis of the collaboration is not on time but primarily on the space.

The approach of CoPe_it! builds upon the observation that environments aiming at the emergence of sense-making provide more flexible means to build knowledge structures than environments aiming at decision making. In particular, they exhibit completely different levels of formality. By the term formality, we refer to the rules enforced by the system, to which all user actions must comply. In CoPe_it!, formality is not considered as a predefined and rigid property of the system, but rather as adaptable aspects that can be modified to meet the needs of the tasks at hand. Figure 3 illustrates the different objectives that can be supported by adjusting the level of formality. Decreasing the systems formality facilitates sense-making while increasing the system’s formality facilitates decision making. Allowing formality to vary within the collaboration space, *incremental formalization*, i.e. a stepwise and controlled evolution from a mere collection of individual ideas and resources to the production of highly contextualized and interrelated knowledge artefacts, can be achieved [10]. In general, this emerging into a new collaboration level is associated with a set of functionalities.

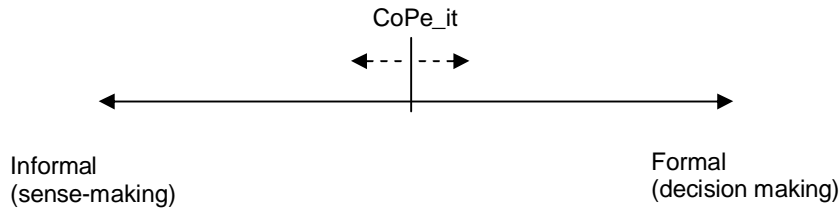


Figure 3: By adjusting the formality of CoPe_it! different intentions of the argumentative collaboration can be supported.

Currently, CoPe_it! supports three stages of evolution of collaboration spaces with more stages planned in future versions. Each stage resembles a *projection* of the collaboration space.

The collection and sharing stage. This is the most informal setting supported by CoPe_it! where it functions simply as a Web-based forum. The emphasis here is simply to express, gather and share knowledge items that the group may possess making others aware of their existence. No advanced structuring is at this point necessary. Structuring of the collaboration space cannot be made explicit, hence no constraints exist on what and how a resource is related to another in the collaboration space. Relationships can only be established by quoting posts or by referencing them in the content of a post.

The synthesis stage. While previous one emphasizes on collecting and initial feedback on the collected items this stage is primarily concerned with providing support for synthesizing existing items and support the emergence towards coherent knowledge structures that can act as building blocks for decision making purposes. The key aspect in this stage is that the emergent structures can be represented explicitly within the system. In this stage, gathering and collecting resources is also possible but do not constitute the main activities. The emphasis is how they relate to other resources and how they can be aggregated into larger structure. At this stage, sense-making means achieving the crystallization of the alternative solutions and explicitly represent them within the system.

The decision stage. This is the most formal setting supported by CoPe_it! as at this stage the alternative solutions of the synthesis stage can be further elaborated with active support of the system. It is at this stage where decision making needs are fully supported. Sense-making here means transforming the resources into a decision.

How an argumentative collaboration emerges in the collection and decision stages has already been documented in previous work [4]. In the next paragraphs we outline the mechanisms with which CoPe_it! supports emergence in the synthesis stage and describe how the entire collaboration space emerges from one stage to another. The later is also referred to as switching projections.

Emergence within the synthesis stage.

Since in this stage emergence of the resources has to be supported in order to achieve synthesis of individual resources into larger structures, such projection of the collaboration space has been build to enable the following:

Spatial interaction with the items on the collaboration space and spatial reasoning. The ability to arrange spatially has already been pointed out as a key factor for emergence [13]. This is in particular important for hatching tacit knowledge that resides latently in a collaboration space.

Arbitrary relationships between resources and the creation of new abstractions. Explicit articulation of relationships between resources facilitates the creation of semantics and the transformation of individual resources into larger knowledge structures. Furthermore, the ability to treat these larger structures as a single entity or even as templates aids the evolution of the collaboration space.

An instance of such a synthesis stage is shown in Figure 4. The figure shows the issue of “alternative teaching modes” being discussed. The argumentation has evolved to a stage where alternatives solutions have started to emerge. Alternatives to the issue at hand are indicated by the rectangles that enclose the structured items that have been jointly authored by the community members. Items that are placed within rectangles –without relationship to other items – imply indicate that they are relevant to the particular alternative.

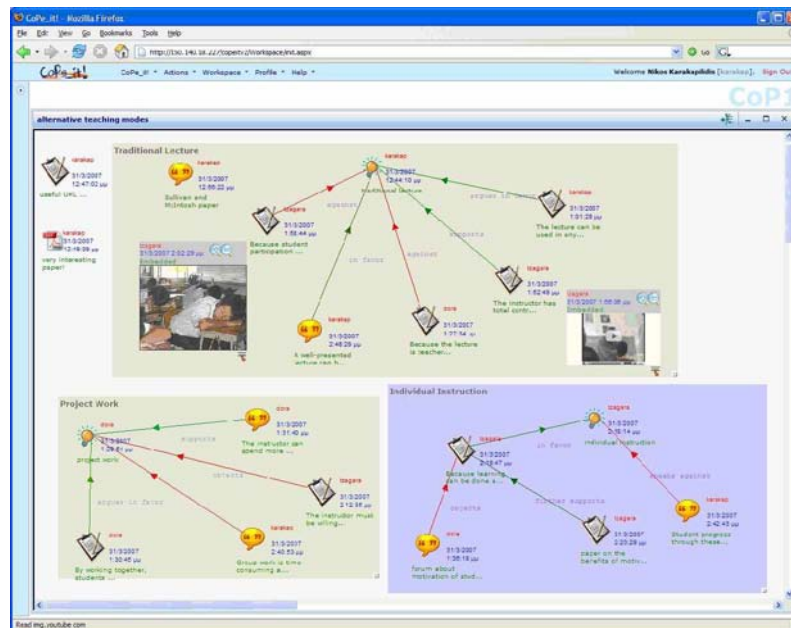


Figure 4: Instance of the collaboration stage at the synthesis stage.

Abstractions

A set of abstractions provided at this stage aids the emergence of the space. These include (a) notes, that are used to represent simple information content, the value of which has not yet been assessed by the community (the content of notes can be anything from text, images or video - a short title acts as the summary of the content), (b) comments that are used to characterize content that comments on an existing resource or comment in the collaboration space and (c) ideas that constitute the main abstraction to explicate individual solutions. Any abstraction can receive arbitrary attribute-value pairs.

Instances of the aforementioned abstractions can not only be spatially arranged but also explicitly associated with relationships. Relationship captions help conveying their semantics to other members. In addition, the visual attribute of every item on the space can be modified. For example, a relationship can be colored red or green to indicate that one resource is standing critically or favorably with respect to another. The thickness of the line representing the relationship may be used to indicate how strong a resource opposes or supports another.

Abstraction mechanisms

CoPe_it! includes means with which resources can be conceived at a higher level of abstraction enabling their transformation into artifacts useful for decision making tasks. These means constitute the main mechanisms with which emergence is supported in the collaboration space as they permit the piecemeal transformation of the available resources. Within CoPe_it! the mechanisms include:

Explicit transformation of resources. Individual resources can be transformed from one type to another without any constraint at any point in time.

Aggregation. Individual resources can be aggregated into larger structures that nevertheless can be treated as single entity and can take part in any structuring activity e.g. relating an aggregated entity with a note or another idea. For example, a set of aggregated resources can be cast into an idea, comment or note. Undoing of an aggregation is also possible. In these situations, the aggregation is dissolved and the constituent 'parts' appear as separate entities on the collaboration space.

Specialization. Specialization permits the creation of finer grained abstractions i.e. more detailed knowledge items out of coarser grained ones. Specialization tasks generate new resources of type 'note' that inherit all attributes and values of the specialized resource. In essence CoPe_it! maintains an explicit relationship of type "is-a" with within the system between these two resources i.e. the system is aware of the type of relationship.

Patterns of knowledge structures: the ability to specify instances of interconnected knowledge items - of any type - as templates. These templates can then be used during the collaboration to create new instances of knowledge items. This allows the definition and use of user-defined abstractions during the collaboration.

Emergence across collaboration stages.

Once the collaboration space has been structured to the point where the semantics of individual items has been assessed and individual alternative solutions have taken shape advancing the entire collaboration to the decision phase is possible. This permits the community to elaborate the generated knowledge structures in new contexts including the formal exploitation of collaboration items patterns, and the deployment of appropriate formal argumentation and reasoning mechanisms. The decision stage of CoPe_it! supports such activities employing an IBIS like formalism [14] and builds on the functionalities of previously developed argumentation system [4]. The emphasis here is not on supporting emergence hence mechanisms such as mentioned in the previous paragraph are not available.

In CoPe_it!, the knowledge structures of the analysis stage are transformed into the IBIS like structures of the decision stage according to transformation rules that capture how the transformation will take place. Transformation rules can take into consideration the type of knowledge items as well as their visual attributes. They can be modified so as to reflect the needs of a particular community. The following table summarizes the current set of transformation rules:

Analysis stage	Decision stage
Collaboration space	Issue
Idea	Alternative
Relationship between comment/note and idea colored red	Position against the alternative
Relationship between comment/note and idea colored green	Position in-favor of the alternative
Thickness of the relationships	Weight of the position

Some resources present in the analysis stage are simply ignored by the transformation mechanism. After completing this procedure the collaboration can continue at the decision stage where advanced functionalities can be provided.

Conclusions

In this paper we have presented how CoPe_it! attempts to address the evolution of argumentative collaboration for decision making in CoPs. When CoPs get engaged in such activities argumentation systems must support both the emergence of the shared collaboration space towards sense-making and the emergence of the entire collaboration towards the decision. Current argumentative systems exhibit with respect to this a gap: they either support well emergence of a space for sense-making or emergence of the collaboration towards decision making. They lack a unifying framework that integrates both aspects. CoPe_it! attempts to bridge this gap by providing a framework that enables incremental formalization of the argumentative collaboration. Future work includes evaluating extensively the proposed framework in environments of real CoPs and investigating additional mechanisms to facilitate the stepwise evolution of argumentation collaboration.

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Using Live Virtual Technologies to Support Communities of Practice: the Impact of Extended Events

Peter J. Scott, Eleftheria Tomadaki and Kevin A. Quick

Knowledge Media Institute, Open University, Milton Keynes, UK
{Peter.Scott, E.Tomadaki, K.A.Quick}@open.ac.uk

Abstract. Physically dispersed Technology-Enhanced Learning (TEL) communities often require support for collaboration over extended periods of time, in what are effectively very long meetings. While there are a wide range of support systems for foreground interactions, such as phone calls and short meetings, and a similar range of tools for 'background' interactions, such as email and instant messaging. This paper presents data from a virtual ethnographic study of a working TEL community using the FlashMeeting videoconferencing application and the Hexagon ambient video awareness system, over month of active at-a-distance project planning. The study is a naturalistic insight into the use of online synchronous communication to support extended synchronous interaction between a working community of practice. Over an extended working period it seems that a complex mix of planned and opportunistic interactions require a new set of working tools, managing the trade-off between awareness and disruption. Switching between foreground and background 'meeting activity' remains a very big challenge.

Keywords: TEL communities of practice, extended meeting, ambient video awareness, videoconferencing, foreground channel, backchannel, synchronous communication

1 Introduction

A wide variety of live communication tools are used by Technology-Enhanced Learning (TEL) communities of practice in order to meet and work virtually. These technologies generally provide a whole range of features, such as presence, availability and awareness, instant messaging, videoconferencing, ambient video awareness, collaborative tagging, social networking etc. Presence is an indispensable social software function, stimulating group awareness [1], [2] and the building of collective knowledge in online communities. Presence has evolved from just being 'online' or 'offline' to a range of preferences such as availability or geolocation. In instant messaging systems, a set of presence attributes may include time, context, availability, location, activity, state of mind and identity. Presence is currently plotted to geographical maps with tools, such as TwitterVision or Google maps, representing the individuals' presence with icons on maps. Geo-location can also be integrated in virtual learning environments and indicate presence and availability of contacts according to the courses a user may be enrolled on (<http://labspace.open.ac.uk/>).

Along with presence, a great variety of tools supporting group interaction and location based social software applications make use of presence data for a wide variety of purposes, e.g. providing awareness of friends being in the vicinity or providing awareness of who is visiting online community sites, or recommending users with similar interests etc. Other social software features may involve activity awareness, indicating individual users' thoughts to a community, such as in Twitter, describing a current activity, a goal, or an achievement etc. Video presence is another feature increasingly found in desktop applications and can be integrated in ambient awareness tools, forming collaborative media spaces, or used in videoconferencing applications. It can be argued that collaborative spaces can be considered as a collective product and can be transformed through the use of technology [3].

Interestingly, TEL communities of practice are usually supported by a range of tools providing ambient awareness for community building, instant messaging for quick opportunistic interactions and videoconferencing for pre-arranged meetings of an hour or so. However, these communities are often required to meet for days, in 'hot' collaborative phases. TEL community members can be engaged in 'extended' events, which can last many hours / days or even weeks or so and can include users 'dropping in' and 'out' of the workflow at many points. Most users may be involved in short, opportunistic interactions via text or video chat with other community members and may run applications on the background for community awareness for the rest of the time. A few other users may drop in the event for a short while to communicate with a specific person and then get back to their work. Extended events have an end when there was a communicative goal which was achieved.

There is still little research into tools supporting extended communicative events. A set of challenging research questions derives from the choice of systems for online video communication, focusing on how different tools support interaction patterns in different communities and how we select the appropriate tools to communicate. What are the parameters influencing the selection of the suitable application for extended meetings? Or, is the selection random, or opportunistic? It seems that we use different tools, depending on the person, context and nature of interaction. This paper discusses results from virtual ethnographic studies of two live online tools, FlashMeeting for videoconferencing and Hexagon, initially designed for ambient video awareness, but evidently used successfully in a variety of contexts for extended meetings. In the extended meeting use, the FlashMeeting and Hexagon participants all share the same project goals for a number of days, with a very specific outcome beyond any 'ambient' usage. We provide insights into the tools usage in one extended event and report on qualitative user feedback from questionnaires and interviews. The choice of the tool for extended meetings depends on a range of factors, such as event temporal duration, purpose and interaction patterns.

2 Synchronous Tools to Support Extended Events

A variety of synchronous and asynchronous tools may support online communities of practice. Email is currently the most popular computer-mediated communication form, running on the background, addressed to one or multiple receivers. Forums are

another form of asynchronous communication intended for virtual communities. Synchronous communication involves the exchange of text chat messages, which can be done in parallel with other tasks [8], and ambient shared spaces, running in the background. Telephone and live videoconferencing are synchronous and considered as foreground communication channels (for a summary account of such online communication tools, see [12]). All these tools can be used to support different kinds of concrete communicative events. However, none of these tools has been created with the view to support extended events. Communities of practice not only have formal meetings, but also work ambiently, or via a combination of both. At the moment, not many applications can provide both formal and informal communication in virtual communities or assist in the switching between them. In this paper, we discuss the use of videoconferencing and ambient video awareness over a detailed period of time by one TEL community.

2.1 Video Meeting

Videoconferencing has been introduced with the first videophone by AT&T in the 60's and is now a well-established video-enhanced technology [4], with distinct echo-friendly benefits across various organisations, also saving traveling time and cost. Videoconferencing attendees usually participate in '*limited*' events of a specific duration, with pre-agreed start and end times and a precise communicative goal, e.g. a teachers' meeting on students' progress reports.

FlashMeeting (<http://flashmeeting.open.ac.uk/>) has been developed since June 2003 as a one-click web video conferencing tool by the UK Open University. FlashMeeting runs with the Adobe Flash player on the web-browser, requiring no additional software installation. A FlashMeeting can last up to six hours and can include up to 25 attendees. The system generates a URL which can be clicked to gain access to the videoconference. The application provides a 'push-to-talk' audio system, allowing only one person to broadcast at any one time, while those who wish to talk, raise a symbolic hand and queue, waiting for their turn to come, or, alternatively, they can break in to a broadcast by using the 'interrupt' button. FlashMeeting events can be recorded and syndicated. The FlashMeeting system is currently used by over 40 EU projects, several international school networks, and student and tutor communities worldwide. It initially aimed at producing a useful 'in house' communication and research tool but rapidly increased in usage throughout the world. Over 5,000 discrete events have been recorded in three years of experimental research.

2.2 Ambient Video Awareness

Ambient video awareness is a concept introduced in the 70's with NYNEX Portholes [10], supporting group awareness in distributed workers [5], but there has been no major deployments of the technology that appear to have survived long-term [11]. Issues of privacy, surveillance, reciprocity and gaze have been reported in previous literature as inhibiting factors regarding the use of the technology [10], while image filtering techniques have been previously used to alleviate privacy concerns [6].

Group awareness and availability checking is considered to be the major benefit in ambient video technologies [1], [2].

Hexagon is a simple applet running in a web page with the Adobe FlashTM browser plug-in, requiring no additional software installation. Hexagon users share live, personal webcam images, updated every 20 seconds on a grid of hexagons. Communication channels include group and private text chat and 'push-to-talk' audio. When two members are exchanging text messages, an animated envelope flies between the text chatting members. Hexagon provides a 'room-based' view of connected users. A webcam image appears as a hexagon, which can be moved around on the grid, and can be zoomed in and out. Users without a camera appear as a grey hexagon, while availability can also be expressed with individual status indicators. A range of communities have used the Hexagon technology at work or in learning and collaborative contexts for over three years. Workers situated in the same location use ambient cues to interact more effectively, e.g. to check their colleagues' availability. Students can interact with other students or tutors using the video for opportunistic learning interactions. The system was offered to various multinational enterprises, European research projects, UK-based organisations and educational institutes. The Hexagon server has hosted over 20 rooms since its launch. Most groups only meet in the context of specific events, with concrete communicative goals, after their initial trials. The tool is used on a daily basis by at least two of these communities for daily video presence and social networking and to enhance the sense of community for workers from remote locations, who interact with co-workers. The other communities may present some minor activity, such as summer school events and collaborative document authoring.

2.3 The Study

This study involves quantitative data logged on the Hexagon and FlashMeeting servers, indicating the number and duration of user connections during one extended event. A questionnaire was circulated in September 2006 and completed by 20 members of the Prolearn community, which is a network focused on innovative aspects of technology enhanced professional learning, with researchers from different European institutes, who have used Hexagon for at least 5 times and FlashMeeting many more. This questionnaire was supported by a set of 9 interviews. The interview data is used here to provide insights into issues regarding communication patterns and tools used in extended events. All respondents indicated that they used a rich mix of tools and technologies in support of their work and community engagement, such as email for asynchronous communication and file exchange, telephone for informal conversations, FlashMeeting for formal meetings and Hexagon for ambient awareness. For the purposes of this analysis, we will focus on the use of just these two tools as representing a primarily foreground communication channel and background channel respectively.

2.4 Anatomy of a Sample Extended Event

Members of the Prolearn community have formed sub-communities of (relatively) short duration for specific events. Here we consider one ‘natural’ extended event of such a sub-community in some detail. The event included 10 main participants from different European countries and lasted nearly a month with main goal the writing of a proposal for a European research funding. The extended event started with a series of emails and an opening formal meeting held via FlashMeeting on 25th February 2005 with 10 videoconferencing attendees users and ended on the 23rd March with 2 simultaneous user connections in the Prolearn Hexagon room.

This sub-community of members arranged a series of 6 FlashMeeting events (Fig. 1) with an overall duration of 550 minutes (over 9 hours), while the mean average time of these events is nearly 1.5 hours. The first event was conducted at the start of this extended period 14:30 GMT on the 16th at which the use of the Hexagon system for a longer-period interaction was discussed. The first 3 FlashMeetings lasted more than 2 hours (the longest one was 179 minutes), as the participants had, at that point, many issues to resolve, such as delivery of tasks. The fourth of these events was the shortest FlashMeeting of 13-minute duration and included 3 participants. While all other events were called ‘meetings’, the shortest one was called ‘instantFM’, denoting its limited duration and informal context. The small number of participants indicates that a subgroup selected to communicate via multi-party videoconference, which is faster than typing group text messages and not feasible in Hexagon, which can host only pairs of users for audio conferencing. The final formal meeting was held on Friday, 18th March, and lasted only 38 minutes, possibly because most issues were resolved by that time. The first and last events included the same 10 attendees, who were actually the main 10 participants involved in the extended event.

Although the use of FlashMeeting, and consequently the formal events stopped on the 18th March, users continued to communicate via Hexagon as the workflow required the ‘bid document’ to be finally ‘tweaked’ and finalised. Fig. 2 shows the maximum number of connected Hexagon users in this scenario from 14th-27th March 2005.

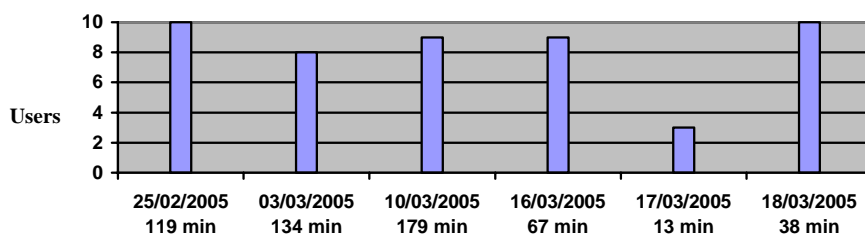


Fig. 1. Videoconferencing formal meetings arranged during the course of the extended event

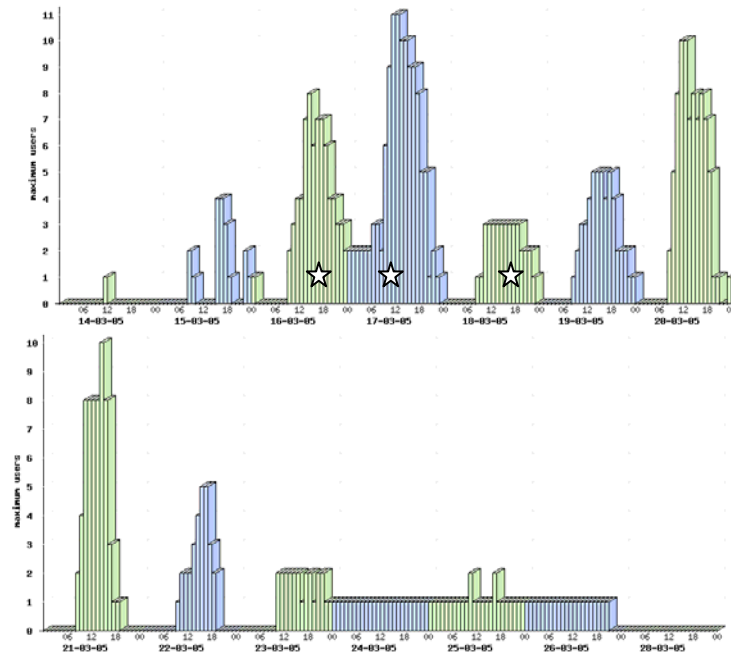


Fig. 2. Hexagon connected users (peak) during sample (14th-27th March 2005 shown)

As shown in the figure, the 8-day working period from 16th-23rd March 2005, was effectively a single extended event for this community which peaked on 17th March with 11 simultaneous working connections. The event was initiated with an uninterrupted 40-hour room activity starting on Wednesday (16th March) of that week. On the first 3 days of Hexagon use, 3 foreground FlashMeetings took place, one informal amongst 3 individuals and the other two including the main participants (the “stars” in Fig. 3 represent the FlashMeetings running in parallel with the Hexagon usage). It should be noted that the times in the figure are listed as the server time (GMT), while participants situated in different parts of Europe were in GMT +1 or +2.

Hexagon has been used for extended meetings in multiple contexts at the same or different physical location. The community interrogated for this study used the system for a variety of working awareness reasons: displaying activity in sending text messages, and a few audio chats. The tool has been proved especially useful for building working communities in intensive phases of writing proposals with partners situated in different countries, offering alternative ways of communication and enhancing the sense of community.

“... people were sitting all over Europe, were logged into Hexagon and were working intensively with each other ... it was very convenient to be in a Hexagon room and checking who’s sitting in front of his desk

and sort of ask him a question without needing to phone somebody up or sending him an e-mail” (MH, female)

After this intensive 2-day (40 hours long) engagement - the next day (Friday) represented some minor activity with people dropping in and out and a maximum number of 3 users connected at the same time. Interestingly, during the next two days - Saturday and Sunday, from 8.00-24.00, many more users connected to the room, reaching 10 simultaneous users on Sunday, indicating intensive weekend activity for this extended event. On Monday and Tuesday the room was ‘empty’ after 18.00. The last day of the proposal work, 5 different users entered the room, with a maximum of 2 users connected simultaneously. Approximately 100 hours of overall room activity has been recorded during that period, including at least one connection. During that week, 12 different individuals were entering the room at different times, while 2 of them were in the room for a limited time and for a specific purpose, e.g. to help with part of the proposal or to provide technical facilitation.

In Fig. 3, a Hexagon room screenshot during this period, shows 8 participants at work in this community, communicating synchronously via private or group text chat, and audio chat, whilst participating in the concerted writing of the project proposal. The communication channels provided in Hexagon are used in different ways. While the video channel, which is continuously open, is used for group awareness, a piece of information relating to the overall proposal can be communicated via group chat, visible by everyone, and pairs of two can collaborate via audio chat. The Hexagon view displays two audio chats taking place at this time, one including users labeled Bernd and Ambjörn and the other one labeled Marc and Peter (with Marc’s hexagon highlighted, indicating that he is speaking using audio at that moment).



Fig. 3. A (Hexagon) grid of (8 participants)

The chat area shows 7 group messages related to participants' tasks for the proposal writing. Hexagon was used in a rich mix, which certainly included other technologies such as email and telephone interaction, and one interesting aspect of the 'extended event' awareness was to help coordinate these other channels most effectively over this time. The work undertaken is seen by all respondents as very valuable, and a positive experience.

"We used it to write collaboratively a proposal, we discussed the documents we were working on, told each other when to expect the new versions of the portfolios, which meant that we didn't have to send things around, as much as we would have to do with e-mail" (AN, male)

While some participants are involved in one-to-one chats, others just used Hexagon as background awareness, not exchanging messages, but still able to read others' messages and have a view of their working community. In this way, the community was able to handle the intensive workflow of the proposal writing and discussion around it in an effective public forum, and manage their other work in the context of this community effort.

"... it helped just to know who was there in these final days of working hard to get it finished on time, it was really helpful to see who was there, say how is it going, do you need any help, are you OK with what's in this document etc. ... when it comes to the final stage when time is getting short and we have to interact in a very short time basis and synchronously sometimes, then it is really valuable" (AN, male)

3 Discussion

Live synchronous tools have proved useful to enhance the sense of community in working groups of short life for extended events. Videoconferencing is a foreground communication channel and has been mainly used for formal meetings of more than an hour including 8-10 participants. The ambient video environment can be used in the foreground for communication, via video and audio, but usually runs ambiently in the background. It was mostly used for short informal one-to-one audio interactions or group messages and to enhance community awareness in phases of intensive group activity. While video meetings were considered more formal in the extended event, participants selected the ambient environment for informal interactions, which allowed at the same time to be concentrated at their work and be able to communicate with peers for a short while, to ask or answer to questions related to work.

However, background interactions can dynamically change the workflow when they become foreground and disrupt the user's attention. The selection of a communication tool relates also to the privacy concerns arising from its usage, such as being in control of what is being transmitted and minimise interruptions triggered by the 'main-channel' interactions. As there is a trade off between awareness and

privacy, and between awareness and disturbance [7], managing disruption in the 'backchannels' is quite challenging [9].

For me it is too intrusive, that's why I stopped using it after the starting try out, I don't really like to be captured on video without me being in control of what is being transmitted or not. (MW, male)
... that has to do with somebody's vision of how people are supposed to work. I have often the impression that as soon as you see someone looking not really busy, sitting at their desk, it looks like they're not working actually, so that might be one of the reasons why people would not feel comfortable if they are permanently on camera. (MH, female)

It seems that users have different privacy issues when it comes to video enhanced communication tools. These may relate to the temporal length of the event and to the communicative goal, expected to be achieved by the event. Events with an end and start and with a specific topic to be discussed, are less likely to make participants think for self presentation issues, as they are engaged in the social event.

If you use hexagon, you need a specific topic and a specific sort of time frame where you work intensively with each other... If you don't have anything specific to discuss, then you would rather send an e-mail or you would sort of use the phone (MH, female)

The interviewees' feedback indicates that an ambient video awareness environment, providing instant messaging and audio chatting, works well for extended meetings with a specific purpose and temporal duration, and when the communicative model is made obvious to the users beforehand.

We really told them Tuesday evening at 8 you will be online with this tool, with this passport and we will chat synchronously about this and this topic. This worked because they had a clear goal. (MC, male)

Sub-communities may originate from wider TEL communities of practice, requiring tools to support the diversity of virtual events they may hold, be it short or extended meetings, opportunistic textual interactions or data exchange. The selection of tools may depend on parameters such as the event temporal duration, and the communicative goals expected to be fulfilled during its course. During an extended event, a range of trade-offs may take place, including formal and informal, explicit or ambient interactions in no specific order. There is a lack in appropriate tools to support such unusual patterns, avoiding at the same time the disruption of the workflow, by leveraging the use of foreground and background channels.

Finally, this study clearly indicates a need for a better model of how to effectively combine communication channels, such as multi-party videoconferencing, video presence, instant messaging and audio chat may form the appropriate collaborative virtual space for community members, managing the challenging switch between background and foreground communication.

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PALETTE Workshop

LORNET Conference, 4 November 07

Bernadette Charlier, Université de Fribourg

France Henri, Télug, Montréal

Bastien Vaucher, EPFL, Lausanne

This workshop presents part of the research and development conducted by the European project PALETTE (Pedagogically sustained Adaptive Learning Through the exploitation of Tacit and Explicit knowledge). Using a simulation strategy, it offers the opportunity to get familiar with the custom made participatory design approach adopted by the project. Participants are invited to take part in a two steps experiment. Firstly, an appropriation session allows confronting the services in use with the anticipated use of the developers. Secondly, participants interacting with project researchers and developers determine improvements for better services to support the activity of a community of practice.

Planning

Introduction of the Workshop 30 min

Short presentation of the PALETTE project objectives 10 min

Short presentation of the PALETTE methodology 20 min

Presentation of Did@cTIC scenario 20 min

Simulation session 60 min

Topic: First meeting of a CoP of developers and researchers seeking to apply PDM

Steps of the scenario

1. Presentation of the participants and animators 10 min
2. Expression and sharing of practice
 - a. Description of events and use of the Amaya template to take notes 20 min
 - b. Choice of significant events: list of selected events
3. Seeking practice renewal 30 min
 - a. Description of practice
 - b. Analysis of practice
 - Analysis of relevant theoretical models, practice descriptions and other documents on practice. Use of DOCREUSE to exploit existing resources with another template

A script takes note of the questions during the simulation to be used during the discussion

Break 20 min

Discussion - analysis of the simulation 40 min

What does it mean to reify and reuse practices?

What does practice means?

Which are the possible solutions?

What are their drawbacks?

Questions about the technological solutions.

Synthesis and conclusions 10 min