What Went Wrong with Technology Enhanced Learning

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CELEBRATE's Lessons

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Abstract. The CELEBRATEproject developed and successfully demonstrated a federated learning object brokerage system architecture and made available to schools over 1350 learning objects produced by both public and private sector content developers. Despite its encouraging results in terms of acceptance by the participating teachers and pupils, some of the assumptions the technical infrastructure was originally designed upon proved to be problematic, which hampered broader adoption of the proposed solution.

1 Introduction

CELEBRATE was a strategic, large-scale (_7M Information Society Technologies – IST) demonstration project that ran from June 2002 to November 2004. It developed and successfully demonstrated a federated learning object brokerage system architecture and made available to over 319 schools in six countries approximately 1350 learning objects produced by both public and private sector content developers.

Thanks to this infrastructure, the project permitted us to demonstrate that:

- Teachers are enthusiastic about Learning Objects (LOs);
- Emerging standards (for interoperability) make it easier for schools to exchange and reuse LOs;
- Given simple, user-friendly authoring tools, teachers who are experienced with information and communication technology (ICT) are capable of developing high-quality learning resources;
- Several Ministries of Education are interested in supporting national teams of teacherdevelopers and finding new mechanisms in order to quickly develop a critical mass of "open content" and are particularly interested in exchanging resources via a new educational content web portal.

Despite these encouraging results, some assumptions that the project was originally built upon proved to be problematic (and in retrospect somewhat naive). They hampered broader adoption of the developed infrastructure. This paper reviews these assumptions and attempts to explain what went wrong. A brief overview of the interoperability aspects of the project is provided in Section 2. The technical infrastructure of CELEBRATE is discussed in Section 3.
The approach used to build semantic interoperability is discussed in Section 4. Finally, digital rights management is discussed in Section 5.

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2 An Overview of CELEBRATE

CELEBRATE aimed at providing an easy way for teachers and pupils to get access to learning resources scattered between different e-learning systems: online educational portals, learning (content) management systems, and learning object repositories[1].

The access to resources consisted of four steps:

(1) Search the pool of existing resources;
(2) Assess their usefulness on the basis of search results;
(3) Obtain relevant resources and (re)use them transparently regardless of the technical complexity associated with the resources and the technical platforms involved, and
(4) Do all this in a way that respects the intellectual property associated with the resources involved.

This scenario was made possible by federating the participating e-learning systems around a brokerage system. This approach had the advantage of being more flexible than more centralized architectures and less complex than peer-to-peer solutions, the two architectures on which already existing networks of learning object repositories were based at that time [VAM04]. It provided a good balance between trust and autonomy. It was decentralized enough to allow content providers to manage their collections autonomously and was secure enough to ensure the trust necessary when dealing with content for sensitive groups like pupils.

The CELEBRATE brokerage system was responsible for:

- Carrying and routing messages exchanged by the federation members (technical interoperability);
- Enforcing semantic interoperability; and
- Digitally managing rights.

3 Technical Interoperability: All Or Nothing ?

Although most e-learning systems (or systems) are connected to the Internet, they can be seen as isolated islands of knowledge. Their content is ignored by search engines, which are generally not able to get access to, and to index, the resources hidden in the system repositories. One of the first problems to be solved by CELEBRATE was to break the isolation of the participating systems by putting in place an infrastructure that makes their content accessible (i.e., discoverable and exchangeable).

As already mentioned, the central part of this infrastructure was a brokerage system (or broker), with which registered systems opened sessions in order to exchange messages. In this infrastructure, no direct exchange between systems was allowed, except those explicitly authorized by the broker. Systems authenticated transactions and messages via synchronous calls to webservices. Messages such as the

[1] In addition, one of the project objectives consisted of understanding, from a pedagogical standpoint, how these new types of standards-based learning resources commonly referred to as "learning objects" are used and re-used in classrooms and what is their pedagogical impact.

queries used during a federated search were Java Messaging Service (JMS) asynchronous text messages.

E-learning systems avoided the hassle of implementing such a complicated communication scheme by using a special software library (or brokerage client) that hid the complexity of the system-broker communication behind a simplified application program interface (API). This technique led to a first communication protocol that let systems focus on the content of messages (e.g., query, result set) without having to worry about the lower-level details of message exchanges.

Despite the relative simplicity of the low-level protocol necessary to use its communication infrastructure, CELEBRATE was victim of its ambition to offer a complete solution for the discovery and exchange of learning resources. All together, a dozen messages based on approximately the same number of XML schemas were necessary to carry out activities such as federated searching [ML04], semantic interoperability [MVA03], learning resources exchange [VAM04] and digital rights management (DRM) [CS03, SC04]. For an e-learning system that wanted to join the federation, it was necessary to support all of them, even when only a subset of them was actually useful to the system under consideration. For example, the DRM protocols are not needed for systems that provide only free resources. As a consequence, it was quite a complex task to connect to the federation. The only result of this all-or-nothing integration policy (that wanted to force systems to "do things well") was to discourage people. As a consequence no one joined the federation after the project.

4 Semantic Interoperability: Is It Affordable ?

Even when they are publicly available online, the dynamic and multimedia nature of most learning resources makes them unlocatable using text-based search engines such as Google which, in addition, return results that are difficult to assess by teachers and pupils. This problem is usually solved by creating metadata to "adequately" describe learning resources.

In CELEBRATE, "adequately" meant adapted to the context of primary and secondary schools in Europe. The problem was three-fold:

- Primary and secondary schools have specificities in terms of organization, pedagogy, and curriculum.
- Although commonalities exist, these specificities vary from one European country (or region) to another.
- In Europe, multilingualism is the rule, not the exception.

These issues were addressed by profiling the IEEE 1484.12.1 Learning Object Metadata Standard (IEEE LOM) [IEE02] as follows:

- Mandatory, recommended, and optional elements of the IEEE LOM standard data model were defined. For example, "Age Range", which was considered as the best way to refer to the audience of a resource regardless of the school system under consideration, was made mandatory.

• New elements were added (such as element 6.4 "CELEBRATE Digital Rights" that permitted the expression of rights associated with a learning resource in a machinereadable form).
• New controlled vocabularies were created, including for "Learning Resource Type".

Each new vocabulary was designed to take into account the specificities of primary and secondary education in Europe. In addition, each vocabulary was translated in different European languages including a neutral form that was used as an interlanguage during the search and exchange of resource descriptions.

Following the CELEBRATE approach, the conformance of the metadata used in the federation to this CELEBRATE metadata application profile [NVA03] was enforced by the brokerage system.

This worked reasonably well. Thanks to the CELEBRATE application profile, a teacher belonging to a school system was able to retrieve a resource created and described in another language (and in the context of another school system).

This being said, the a priori description of resources according to the application profile also has drawbacks. It requires specialized indexers. Its cost in time and money is proportional to the number of resources to describe, which makes expensive the indexing of large collections of resources. In addition, it potentially restricts the use of the resource. For example, the CELEBRATE evaluation demonstrated that a resource described by a publisher as a "drill and practice" learning object could actually be used in more innovative ways (e.g., for collaborative learning) by an experienced teacher, thereby rendering the "Learning Resource Type" description as somewhat inaccurate.

Moreover, as time went by, requirements evolved and it became necessary to adapt the application profile. Although the adaptation itself is a tedious process (it is necessary to collect requirements, build consensus, ensure backward compatibility, translate), the main difficulty of the task consists of finding an affordable way to convert existing metadata to the new application profile.

5 Digital Rights Management: What For ?

Content is a key factor to attract users in a federation such as the one developed by CELEBRATE. The project targeted commercial content providers and, at their request, put in place a technical infrastructure necessary to digitallymanage the rights associated with the learning resources exchanged through the federation.

The digital rights management (DRM) mechanism [SC04] was based on a subset of the Open Digital Rights Language (ODRL) [Ian02]. It permitted description of the rights associated with each resource and storing of these descriptions in the learning resource metadata.

The rights document included in the resource metadata corresponded to an offer. Once a resource requester had the offer, the next step was to initiate a negotiation with the provider and to instantiate an agreement that binds both parties; the requester and the provider. An agreement is dynamic by nature. For instance, a permission may

be granted for a specific number of accesses to the resource, which requires a proper accounting of the resource use.

It was the responsibility of the brokerage system to store and enforce the agreement. Each time a resource was requested, the brokerage system checked that a valid agreement existed and that all preconditions and constraints were met before authorizing the use of the resource by returning a handle to it.

One of the lessons learned in CELEBRATE was that commercial content providers were not ready and/or did not yet have a business model for providing content through a federation. They were unable to define the rights they wanted to associate with their resources although the technical infrastructure to support these rights was in place.

CELEBRATE was a demonstration project; within the available budget, there was only the ambition to develop a critical mass of content in a limited number of curriculum subjects to have a credible validation of the approach with schools. At the end of the project, commercial content providers, although interested in a new channel of distribution (they supplied hundreds of learning objects), did not yet have clear business models to deliver content through the infrastructure. On the other hand, potential users, although interested in the CELEBRATE resources, found the number of available learning objects too limited. This led to a chicken and egg situation: not enough users to draw content providers' attention and not enough content to keep users.

6 Discussion

As a demonstration project, CELEBRATE was a success that proved the usefulness of exchanging and reusing learning resources. This being said, it also showed that proposing a theoretically sound interoperability solution is not sufficient to have this solution adopted.

In our opinion, it should be possible to overcome this limitation by:

- Limiting the role of the brokerage system to carrying and routing messages exchanged by the federation members rather than trying to enforce semantic interoperability. Semantic interoperability will become the responsibility of the federation members that will rely on the brokerage clients to support the negotiation of common metadata formats.
- Making the proposed solution more scalable by breaking the functionalities of the brokerage system into independent services (e.g., resource discovery, resource exchange, semantic interoperability, digital rights management) that can be used separately and combined with any (group) of the others. When connecting a new system to the federation, it should be possible to start with a limited number of services in order to make the integration effort proportional to the number of services being integrated.
- Initially focusing on linking repositories that have large collections of open content in order to obviate some of the more problematic DRM issues and to quickly make available the criticalmass of quality content necessary tomake the federation attractive.

- Trying to improve the quality and quantity of metadata and to lower their costs with new approaches to automatic metadata generation.
- Experimenting with new approaches to social tagging involving teachers as a way to improve the accuracy of the descriptions of "Learning Resource Type" and to help decrease the costs of volume metadata creation.

Since October 2005, these new approaches are partly applied in the context of a European project called CALIBRATE that aims to support the collaborative use and exchange of learning resources in schools. A more detailed description of the technical aspects of these approaches can be found in [CM06]. In addition, it is planned to evaluate automatic metadata generation and social tagging techniques during another European project named MELT that will start in October 2006.

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A Technology Enhanced Learning Case from Birth to Deployment: Critical Analysis of the ALaRI Intranet Platform (Case Study)

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Abstract. This paper aims at illustrating the necessities that led to the decision of building a technological learning platform for the ALaRI (Advanced Learning and Research Institute) academic institute, at University of Lugano (Università della Svizzera italiana), Switzerland. Following that, the paper will analyse the development of this platform, the difficulties met, the unforeseen events, the requested changes and modifications, pointing out the achieved successes, as well as the errors and failures occurred. The goal is that of learning also from the wrong experiences and not only from the best practice cases. In particular, what this article would like to put in evidence is how technology and communication are strongly joined and how only the good performance of both can contribute to provide the users of the platform with a really efficient and effective artefact enhancing the remote learning interactions.

From this perspective, I will investigate how failures that are apparently of technical nature may actually stem from lack of communication, or misunderstanding and incomprehension, among the persons responsible of the development of the platform (the principal stakeholders/the decision maker, and the developers team), and also between them and the final users. The following loop stands out how the phases of design, development and use involve different actors, often with different backgrounds as well as different cultures, who should be able to collaborate together to realize an efficient and effective elearning platform.

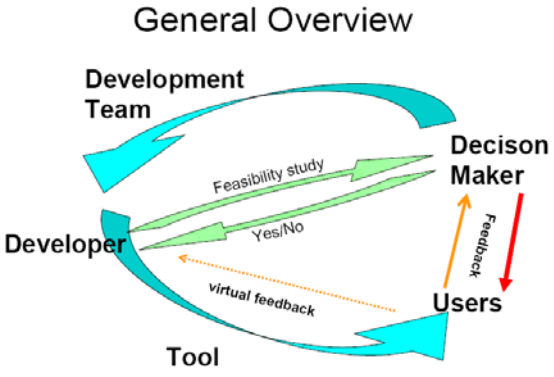

Fig. 1 General Overview

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Figure 1, starting from the decision maker, shows the communication flows and the working groups taking place at ALaRI environment. Basically, it represents two principal loops: the first one describes a technical and locked loop, where the technical aspects of the intranet platform are defined and developed by the decision maker and the development team, taking into consideration the ALaRI actors' requirements, their activities, and the specifications of the system. The second loop is wider, in the sense that decision maker, and also the developers, should consider the impact of the intranet release on the final users. This means to verify how the platform is really used, observing how the ALaRI actors interact with the intranet and moreover through it among themselves, and asking them explicitly through usability tests (task scenarios, interviews, and questionnaires) to get a feedback. The feedback from the final users should be of interest not only to the decision maker, but also to the developers in charge of the implementation of the platform. Then, further modifications and implementations should take into account what it went wrong and why final users are not satisfied.

Sometimes it is the communication flow in place (or its lack) inside each one of the two loops and between the two loops themselves that has generated incomprehension affecting the optimal realization of the platform.

According to this scheme (*figure 1*), it becomes necessary to learn to negotiate in order to reach a common agreement and arrive to a co-shared result, where it is clear that the final goal is the benefit of the entire ALaRI community and not only the personal or particular interest of one or a limited group.

In the following paragraphs I will illustrate the **ALaRI challenging approach**, and how the ALaRI platform would enhance the remote learning, together with a brief description of the ALaRI institute, its mission, its environment, the principal actors and their roles. Then, there will be an **analysis of the occurred risks about the ALaRI intranet** development and its use. Further **what did not work and why** will be explained, providing also **some general aspects from the occurred problems** in this specific case. Some considerations about **what it is possible to learn** from this experience **and how it is possible to benefit** from the occurred failures will follow. The successive object will be **instead what did work and the achieved successes**. Finally a set of **overall recommendations that can apply to other situations** to achieve satisfactory results will complete the analysis. The **conclusions** will close my reflections.

The ALaRI challenging approach

The ALaRI institute is active from 1999 at the University of Lugano, Switzerland, with the aim of promoting research, education and training in the field of the embedded systems design, through the synergic interaction of three principal actors: European academia, American academia and international high-tech industry.

Since 2000 ALaRI offers a master program in embedded systems design (the *Master of Advanced Studies in Embedded Systems Design*). This master program lasts one year, from September until July, and it finishes with the final workshop where the participants present their master research projects, developed during the year with the

support of teachers, tutors, and industrial experts or other academic mentors. Since 2004 ALaRI has also introduced a new master program in embedded systems design (the *Master of Science in Embedded Systems Design*). It is a two-year graduate program (following the so-called *Bologna model* for European University studies).

The peculiar characteristic of the ALaRI institute is its plan of learning: an innovative approach to the working organization and learning environment.

Participants in the master's programs come from all over the world and during their stay at the institute have the possibility to explore and to study in depth the subjects related to embedded systems design, acquiring theoretical background and practice with design tools. Teaching is organized into teaching units ("modules") whose length may go from 24 to 50 hours, inclusive of theory, exercises and practice. Modules end with an individual evaluation that may include home assignments and a module project. With very few exceptions, lecturers (about thirty) are present at the institute in Lugano only during their period of teaching (normally distributed over 1 or 2 weeks). This last fact is one the basic factors that guided towards introduction of particular remote-teaching solutions for ALaRI.

Research projects run in parallel with conventional studies and complete the students' training, leading to the final master theses. The applied-research projects relate in general to actual industrial research, design activities and technological needs; they are assigned to each participant early in the academic year[1], and checked periodically through remote interactions by the Industrial Partners of the ALaRI community as well as by lecturers from the (remote) Faculty, who act as advisors. Both academic and industrial experts tutor the development of each project.

Several parallel projects may complete a larger research activity, where practical experience in teamwork allows participants to grasp the problems of design management from the perspective of work organization as well as financial relations.

Thus, during the master's programs, students are trained both to work on their own (and in team work) and to interact remotely with their supervisors (academic members and industrial collaborators) to develop research projects leading to their final master's theses. In this context, two main difficulties have been tackled. One has been the interaction between students and international lecturers, because of the limited physical presence of the lecturers at the Institute. The other has been the need to coordinate the workflows among the several actors at ALaRI during the academic year.

The above problems led to designing and building the ALaRI intranet: a web-based remote application accessible from the ALaRI web site – www.ALaRI.ch/intranet – with the aim of supporting and managing the relationships among the different actors around ALaRI community. Through the intranet, new social and technological dynamics have been developing at the institute, integrating learning in presence with remote cooperation in a complex and truly distributed reality (Dillenbourg & Schneider, 1995)[2].

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[1] In the first academic year for MSc students.

[2] Within remote learning, a distinction has been made in the literature between a *collaborative learning* model and a *cooperative learning* one. The former addresses situations "in which two or more subjects build synchronously and interactively a joint solution to some problem" whereas the latter is "a protocol in which the task is in advance split into subtasks that the partners solve independently" (Dillenbourg & Schneider, 1995).

Further, this information system offers heterogeneous services integrated within several areas, accessible from remote places and in an asynchronous way (Negri & Bondi, 2004).

The main difficulties met during the development of this platform stem from the very fast and sudden growth of the institute together with its entire environment. In fact this led the decision maker and the designers to re-think very quickly the entire organization of the platform, extending the application, and facing the many different demands of the institute and of its actors, as they appeared, with the purpose of broadening and boosting the management of all the ALaRI activities on a unique remote platform. Further, when the ALaRI intranet building began (during the academic year 2002-03) there was no *ad hoc* application complying with ALaRI requirements; moreover the existing tools were neither modular nor integrateable, and interfacing them with each other was far from easily and efficiently feasible, if at all. So it was decided to create a new *ad hoc* intranet for the ALaRI institute.

In order to better understand the demands of the ALaRI institute, it is useful to have an overview of the seven principal profiles of the actors involved in the learning programs (i.e. *Scientific Council; ALaRI Staff; Faculty members; Industrial Sponsors; Students; Alumni;* and *Guests*), and of their mutual interactions by means of the ALaRI intranet.

The *Scientific Council*, consisting of the ALaRI stakeholders, is basically in charge of the ALaRI strategies, and it is responsible for the remotely supervising of all the research projects ongoing at the institute. Together with the *ALaRI Staff* (i.e. PhD students supervising some students' master projects, and intranet administrators who maintain and update the system) they have access to all documents (private and public) and to all ALaRI intranet data.

The *Faculty members* are professors and experts from academic and industrial environment who hold courses and whose materials are available on the ALaRI intranet. In some cases they also provide academic supervision for master projects, checking and evaluating – through the intranet platform – only the reports of those projects they are involved in.

Industrial Sponsors are academic or external collaborators interacting with the students during all the period of the project development, defining the milestones and the deliverables of their supported projects, and working with the team from remote places.

Students attending the two master's programs can perform different activities on intranet, working alone with the available teaching materials of the courses, or working with their team, supervisors and tutors about the master project they are assigned to. They can share together the ongoing results of the projects and upload new reports. Further, they have access to the intranet area with public documents of previous projects, where they can also upload other relevant materials interesting for the development of their research projects. In this way the intranet aims at being the main instrument for building the research projects. There is also a career area, where students can upload their *curricula vitae* and letters of intent, making them visible to the faculty members and sponsors. Finally, through the part-time job area, students have the possibility of applying for little on campus part-time jobs, posted by ALaRI staff, with the aim to cover basic living expenses during their stay away from the family.

Alumni (ALaRI former graduated students) have access the most recent public materials on intranet and private reports of their former master projects for a few years after their graduation. Moreover, they can also keep visible their *curricula vitae* and keep consulting possible job offers.

Finally, *Guests* are persons outside the ALaRI institute and its network, who may be interested in some research activities at ALaRI, and may find some opportunities accessing the public reports of master projects and other public documents.

This interactive information system wants to allow ALaRI actors with different roles to carry out asynchronous communications from remote places, supported also by an advanced data filtering system (logging in the own username and password) that assures different views of the data and of the several services according to user's profile.

These heterogeneous services in the intranet system are based on seven main general areas, concerning: *People* (the ALaRI actors directory, where several data, such as e-mails or *curricula vitae* can be visible to all or kept private), *Projects and Research* and *My project* pages (about the master's projects management), *Courses* (where all the learning material is collected, including professors' slides, references, suggested books, etc.), a knowledge repository called *ReSearch* (where it is possible to collect and to store the ALaRI know-how, i.e. theses, publications, articles, studies, and so on)*, Library, Career Centre* (where jobs or internships are posted by faculty members or industrial sponsors, and applied by students), and *ALaRI Jobs* (about ALaRI part-time jobs). Further, each of these areas is subdivided in specific and peculiar sections. Finally, *Policies* and *Help Index* online are available to illustrate to the user the whole structure of the application, the services offered and how access them, such as a sort of electronic manual.

In this way, the ALaRI intranet answers the problem of creating a virtual operative workplace, ensuring an interactive participation of all its members within a steady and secure environment.

Risks analysis of the ALaRI intranet

Such a technical learning system, in order to work properly, needs the active cooperation and methodical interaction of all its actors who, in turn, require easiness of use and immediate understanding of the available services.

The very quick development of the ALaRI intranet, although it has been focused on the building of useful technical functionalities, did not let to pay enough attention to the way in which these functionalities have been offered and to "the effectiveness, efficiency and satisfaction with which specified users can achieve specified goals in particular environments" (ISO 9241-11).

Thus, during the time of development and then of use, several elements have affected the proper and correct use of the e-learning system. The main tackled risks concern the following aspects:

- the necessity of creating, developing and implementing an *ad hoc* tailored platform, following the continual incoming requirements of the ALaRI actors;

- the goal to realize a functional and active platform as soon as possible, in order to improve the workflows within the ALaRI learning environment, reducing the necessity of e-mailing and enhancing the asynchronous interactions on the platform to bridle the acquired knowledge;
- the continuous updating and revisions of the initial specifications and requirements, due to the increasing number of users (students, teachers, and other profiles not strictly connected with the learning) and of organized activities – in fact the specifications phase, at the beginning of the project, and before starting the development of the intranet system, is very delicate, and it can never be totally definitive;
- a "home made" platform, created by young ALaRI internal developers, sometimes helped by some ALaRI students interested in this project. Thus, it has been necessary to motivate young developers and students to work on a tool from which experience they can resell their acquired knowledge;
- the staff turnover: persons working on the platform changed during the time, making it necessary to hand over intermediate products to somebody else, in order to go on with the implementation of the intranet;
- and consequently work has been performed in a broken/irregular way (in fact the intranet building started in the academic year 2002-03, and now it is still under implementation), so opening another problem:
- the traceability of the tool, i.e. the possibility to document each phase of building and implementation of the intranet;
- moreover, the increasing complexity of the project required a continuous and punctual supervision of the development of the platform (also valuating the limits of the tool itself), but the person in charge of this had also to follow several other activities. As a consequence, difficulties in the intranet use were noticed and discovered late, when the user was not able to perform some tasks and the specific activity could not be carried out;
- finally, the initial difficulty in involving all the ALaRI actors in the use of the platform, making them aware of its services and really facilitating their interactive activities, was a further problem. In fact at the beginning only the students after a brief training seemed to be disposed to use the platform; while professors and other actors did not use it, and in the worst case they did not even know the existence of it.

What Did not Work out as Hoped and Why

Here I would like to analyze what did not work out, and try to understand why. During the summer 2004, it was performed a first usability test, since the use of the platform did not achieved the hoped results. From it and a successive my research (then published in Salvioni, 2005) it was clear that, especially during its first release, the ALaRI intranet was very few used compared to the offered services to the students, faculty members, and industrial sponsors: only some of all the services on the intranet were really known, and few services were really used.

From the users' point of view, two main difficulties concerned on one hand the practical approach to the intranet system, and on the other hand the lack of consciousness about sharing the use of the platform with the other ALaRI actors to increase the know-how of the community.

The analysis conducted showed that, while the technical part of the platform was generally well developed (just few strictly technical problems), limited attention was paid to its interface, because not enough customized according to the final users' demands. In fact, as here below listed, several aspects of usability did not work, generating drawback and disappointment. Such aspects regard:

- semiotic issues, such as the meaning of labels, headings or keywords that should synthesize the contents to which they refer; or the interaction images, i.e. the meaning of any non-textual sign or symbol used for navigation purpose. For instance, some label names do not help users understand their contents, such as the title *ReSearch* that should suggest the whole ALaRI repository, but it is not clear at all; so also the labels *Main Projects* and *Master Projects* (section of *Projects and Research* area) do not explain the difference of the contents they cover, running the risk of losing confidence in the site. Then, about the interaction images issue, there are troubles stemming from the lack of conventional and intuitive symbols, as instead we are used to recognize on web pages: such as the click buttons here represented as little blue triangles in little white squares; or the difficulty presented by underlined words that sometimes are links, and sometimes not
- cognitive problems about the arrangement of information and the user's cognitive effort to read an intranet page overloaded or with redundant terms, but also an intranet page lacking of information that prevents from efficiently completing a specific activity or a task. This can lead to compromise the efficacy of the intranet communication. For instance, on *Projects Search* page (sub-menu of *Projects and Research* area) there are too much information crowding the page, so that it looks like a book page to be read carefully rather than an intranet page with immediate and intuitive services; also on *Library* and *ReSearch* areas there are long list of mixed documents, not divided by subject or type of text, or by author. On the contrary sometimes the lack of details or definite deadlines (about an activity), like on *Part-time Job* area, can prevent from the completion of a task
- graphic elements such as the limit (due to the tool) of getting only square or rectangular areas
- navigation, when it hampers the easy access to some information of interest. For instance, on *Guiding Themes* page (in *Projects and Research* area) four clicks are needed to reach public documents; whereas this path could be simply reduced to two clicks. Then, on intranet pages there is not any backward button to make easier the navigation to the previous visited page (there is only the back functionality offered by the browser)
- technical difficulties about the lack of clear feedback messages, such as error messages that are not in a natural language, but in code, hampering in this way the user to understand how to repair it; and also the lack of messages confirming the successful conclusion of an operation (e.g. the correct uploading of a document-on private or public area-and its availability to the

right addressees). Or the difficulty to remember passwords that must have specific characters, such as an upper case, a number, a specific length, etc.

Then, some errors, that might seem to come from technical troubles, really show failures during the first specifications phase, such as the denied access to read documents of interest. In fact, for instance the second supervisors (the so Italian called *contro-relatore*) found to have no access to read student's theses, just few days before the final discussion – the reason was that during the specifications phase this particular profile was not considered as an ALaRI intranet actor.

Really these troubles slowed down the adoption and the use of the intranet, especially at the beginning, because users were prevented from completing the execution of tasks (in fact, during the first usability test - summer 2004 - just one user out of eight was able to complete his task).

The principal reason was a not suitable attention to the customization of the user interface; but it would have been important also to valuating the limits of the tool itself in advance. Thus, inopportune choices for the realization of the interface would have been avoided.

Other problems are about the maintenance and updating of data and educational materials on the intranet system, for instance when there are personal data to change (about a lecturer, or a student) or course materials to update. This problem was crucial especially at the beginning, because of two reasons: first, developers had not enough time to control all the critical information; second the users were not enough made aware about the necessity of controlling the data of their competence, e.g. the staff users should check administrative data and details about part-time job or master projects; students should up load their profiles, curricula vitae, and the reports of projects according to the milestones; lecturers should provide course materials and assign marks to the students in due time, respecting the intranet policies.

The necessity of making aware the actors about the use of the intranet is an aspect very important that was not enough considered either by technical developers or by the decision makers. In fact this has also had an influence not only on the intranet use, but also on the consciousness of its role for the ALaRI community. For this reason, later online manuals for students and also for lecturers and sponsors were prepared and uploaded on the intranet; and now they are also considering inviting users to attend *ad hoc* training sessions, specific and tailored to the different users' profiles.

According to this perspective, technical developers should have the responsibility to capture how the product is perceived, learned and used, and the requirements that the product can fulfil. This leads to make three considerations: allowing the development of representation models in accordance with the user conceptual model; using cognitive theories in order to build understandable interfaces for information and data display; and evaluating final products also in terms of aesthetics features.

On this subject, the previous *figure 1* can help to understand what did not work out in terms of effective communication among all the ALaRI actors. In fact, while, since the beginning, the first technical loop has showed the good will of building a technical useful artefact for the community; the awareness of the necessity of collaborating and having good communication flows between the two loops, to get a very satisfactory intranet platform, came later, maybe too later.

It is enough to think over the gap between the development of the platform and its test of accessibility and use: during the academic year 2002/03 the intranet building

started, but only during the summer 2004 a questionnaire and a usability test have been provided to the users, since the use of the platform did not achieved the hoped results. In fact at the beginning, in order to get the main necessary requirements, it was just provided a questionnaire via e-mail to some users, and the outcomes were discussed only among the technicians, while the users were not more involved in the development of the platform.

The lack of communication has also had repercussions on the display of some courses data on intranet, when for instance some important details were missing about the association of master programs courses and year of course; about credits associated to specific program and courses; or about the pre-definition of elective and fundamental courses according to the master program. Or when the designer considered valid some previous data, he made by himself decisions regarding a particular course, but without asking any details to the decision maker or to the responsible lecturer. This particular situation can occur in ALaRI because the intranet platform is developed by persons inside the institute, who were former ALaRI students. So it can happen that they take for granted some information about courses they already attended, whereas they should verify it.

Another issue concerns the policies and the rules decided by the ALaRI steering committee that are uploaded and implemented on the intranet platform. These policies affect all the educational organization and involve in also lecturers and sponsors. If ALaRI actors do not comply with these policies, all the educational system is compromised. For instance, it is important to respect the deadlines to perform several activities, e.g. the uploading of the master thesis on behalf of the student; or the reading and the evaluation of the thesis, or the uploading of the learning materials on behalf of the lecturer; and so on. But it must be clear that the policies on the intranet are established by the steering committee and they must not be perceived as constraints of the sytem. So it is crucial also to understand how to put the policies on the intranet in order to not discourage the users to work on it.

All these considerations underline that the occurred problems were not only around the user interface, but also about the maintenance and updating of the data on the intranet, the promotion of its use, and the relationships within the institute.
In short, the problems occurred in practice affect several perspectives:

a) the users' point of view about:
- the practical approach, i.e. interfaces not intuitive, lack of customization according to the different users' profiles, problems of usability aspects
- the awareness of being part of a community

b) the communication point of view:
- lack of deep analysis of the users' requirements
- belated request of feedback from the users
- lack of communications among all the ALaRI actors (developers, decision makers, final users)
- lack of suitable promotion of the platform and its services

c) the technical point of view:
- lack of previous identification of tool limits

What is it possible to learn from this experience? How is it possible to benefit from the occurred failures?

Negative consequences imply not only that users cannot achieve their goals with satisfaction, but also compromise the development of a real community identity whose principle of organization is based on the information system itself (Wenger 1998).

Thus, from this analysis three considerations arise, namely:

1. the possibility to create a very general and extensible model of the application, considering all the possible features and prerogatives, in order to have a flexible environment, broader than the first specifications, where it is possible to make changes and modifications without running into insuperable difficulties;
2. the development team should have a deep knowledge of the tool and it should be well coordinated and supervised;
3. and finally, more attention should be paid to the user interface, its maintenance and the promotion of the platform.

The first consideration highlights the crucial problem of the flexibility and of the amenability to modifications of a product, moreover when it is new and just born.

The second point involves two main aspects in ALaRI case. One is the necessity to motivate young developers and students to learn a software language, persuading them that it can always be a work experience to resell. The other concerns the methodology and difficulties proper of the system development that requires the need of portioning the application, subdividing the work in several blocks in order to run the developing phases of the projects in parallel. So doing, it would be easier to take into account users' feedback, and improving the platform step by step, finding possible failures in due time.

The last consideration points out the necessity of working closer with the final users, starting from the design of the application, through the accurate definition of the users' tasks, till the organization of training sessions to promote and enhance the use of the intranet. Then, these sessions should be organized in accordance with the user's profile, reminding that faculty members, students and industrial sponsors have very different features, and consequently they need different approaches to properly use the technology enhanced learning system.

The engagement of heterogeneous human and technical resources in the restoration of a working order can successfully bring to problem dissolution, but it needs a great effort to overcome possible incomprehension and disagreement. Using an own jargon, quarrelling about priorities, and an excessive assertion of own peculiarity become dangerous whenever drive the community of specialists to the isolation and estrangement from giving the waiting answers to a larger community of users (Scott, in Laurel, 1990).

It becomes also worth of value to estimate a costs preview, considering, besides a money budget, the human resources to dedicate on the activity, and the time spent both on the building and on the maintenance of the platform, and on the learning of its use.

Last, but not least, formulating a contingency plan can avoid being naïve in case of difficulty. In fact it aims at valuating the possibility that something does not work as planned, and thus, it helps to be aware of possible troubles that might occur during the development or the use of the system; in a dynamic environment such as ALaRI, it is extremely important to try to foresee changes and modifications that can have strong impacts, especially speaking about e-learning platform.

More generally, from the human and communication point of view, other elements may affect the use of the system, such as the users' habits and resistance behaviour.

It is not easy to change the habits of other persons, especially when they are well with the already existing technical tool (e.g. the simple e-mails). The individual resistant behaviour to adopt and use something new involves the matter about the comfort of the existing habit, the *status quo*; perceiving also associated risks (Szmigin I., 2003), as the here below scheme illustrates (*figure 2*).

RISK		*HIGH*	*LOW*
HABITS	*STRONG*	**a) Dual Resistance** (Social change)	**b) Habit Resistance** (Evolution –continuous- and replacement innovations)
	WEAK	**c) Risk Resistance** (Radical –discontinuous- technological innovations)	No Resistance (Fads and Fashion)

Fig. 2

Three types of risks are here above considered:

a) the dual resistance involves physical, social or economic adverse consequences, and it occurs when there are strong habit and high risk due to the introduction of innovation. This kind of risk is often found in the area of social change, e.g. e-business or internet shopping; or it occurs when the use of innovation, not yet fully tested, may not work effectively, or when its price is very high, but it should come down over time;

b) the habit resistance underlines performance uncertainty, because the stress is on changes in existing habits and practices rather than on innovation risk (and this is also the case of the adoption and use of the ALaRI intranet). This type of risk may also include resistance due to conflicts with a previous belief and cultural structure;

c) the risk resistance highlights side affects associated with the innovation: here the matter is not much of changing existing habit but more of introducing new ones. Often radical and revolution innovations generate new forms of habits that have a high risk perception, at least initially, e.g. the microwave oven.

When there is neither risk nor habit change the innovation is very welcome, e.g. the *Swatch* fashion. Thus the resistance in adoption may meet functional or psychological

barriers. Functional barriers include product usage patterns, product value and risks associated with product usage, reflecting the ideas of complexity and relative advantage. While psychological barriers arise from existing habits, prior beliefs, traditions, and they can reflect the idea of a compatible technology. The barriers entailed by this above mentioned ideas are here below briefly described.

The complexity of a product implies the need of special training to use it. And in ALaRI case it is relevant both for the developers and for the final users. In fact, on one hand the developers had to learn a particular software language, standard but not very used, in order to build the ALaRI intranet platform; and on the other hand the final users found an interface not intuitive, with some usability troubles, that did not make easy its use.

The perception of the relative advantage has greatly affected the use of the ALaRI e-learning systems, especially on behalf of the faculty members. In fact some of them not only did not use the platform, but often did not even care to know it existed, while students (and alumni) appear to be more inclined to become familiar with the platform, perceiving its utility.

The introduction of a new system requires to change previous habits and learning a new model of communication with the students and with the other ALaRI actors, whereas faculty members were used to write simple e-mails to them, or to delegate work that now they can accomplish by themselves using the ALaRI intranet platform (such as providing students with pre-defined marks from a scroll menu). Thus, on one hand the intranet allows a more autonomous and independent management of several information, but on the other hand it also engage more strictly all the users to make such a system a real value for the whole ALaRI community.

Since the relative advantage is something extremely subjective, it becomes a critical activity also to identify the relative advantage that faculty members are disposed to value, and make it well visible and tangible, also long-term.

The compatible technology refers to the context of adoption and to the possibility of integrating the innovation within both the social and technological system already existent, verifying if the new product is consistent with the users' values and past experience. The ALaRI case is particularly interesting because its e-learning intranet system is mainly developed by and for people with engineering, technical and scientific background. Further it has been built for this specific and particular community. So at first sight it seems to be totally compatible with its social and technological system, where apparently in terms of conceptual model there is not any difference between who build and implement the system and who use it. Nevertheless, the resistances to use it show difficulties of usability and communication.

What did work successfully and the achieved results

What instead did work successfully around the ALaRI technology enhanced learning is here below described:

- the ***advanced data filtering*** based on user type and status has granted filtered access to shared information, protecting sensitive data and documents.

Navigational patterns are limited for a certain user by the access rules imposed on his/her account. For example, a sponsor cannot see actors associations for projects he/she is not involved in, whereas the scientific council or the ALaRI staff can.

- the intranet has proved to be the best solution to **keep important documents long-term**; whereas the short-term information are put on a *wiki* platform, more suitable for this purpose
- the **persistent storage** of project deliverables, achieved results and other documents **into the repository** has avoided losing ALaRI know-how acquired during these last seven years (the problem instead is to find the best way to visualize all this know-how to the users)
- on the platform, **policies and rules** are **well issued and accessible**, so that ALaRI actors have to respect and to comply with them, as for instance the uploading of report within defined milestones; or the uploading of master thesis within deadlines to allow the reading and the evaluation of it. And thanks to the policies and rules, a level of formality among the users, also working from remote places, is supported
- the system **makes easier the management of the ALaRI back office**, acting as a sort of "electronic secretary"
- **the ALaRI *alumni*** (the former ALaRI students) **follow-up** has been successfully managed through the intranet, offering them career opportunities and the access to the project results also after the finish of their master's courses
- the promotion of several services, besides the pure educational ones (the strictly e-learning platform)
- the physical closeness (of place and of age) has allowed developers to improve the customization of the staff's and student's interface more quickly and easier rather than the lecturer's and sponsor's ones, thanks also to the possibility to speak with them directly and have immediate feedback.

Consequently staff and students have met less difficulty in the adoption and use of the system (but it is true that the interface is not intuitive and it is necessary to take more into considerations the different users' requirements)

Further, improvements of usability on the intranet have allowed:

- all users to **send suggestions**, critics, and recommendations to the intranet administrators for any requests or questions about the services of the intranet system. And, in this sense, the intranet home page and others particular pages are provided with the technicians' emails to contact
- to **send messages to the employer's private e-mail box**, informing when somebody applies for a job posted. This faces up to the problem to not check the intranet regularly, and so to not see students' applications for some time
- to **up load students' photos** near their names. This helps to recognize the students, associating their faces with the proper names more quickly. And in multi-cultural and multi-ethnic classes with students coming from all over the world, this little expedient gains a considerable importance, making easier the interpersonal relations

General recommendations

Abstracting from this concrete case, in my opinion some overall recommendations could include the following aspects to achieve satisfactory results:

a) About the technical building of the platform:

- the specifications phase is very delicate, and it can never be definitive
- it is necessary to create a very general and extensible model of the application to have a flexible environment, broader than the first specifications
- it is necessary to coordinate and supervise the development team
- the developers have to acquire a deep knowledge of the tool
- it is important to design the whole platform, but then to split the development phases, building one section at a time (e.g. first developing one user section, testing it and starting to use it, and then reviewing and redefining requirements not considered previously)

b) About the users' requirements:

- try to work close to the final users, if possible
- analyse carefully the several users' profiles
- customize the user interfaces according to the different users' site-views
- do not underestimate the usability aspects (such as cognitive, semiotic, navigational, technical, and graphical issues)
- maintain and up date data and information on the platform
- try to meet the user's expectation at first - negative experience discourages user
- provide the platform with online help manual, tailored for each profile

c) About the users' feedback:

- find user available to test the platform internally, before its release – identifying the critical users and trying to comply with their requirements
- request the users feedback through usability tests assigning tasks within specific scenarios, and observing and then evaluating how users perform them
- review and redefine requirements not considered previously
- improve the following phases of development with the provided feedback and make the suitable modifications
- consider users' resistance and habits, such as functional barriers, i.e. the complexity of the product and the perception of the relative advantage; and psychological barriers, i.e. the compatibility of the technology with the user's background and culture
- promote the use of the platform – at all levels through several actions (e.g. tailored training sessions)

d) About the financial issues:

- estimate a costs preview, i.e. efforts of money, human resources, time spent on learning the tool and building the system, the use of the platform, the maintenance of the data
- formulate a contingency plan, i.e. valuate the possibility that something does not work as planned.

Maybe these suggestions can apply to other situations and help to avoid the problems occurred in ALaRI
community.

Conclusions

The ALaRI intranet was principally thought to create an educational platform, able to enhance the elearning also from remote places, to develop the asynchronous communication - reducing the necessity of e-mailing - and with the goal of providing the ALaRI actors with a knowledge repository, where they can collect and increase the know-how acquired.

According to this analysis, it is clear that several difficulties have taken part in the complete adoption and use of the ALaRI intranet by the whole ALaRI community. These difficulties range from a not well customized interface, also due to a limited attention to the users' needs, to the time spent on building and implementation and to a lack of proper management of internal communication.

Consequently, in the production phase, various problems occurred to hand over intermediate products to new developers and to control and coordinate the ongoing activities.

Therefore a complex network of communications and relationships has affected the optimal realization of the product, but the originally intended outcome is not compromised, and the particular academic environment of ALaRI allows going on with the technology enhanced learning, trying to benefit from the previous failures.

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Ambient Video Awareness: "It's Great, but I Still Don't Want It"

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Abstract. Video instant messaging tools are not as widely used as we would have predicted and have so far failed to fulfill their promise to become an indispensable tool of social presence, interacting within the workgroup environment and creating a sense of community. Whilst users are becoming comfortable with videoconferencing and software video meetings, the use of video in "awareness" is still very uncommon. Over a 2-year period, we have run 8 discrete Hexagon room studies on naturalistic "ambient video awareness". Only one of these studies can be considered to be a (limited) success. This paper discusses some of the factors inhibiting the use of such tools in e-learning environments, based on users' feedback on issues, such as the tool promotion, user interface, size of community and visibility concerns.

Keywords: video ambient awareness, collaborative media, group awareness

1 Introduction

The "potential of awareness information" using video cues has excited researchers since the very early days of remote video meetings [1]. A range of video, audio and text-based instant messaging tools offer awareness features that can be used for office or learning 'group awareness'. Studies on the impact of these community tools have been very positive. In early systems, such as the XEROX and NYNEX Portholes [1], [2], a shared awareness was viewed as helping to build a sense of community using video broadcasting technology. Awareness in terms of video and text instant messaging tools can be achieved by denoting social presence with live images transmitted via networked computers and by exchanging text or voice instant messages. In social presence theory, the role of media is to provide valuable 'cues' about the presence of others: including facial expression, tone of voice and other key aspects of presence, such as clothing or hairstyle [3]. It is argued that face-to-face communication is rich because it includes deictic elements and objects, which are visible to both participants of the communication [4] and that this is critical to participants. Computer mediated communication for workgroup awareness was viewed in the past as a direct replacement of this aspect of face-to-face communication. Video technology can be used effectively in physically distributed workgroups around the world, saving travel costs and minimizing the time taken to complete a group task [5]. Video instant messaging tools can enhance computer-supported group-based learning, which is an important part of contemporary

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education, focusing on concepts such as ‘cooperative’ and ‘collaborative’ learning, motivated by learning environments similar to original working processes [6]. However, where video is involved, issues of surveillance, invasion of privacy and concerns about being on view to the community are common. The evidence of the last ten years is that video instant messaging and awareness tools have failed to become an indispensable tool of the everyday communication in e-learning and workgroup environments, despite advances in the technology that made it genuinely usable outside of the research lab.

This paper focuses on the video awareness tool Hexagon. Despite deployments into over 8 different target communities and some very positive feedback, the tool has failed on the one single measure of an effective piece of software: does it continue to be used once the initial novelty factor and research enthusiasm have worn off? This is a very high standard for much experimental work, and on this measure only 1 community of the 8 can be considered to be a limited success.

2 Hexagon Video Presence Technology

Hexagon is part of a research programme on telepresence, which focuses on issues such as ambient presence awareness and working and learning in public. It is a simple applet designed to run in a web page, using Adobe Flash™, a pervasive and cross-platform browser plug-in, which typically requires no additional software installation. Hexagon users share regularly updated, live, personal webcam images, laid out on a grid of hexagons. Features such as a text chat facility and a voice communication mode, allow large groups to interact with each other.

Hexagon provides a ‘room-based’ view of connected participants to specific ‘room instances’. Some Hexagon rooms allow guest access, whereby users can enter without registration and can typically remain for a time-limited period with limited functions. Registered ‘room users’ can send instant text messages to other users individually, or as a group, can have an audio chat with individuals and can look at the “room history” of user attendance. A user’s webcam image appears as a hexagon, in a grid of other user hexagons. Users can move the hexagons around on this grid, and can zoom in and out on them, and users without a camera appear as grey in the grid. The images are very low refresh Adobe Flash™ movies, and update independently with a new frame every 20-30 seconds. The most recent ‘image refresh rate’ allows the applet to update without overly taxing a client’s personal computer and network. Simple graphical effects are used to indicate to the present community that users interact with each other, e.g. text chat sent from one user to another, is animated by a small spinning ‘envelope’ graphic moving between the two relevant hexagons. The applet has been tested with 50 simultaneous webcam connections in a single room, and is theoretically capable of supporting many more. However, no ‘real’ room uses in this study have exceeded that number of video connections. Fig. 1 shows an annotated view of the main ‘hexes’ screen, including the views of 7 different webcams, involving users or specific locations. Individual status indicators can be set showing whether the users are ‘busy’ - as in many other instant messaging tools.

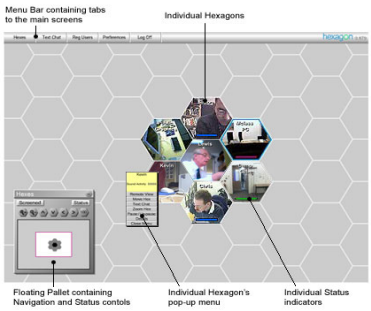

Fig. 1. A view of the *(hexagon)* screen showing *(7 participants).*

The Hexagon technology was designed to support ambient awareness in a coherent community. In a working office context, we envisaged that remote workers would get an increased sense of community by seeing co-workers and office locations; and that they would use ambient cues to interact more effectively, e.g. to quickly gauge availability, engagement in work on the phone or meetings from video cues. In learning contexts, we envisaged that groups of tutors and students could mingle in such a space to make use of the video for convenient opportunistic learning interactions. The technology supports a number of work and learning models, from 'student drop-in centre' or 'public helpdesk', to acting as a 'jumping off point' for video meetings or other interactions, to a full 'virtual learning space'.

3 Evaluation

Over the last three years, the Hexagon system was provided freely to a range of companies, research projects and organizations. All but one of these groups have taken enthusiastically to the technology, but failed to convert their interest into a stable, long-term working model for video presence in their community. Most of the workgroups have deployed the system to a small number of enthusiasts, who have used the technology for only a few weeks. Once the novelty factor has worn off, the working models that remain have been insufficiently compelling to bring users back to the system. This section includes an analysis of Hexagon's failure to become an in indispensable tool for social presence and interactivity in different workgroups.

The Hexagon applet was prototyped in the summer of 2003 and tested with a range of user communities through to 2004 under various models. The current studies started in April 2004, with detailed recording of activity in each room. The most heavily used 'room' (the Knowledge Media Institute's own lab room) has recorded around 19,000 logged-in connections. However, in addition to this one successful room, 17 further user-communities were offered access to the technologies to deploy in a naturalistic setting. None of these studies have come close to the success of this initial context. This list includes a number of large 'corporate-level' organizations, specifically the e-learning and training departments of: a multinational telecoms

company, a multinational energy company, a multinational computing networks company, a large UK-based broadcasting organization, and a UK-based government supported civic organization, communications department. Also, by more 'local level' organizations: a small USA-based independent music teaching company, a local UK-based innovations organization to support small enterprises, and a UK-based schools-networking organization. It has been trialed by 3 organizations within the Open University, and by University groups in South America, North America and Central Europe and has been used with "project-based" highly distributed groups in 3 pan-EU projects. The typical pattern of use in our studies is illustrated below. Almost all of these trials exhibited a similar pattern to the illustration, which appears to be a form of "adherence failure" in which the technology evidently fails to 'stick' with a given community. In all cases, users appear to like the technology and to report minimal technological problems, but still do not continue to use it after the initial trials.

3.1 The 'Prolearn' Hexagon

On 23rd September 2005, an EU funded network of excellence in Professional Learning (see: http://prolearn.tv/) conducted a webcast using the "Prolearn" Hexagon room as an 'audience presence space'. Those 'tuning in' to the broadcast event were invited to join the Prolearn Hexagon study to see the remote audience and to interact with other attendees and the speaker. The event served to excite a small community with the potential of 'ambient presence' technologies, bringing webcam users into the room for a short while. The event was 'attended' by 16 Hexagon clients from all over this European community (although this figure includes some 'contextual cameras' in the presentation itself) (Fig. 2). Overall, the room in this week had 501 chat messages between 34 unique IPs of participants. The webcast audience included attendees from the computer science department of the Katholieke Universiteit Leuven, Belgium. This group of enthusiastic students and researchers returned, bringing more webcams to this Hexagon room the following week (requesting full accounts that would enable them to remain in the room past the 'guest allocation time out') and remained for four further weeks. Figures 3 through 7 illustrate the use of the room over five weeks, with peaks through to the early afternoons (Monday to Friday). Fig. 3 shows some minor activity over a weekend, but most activity was clearly in the working week.

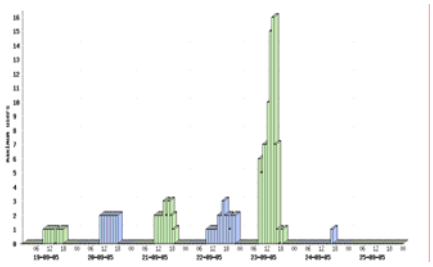

Fig. 2. *(Prolearn Hexagon) Room* Week View *(19-25 Sept 2005)*

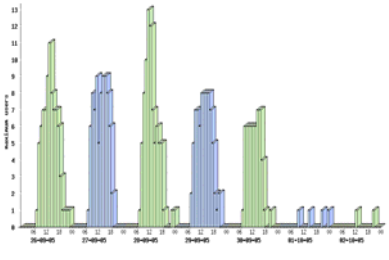

Fig. 3. *(26 Sept-02 Oct 2005)*; 1069 Chat Messages, 49 IPs

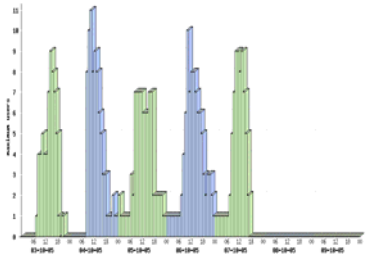

Fig. 4. *(03-09 Oct 2005)*; 424 Chat Messages, 29 IPs

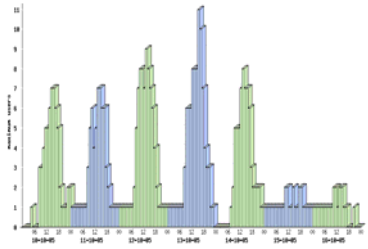

Fig. 5. *(10-16 Oct 2005)*; 456 Chat Messages; 25 IPs

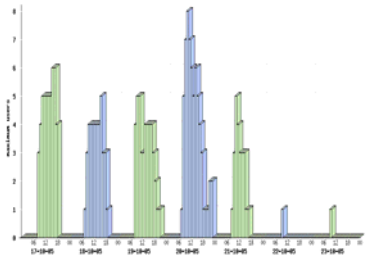

Fig. 6. *(17-23 Oct 2005)*; 87 Chat Messages, 16 IPs

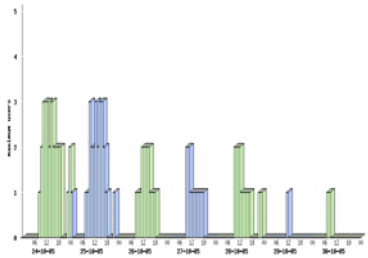

Fig. 7. *(24-30 Oct 2005)*; 3 Chat Messages, 15 IPs

Overall, there was significant room activity with over 2000 text chat messages generated in this short time. Little use was made of person-to-person audio in this time (only 5 audio chats in the first week and then 5 over the remaining 5 weeks). However, as can be readily gauged from the sequence, the level of presence in the room gradually fell to a core of 4-5 users (the most active of the KUL students and researchers). In the latter of these weeks, whilst 15 unique IPs came and went from the room, a maximum of only 3 were co-present at any one time. Evidently, this was below the threshold for this community and signals the end of this phase of its use. The room remains open, to date, and since this October activity has hosted 3-4 users on infrequent and irregular occasions. Whilst all 8 trials have been different with respect to their initiation, most have followed this general pattern, with users reporting a continued enthusiasm for the technology, but 'measurably' NOT using it.

3.2 The 'KMi' Hexagon

The Knowledge Media Institute (KMi) occupies a single floor in one building in Milton Keynes in the UK. It has a large open plan central area where some researchers and graduate students work in 'cubicle' spaces, surrounded by 1 and 2-person enclosed offices. The enclosed offices all have full glass panel doors, to allow visitors an unrestricted view inside. Workers often have multiple computers, and webcams are freely available. The 'KMi' Hexagon room has been in use every single day since this work began. We can consider this to be a relatively naturalistic study,

because whilst KMi lab members have been encouraged to join this room, through occasional emails (4/5 over 3 years), no management pressure or negative sanctions have been used to oblige participation. We examined the detailed log for a complete calendar year: Aug 2005 to Jul 2006 inclusive. This showed that some of 52 possible accounts for this room, 33 "registered users" used Hexagon somewhat during that period. There were a total of 7,500 connections by those registered users in that time, with a further 360 accesses by 'guest' users. Fig. 8 shows the most active 19 registered users with over 10% connections to the KMi Hexagon room during a weekday in this calendar year (Monday to Friday). Some 14 active users with less than 10% connections on weekdays have been excluded from this chart.

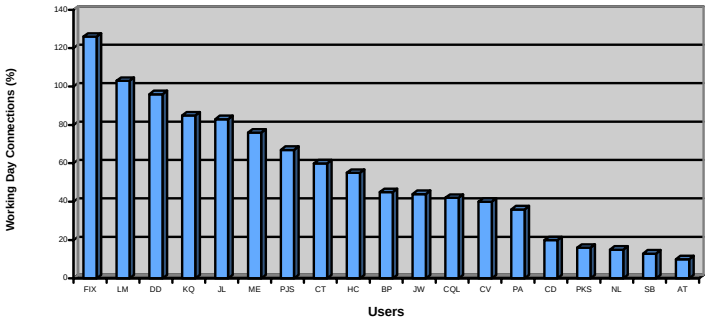

Fig. 8. Connected weekdays to KMi Hexagon Room, 1 Aug 2005 to 31 Jul 2006

The chart measures (at least) one connection by the user to the room on a day in that year (excluding weekends, but not taking into account any other holiday or exclusion periods). Ergo is a percentage of the maximum possible working days the user could be connected. Some anomalies with the figure should be noted. The 'most active' user FIX is over-represented, as this is a generic account for fixed cameras in the laboratory, which are automatically on and overlooking public spaces when relevant computers boot up. Ergo, one or other of these are logged into Hexagon for 90% of the year, being 126% of possible working days. In the same way, users PJS and PA are workers in the lab who leave Hexagon switched on permanently. Their connections do not show up sufficiently in these daily connection statistics as their machines remain on and do not 'log' many daily connections, unless restarting their computers. One other issue is that users CQL and AT joined the lab during the sample period and so their % attendance in the Hexagon room actually corresponds to a proportional >90% of their possible use of their membership of this community. These caveats mean that 11 working individuals connected on at least half of the weekdays, (that they possibly could have done), in this calendar year. Interestingly, 7/18 individuals in Fig. 8 have single offices, whilst the remainder have a double office, and a few also work in an open plan context. The Hexagon applet does not automatically launch and must be opened and maintained in an open browser window. It is likely that 1 or 2 users may have set it as a browser default page, or have scripted its automatic opening, but most users go to some real trouble to 'make the

application' work. Although the Hexagon room concept seems to work well for a proportion of KMi denizens, the majority of lab workers do not use it.

4 Why Do Non-Users NOT Use Ambient Video Awareness

It is notoriously hard to reach non-users of any technology or system, and even harder to motivate them to explain why they do not use it. It may have been badly explained to them, or not explained at all. It may not make sense to them, or fit in with their working or learning style. They may simply not like it. The Knowledge Media Institute is a large and busy research laboratory. Where Fig. 8 shows active users of the system, there are 19 registered users not shown whose use is less than 10% of possible working days and a further 14 members of the lab who have never requested an account. In July 2006, we sent a questionnaire to these 33 non-users. Eighteen researchers, male and female, provided their feedback on 15 question topics. More than half of the researchers, who answered the questionnaire, have worked for more than a year in KMi, with 8/18 being employed more than two years. Just under half of the respondents (8/18) were very-low-users (under 10% in our 2005-6 sample) and the remainder were non-users. All of them use other instant messaging tools for regular communication, but said that they liked the Hexagon interface.

It appears that the main factor for not using Hexagon, according to more than half of the respondents, is that they do not like being visible to the community all the time;

"I don't like the idea of me being on video camera all the time. I don't mind being on camera when I 'want' to be on camera (in a video conference) but I don't like the idea of constant surveillance". (MG, Open Plan non-user, Male).

"I don't like the idea of being on-camera all the time. It feels like an infringement of my privacy." (CD, Open Plan non-user, Male).

Visibility concerns have been observed in the past in other live image broadcasting tools for office awareness. Negative statements, such as "feelings of instant dislike for strangers" are described regarding the AT&T Picturephone, one of the first video teleconferencing systems [5]. Negative user reactions to the camera, such as camera shyness, threat of surveillance and loss of control over privacy were also spotted in the use of NYNEX Portholes [2]. In the case of Hexagon, these feelings were most common amongst 'open plan' office inhabitants who were already very visible to the lab community. This might initially make their concerns seem rather odd. However, it may represent a 'resistance' factor – in that they could perhaps not close their door to the community (not having one) but could at least leave their webcam off! Other users noted that, even if they did not find the awareness concept intrusive, they found the applet to be too dominant, eg. they did not want the intrusion of seeing all the others:

"I want the instant messaging applications to be silent and noticed only when I need them or when I am being messaged." (AS, Open plan non-user, Female).

Or worse, that it was more interesting than their work:

"It diverted my attention from work, when I had a hard problem to solve I started to watch hexagon instead." (MS, Double office non-user, Female).

Another issue is that Hexagon video awareness competes with a range of other technologies that provide awareness and communications functions. Users reported

that there were at least 8 different systems that they used on a regular basis and that provided some competing functions. They also reported that the working context seemed largely irrelevant in such a context:

"… because everybody I work with is always in the office, the functionality of Hexagon was a bit redundant." (MS, Double office non-user, Female).

"Since all the users are situated within KMi I always found it more convenient to visit the person myself". (AN, Open plan non-user, Male).

Others noted a preference for other, more traditional technologies:

"…by phone sometimes it is easier". (AO, Open plan non-user, Female).

Another reason why Hexagon is not as widely used as predicted by its designers is that it was not promoted enough so that potential users can realize the functions related to the sense of community and take advantage of it in terms of social presence and interaction within the same work environment or whilst working remotely. The context of using video instant messaging also matters; five occasional users noted that it was useful to see whether a person in a different physical location was present, but their team members are already visible, working in the same lab area.

We should note that no software is embedded in a community out of context. The roles of individuals, champions and enthusiasts can make a very big difference to the uptake of a technology. The KMi Hexagon succeeds because it has contained evangelists for 'ambient presence' since it began! All the other studies have not made the 'critical mass' to make the Hexagon room aspect of their community robust, such that it could survive the inevitable temporary loss of key members. Ambient video presence is indeed as exciting as Dourish and Bly [1] hoped, over ten years ago, but we still have not quite learned enough about how to make it realize that potential.

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