Human Centred Technology Workshop 2006

Designing for Collaborative as well as Indivualised Environments

PROCEEDINGS

9th Human Centred Technology Group Postgraduate Workshop

Department of Informatics, University of Sussex, Falmer, Brighton

In association with Future Platforms

11th – 12th September 2006

At the University of Sussex Falmer Campus

Organisers:
Genaro Rebolledo-Mendez, Edgar Acosta-Chaparro, Madeline Alsmeyer, Katerina Avramides, Sallyan Bryant, Amanda Harris, Joh Hunt, Zaliman Yusoff

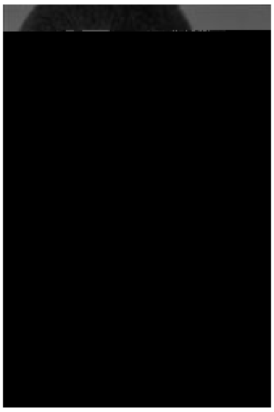
Invited Speakers and Guest Discussants

Benedict du Boulay is Dean of the School of Science and Technology and former Dean of the School of Cognitive and Computing Sciences (COGS). He is a leading member of the IDEAs Lab and the Human Centred Technology Group. He is former Editor of the International Journal of Artificial Intelligence in Education (AIED) and is now a member of its Advisory Board. He is on the editorial boards of the Journal of Interactive Learning Environments and the Journal of Computational Intelligence, and was Programme Chair for AIED'97. Program committee member for numerous conferences.

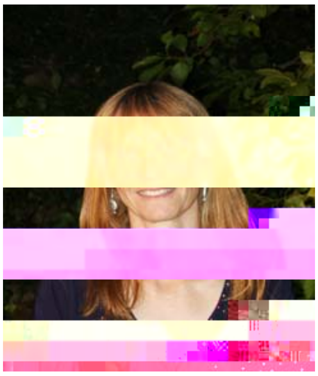
Judith Good. My areas of interest are in contructivist learning environments, the use of games in education (particularly to foster the development of narrative skills in children), and visual programming languages. Judy Robertson (at Glasgow Caledonian University) and I are collaborating on the development of Adventure Author, a game-authoring tool design to support interactive storytelling skills in a 3D virtual reality environment. Much of the work leading up to the development of a prototype tool involved the use of a child-centred design methodology. I teach a course in Interactive Learning Environments, and, at the University of New Mexico, where I was previously, taught courses in Instructional Simulations, Adaptive Learning Systems, Instructional Multimedia, and Artificial Intelligence and Learning Systems.

Rose Luckin. I am Professor of Learner Centred Design at the London Knowledge Lab and a Visiting Professor at the ideas lab at University of Sussex. The aim of my research is to increase our understanding of the process of learning with technology and to use this to design technology effectively to stimulate curiosity, maintain engagement and foster creativity. I am particularly interested in the development of participatory methods to engage learners and teachers in the process of designing technology to fit their needs and to enable them to access all the resources within their environment that might effectively support learning.
You can find out about my current projects through these links
http://www.lkl.ac.uk/graphics/projectsheets/ar.pdf
http://www.lkl.ac.uk/graphics/projectsheets/homework.pdf
http://www.lkl.ac.uk/graphics/projectsheets/vesel.pdfsex

Lyn Pemberton is Principal Lecturer in the School of Computing, Mathematical and Information Sciences at the University of Brighton. She heads the School's Interactive Technology Research Group, and has research interests in learning technologies and user centred development methods. Most recently her research focus has been on the usability and acceptability of interactive television for learning particularly in conjunction with other technologies such as the Web and mobile phone. She's currently involved in LOGOS, a European project to develop cross-platform, multimedia learning objects from archival material. She has supervised six PhD students to completion and is currently supervising six students working on projects ranging across Learning Technologies, Visual Semiotics and Computer Mediated Communication.



Pablo Romero is a Lecturer in Computer Science and Artificial Intelligence at the Department of Informatics, University of Sussex. His interests include Psychology of programming and human reasoning and problem solving (especially with external representations). He is a research fellow in the CRUSADE project which investigates the role that perspective, modality and individual differences such as cognitive style play in the co-ordination of multiple external representations in novice program comprehension.

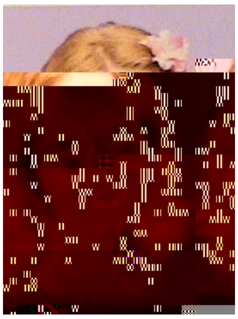


Helen Sharp is a Senior Lecturer in the Computing Department of the Open University, and a Senior Visiting Fellow at the Centre for HCI Design at City University, London. She is also co-leader of the Department's Empirical Studies of Software Development research group. Since working as a developer in the 1980s, Helen has been keen to understand software practice, i.e. how software is developed in reality, and thereby to inform the development of better support for software engineers. This has led her to look at a variety of research areas, from software design support environments to ethnographic studies of developers, and from process modelling to quality assurance. Throughout her investigations, she focuses consistently on the people and their social interactions, rather than on the technologies available and where to apply them. Her recent studies have focused on agile development, specifically the social side of eXtreme Programming, and more recently the integration of HCI concerns into agile development.
She is joint author of a leading textbook on Interaction Design and has published over 50 peer-reviewed articles. She received a BSc in Mathematics and an MSc and PhD in Computer Science from University College London. She is an affiliate of the IEEE Computer Society, and a member of the British Computer Society, the Engineering Council and the ACM. She is also a chartered engineer.

Edgar Acosta-Chaparro

I'm currently a PhD Student of Computer Science and Artificial Intelligence at the Sussex University. My general research interest is the application of artificial intelligence in education. My particular interests are in investigating how intelligent learning environments can mediate and facilitate collaborative learning, particularly in learning to program.

Madeline Alsmeyer



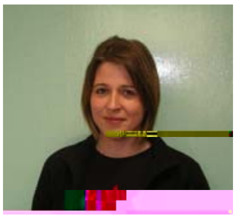
Madeline is nearing the end of her first year as a DPhil student within the IDEAs lab at the University of Sussex. Her research is investigating the relationship between a learning context and a learner's affective state, with particular emphasis on the way a learning context can adapt or be adapted in order to optimise a learner's affective state.
Prior to joining the IDEAs lab, Madeline worked as an instructional designer for a Brighton-based e-learning company, working on a number of excruciatingly interesting projects with a number of very happy and helpful clients.
When Madeline isn't working she likes to tend to her allotment and perhaps drink the odd pint here and there.

Katerina Avramides

Katerina is currently a PhD student in the IDEAS lab at the University of Sussex. She is studying the role of people's beliefs about knowledge and knowing in the way they assess their knowledge of ill-structured problems. Her background is in Cognitive Science (University of Nottingham, Carnegie Mellon University).

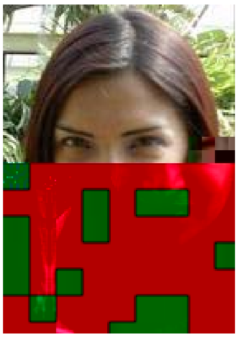
Niamh Caprani

Amanda Harris



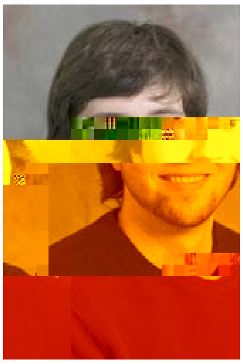
Amanda is currently writing her thesis for submission in September 2006. Her DPhil (Psychology) explores the role achievement motivation plays in the way children interact with each other in peer learning contexts. She is also a Research Fellow in the Department of Informatics and is currently working on a project exploring motivational approaches to learner modelling and the provision of scaffolding structures in order to support productive collaboration between children.

Hina Keval



Hina is a currently studying for her PhD in Computer Science at the University College of London (UCL). Her PhD work examines the issues with modern control room technology and the effect it has on task performance within city centre CCTV control rooms. The interactions between different CCTV users and task performance were studied using a mixture of 'quick and dirty' ethnography and interviews with key stakeholders. Other empirical work she is involved with includes the use of an eye tracker and task performance measures to identify optimum task performance when digital CCTV video is degraded under several quality levels.

Sven Laqua

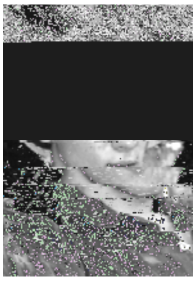


I'm Sven Laqua, since August 2005 a PhD student in the Human Centred Systems Group in the Department of Computer Science at University College London. My research focuses on intelligent user-centred interfaces for web-based environments.
After living in Berlin for 18 years and finishing my a-levels, I moved to Dresden (Germany) where I studied Computer Science and Multimedia at Technical University Dresden, receiving my BSc in 2003. After that I studied one year in Newcastle, where I received an MSc in IT Management with distinction from Northumbria University in 2004. More information about me on my website: www.sl-works.de

Julie Maitland

I am coming to the end of my first year as a research student at the University of Glasgow under the watchful eye of Dr Matthew Chalmers. My overall area of interest is Ubiquitous Computing and Social Interaction; particularly within the realms of health promotion and health care. I gained a BSc(Hons) in Software Engineering in June 2005 from the same university, and before that trained and worked as a Registered Nurse. Apart from the crazy world of ubicomp I love snowboarding, rock-climbing, my two terribly-behaved dogs, and of course my long-suffering husband.

Phil Tuddenham



Phil Tuddenham is completing his second year as a PhD student in the Rainbow Research Group at the University of Cambridge Computer Laboratory, where he previously completed his undergraduate degree. He works in computer interaction with tabletop displays under the supervision of Professor Peter Robinson. His research is supported by Thales Research and Technology and the EPSRC.

Zaliman Yusoff

I'm a third year Dphil student at the University of Sussex. My research interest is to study the relationship between emotions and learning gain especially within an intelligent tutoring system environment. Although emotions have been strongly regarded as a key success factor in human intelligence, very little research has been done to study about the interactions between human emotions and learning outcomes within an intelligent learning environment. Therefore, my research is aimed to study and explore the insight of these interactions by developing an emotionally sound affectively framework that able to intelligently adapt and react to the changes of users' emotional state which is hypothesised would also improve their learning performance.

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Collaborative e-Health Systems

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It is well acknowledged that an individual's social environment can contribute to and influence both their health and their attitude towards health-related issues [7]. Despite this, many e-Health systems focus on the individual in isolation rather than the social networks that play a role in his or her everyday wellbeing. In the same way that CSCW is based on the premise that people generally work together and as such require collaborative working environments, it is suggested that collaborative systems are a potentially valuable and as yet relatively unexplored area of e-Health.

Background

As mobile and pervasive technologies become a more integral part of everyday life, attention is now being paid to how these ubiquitous computing systems can be used to monitor and contribute to health and health care. Commodity technology such as mobile phones and desktop computers are ideally placed within the environment of much of the general public, such that they offer great potential for enhancing awareness of health issues with relatively little effort on the part of the user. At the same time, special purpose devices are being developed and deployed that allow remote monitoring of patient groups in the community [5].

Much e-Health research has focused on the individual: the development of electronic medical records and online patient diaries has converted a number of established paper-based practices into their digital counterparts. The support of collaboration within e-Health systems has mainly fallen on the side of the health professionals or carers rather than the patients/individuals themselves. *The Aware Project* aids collaboration between staff in a hospital environment by facilitating 'social awareness of the working context of fellow co-workers' [2]. Multi-disciplinary community-based collaboration is currently being investigated in the *Mobilising Advanced Technologies for Care at Home (MATCH) Project* [14], alongside the development of assistive ubiquitous technologies. The role of interaction between a patient and his or her social circle, and the role of that same social circle in times of well–being, are aspects of collaboration unsupported by many e-Health systems.

One well-established collaborative e-Health environment is that of the online patient community, where sociability is supported alongside information provision [8]. It is interesting to note that the drive behind the development and maintenance of these collaborative environments originated from the patient communities themselves rather than computing or health professionals. There is evidence that the role of peers is being acknowledged in some health-promotion applications. *Houston* [6] and *Shakra* [12] are mobile phone-based activity promotion systems that facilitate the sharing of activity-based information between friends, and show a positive influence on daily activity levels as a result of mutual awareness and friendly competition.

Interviews with women who stipulated a desire to become more physically active guided the design of *Houston*: a system comprising of a pedometer connected by USB to a mobile phone. A user can view the number of steps taken each day via a text interface on the phone, and annotate days by using the phone's keys when he or she wishes, e.g. on a day when he or she goes for a swim. The annotated information may then be shared between friends, and this sharing was proven to be a positive motivational factor when the system was trialled against a non-collaborative control application [6].

Shakra is a system that was developed by members of the Equator IRC based in Glasgow and Bristol [12]. It monitors the daily activity levels of users and shares this information between peers. A key design goal of the system was to provide an unobtrusive method of monitoring daily activity. This was achieved by avoiding the burden of additional technology, such as a pedometer, being carried by the user (assuming that the user normally carries a mobile phone). The application monitors the fluctuation in GSM signal strength and neighbouring cell information to infer the current activity of mobile phone carrier. Periods of detected moderate activity contribute to a daily total of minutes of activity per day, which can be viewed on the phone either in isolation or in comparison with peers (through hourly GPRS updates). The week long trial that took place with 9 people of varying levels of physical activity confirmed the application's positive potential for future use and development as an awareness- and motivation-increasing tool. It was expected that the sharing of information between peers would have a positive effect on motivation and awareness, but we were surprised by the amount of collaboration, competition, and game-play like behaviour that occurred.

Both of these systems afford only minimal peer-to-peer interaction, but this is enough for *Shakra* to foster friendly competition, and for *Houston* to improve on the motivational affect of a single-user equivalent. These and other findings are feeding into plans for future work, as the next section outlines.

Future Work

As part of work aiming to advance collaborative e-Health systems, there are three distinct yet related aspects of my work: existing practices, conceptual work and new system designs.

Ongoing review of existing e-Health systems will inform our future designs. It is important not to neglect traditional health systems, both effective and ineffective, because rich experience of their situated use and evaluation 'in the wild' has built up over many years.

Also, there is an existing body of conceptual work, namely activity promotion models such as the Transtheoretical Method (TTM) [11] and Social Cognitive Theory (SCT) [9]. Both acknowledge the social influences on health, but on the whole approach the individual in isolation within their theories rather than the individual as part of a social group. SCT has been shown to be ineffective visiting systems, which have already been shown

Collaborative Decision Making in Complex Safety Critical Systems: A Common Information Space Approach

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1.1 Introduction

Complex organizations encompass multiple distributed, interdependent workgroups that function autonomously yet are influenced by actions of others, thereby requiring cooperation and coordination of activities between these groups. In distributed work settings, information is distributed across operators and tools. The co-ordination necessary for the successful accomplishment of tasks is mediated through the construction and use of shared representational artefacts. The way in which information is represented and propagated across individuals shapes the interaction essential to achieve the required coordination (Marti 2000). Much research in the area of Computer Supported Cooperative Work (CSCW) has focussed on providing shared workspace systems (groupware, collaborative virtual environments, etc.) that support facilities for cooperative work by integrating information and representing activity. Research in this area has been mostly concerned with cooperation taking place within an organization. Apart from a few exceptions not much deliberation has been given towards inter-organizational cooperation, although other research fields such as Business Administration has been investigating this for a long time (Steven & Wulf 2002).

1.2 Research Focus

My research is concerned with understanding how people work in networked communities, and exploring the role of Common Information Space (CIS) in facilitating decision making taking place in such a collaborative setting. Also, the research is interested in how such a stance could be taken into account in the design of technology for work environments where information managed from various sources influences the coordination and cooperation between individuals involved and is vital for successful accomplishment of tasks. This work investigates how the notion of CIS can assist decision making in a time constrained safety critical environment, such as that of Air Traffic Control, by providing an information space within which people can collaborate, especially across work communities. Safety critical systems involve multiple agents and work groups who are distributed in time and space and are actively interacting with each other because of the interdependent nature of their tasks. The domain is complex because the system is dynamic, unstable, can vary in terms of the number of processes to be controlled simultaneously and the relationship between them, and requires cooperation between people, machinery and technology. The complexity is also due to the tight coupling between multiple processes, and the need to operate under time and various resource constraints. Also, the consequence of actions can result in catastrophic situations affecting human safety, economics, environment, and the like. This complexity places enormous demands on the individuals involved and has important implications for the design of systems intended to support collaborative decision making.

In such an environment, apart from the geographical distribution of work, there is also a cultural distribution. Therefore to coordinate activities across organizations not only is there a need for shared access to information but also common interpretation. Existing approaches such as Activity Theory (Bodker 1991), Distributed Cognition (Hutchins 1990) and distributed information resources (Wright et al. 2000) has helped to understand collaborate work and the factors affecting it such as context, environment, organization and social factors. However, it does not take the above mentioned factors into account while analyzing collaborative activity. This drawback could be resolved through the notion of Common Information Space **(**CIS**)** which is considered to be more suitable for analyzing distributed heterogeneous work communities (Fields et al. 2004). This notion concentrates on both representation of information and meaning attributed to it by the concerned individuals.

The most influential work in this area has been that of Schmidt & Bannon (cf. Bannon 2000) on how people in a distributed setting can work cooperatively using a common information space. Bossen (2002) attributes the value of this notion to its focus on the *interrelationship between information, actors, artefacts and cooperative work*. Work by other researchers such as Bertelsen & Bodker (2001), Bossen (2002) has contributed in sculpting this notion but literature provides a picture of how inadequate and fragmented this work is currently and also how sceptical the researchers are about the use of the notion because of its loose conceptual definition. The use of this notion raises various issues such as how and who will constitute the space, how will the interpretation of information be held in common especially across different professional communities, articulation work required to coordinate interpretation, etc. Apart from this, the safety critical nature of the environment creates additional constraints.

1.3 Research Contribution

Decision making has been perceived as an individual cognitive activity. In recent years however, it is considered to be a device for collaboration because people use decisions as devices to shl con06eo3ta

student and a very few use a GOLM – but how many of them contain both the notion of reflecting back group knowledge and a concern for what learners say to each other? Five systems have been selected and compared as representative of the state of the art.

Table 1

- *GLM*: the group model that reflects what happens when learner1 (L1) and learner2 (L2) work collaboratively to solve the group task.
- *IdealGLM*: the group model which is generated from merging the performance of each learner (ILM1 and ILM2).

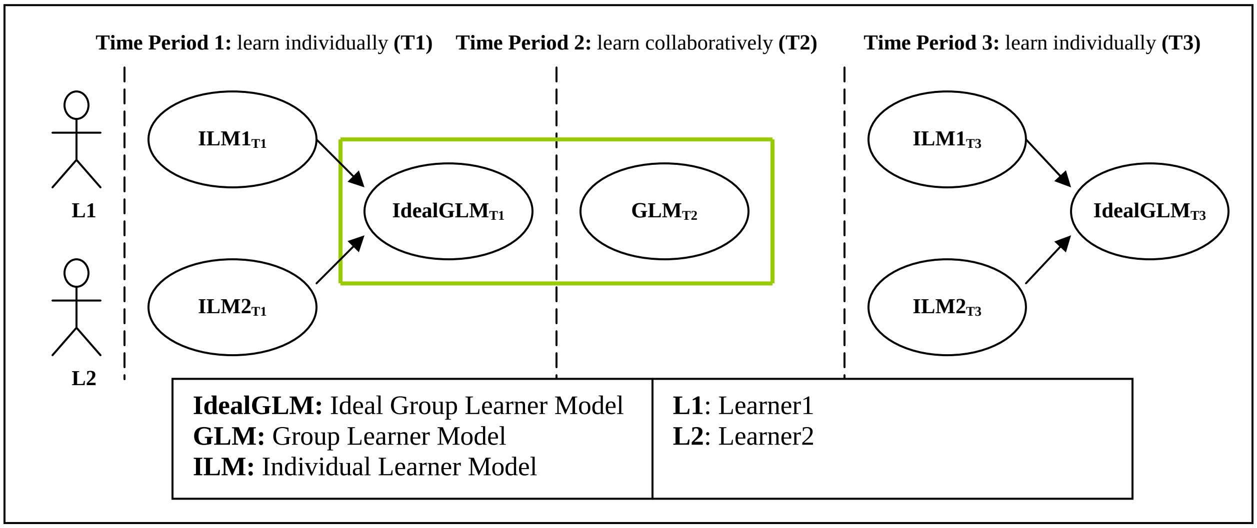

Figure 1: A Group Model diagram

In the system, both individual and group models are calculated over three periods of time (time

4. Conclusion

This work aims to encourage students to obtain an advantage from both collaborative learning and the use of an Open Learner Model in a computer-based learning environment in order to see if the result of collaborative learning with the ability to inspect a group model allows the learner to get a higher score than when unable to inspect the group model.

Learning improvements which have been demonstrated for many collaborative learning systems [6, 7, 9] and for Open Learner Models [1, 5, 8, 9] gives us reason to belief that our system, which combines these two approaches, will show similar improvements.

After this hypothesis is tested, further questions for this work include ‘is there any significant correlation between patterns of dialogue moves and the improvement of knowledge for each group?’ and ‘how general is this approach?’ We could also look at the difference between learners to see and not to see ILM_{T2} together with GLM_{T2} in order to see whether we need an ILM_{T2} in this system or if only a GLM_{T2} is adequate and ‘what theoretical reasons might there be for a GLM to be more effective than an ILM for individual learning?’

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approach, information will be modularized, hierarchically structured and displayed like visible in Figure 1. A complete explanation of this theory can be found in the paper "The Focus-Metaphor Approach: A Novel Concept for the Design of Adaptive and User-Centric Interfaces" [1].
For the further development and research, it is planned to conduct long term user studies and extensive in laboratory testing using eye-tracking equipment as well as physiological feedback to significantly improve the users' experience of online information environments. It is aimed to investigate effects of user confusion, user orientation and navigational behaviour, cognitive load and other related aspects.

Starting with Furnas' work on "Generalized Fisheye Views" [4], user interface visualizations using a focus + context approach became increasingly popular. Since then, many different projects have aimed to develop solutions to create contextual interfaces and Card's work at Xerox Parc on DOI trees [5] represents a quite popular alternative. But even today, these solutions target mainly an alternative form of navigation which links to external content. This represents a "cognitive break" within the interaction process, which might especially effect performance in more complex tasks and increases cognitive load. Another alternative is the direct application of Fisheye views for graphical visualizations [6], but these scenarios are only usable for very restricted domains, like maps, lists or the like.

In contrast, the proposed research is focussing on a much more holistic approach of combining this sort of contextual navigation with the actual presentation of content. The Focus-Metaphor UI is dynamic, seamless and optimized for cognitive load, offering a focus + context visualisation that aims to provide a personalised "window" onto the IS. This personalisation will be created through various means, manually by the user as well as automatically through a smart backend. Whilst work on this novel UI is one core area of research, the second area will be the design and integration of this smart backend in form of a novel feature rich tagging framework that allows structuring the entire information space and providing a personalised view for each user. With these mechanisms of social tagging, the IS will be structured and personalised in a semantic way. When accessing information, users will have control on displaying what is relevant and interesting as well as hiding unwanted or overhead information.

Relation to Workshop themes

At the core of the proposed research stands the aim to deliver a more intuitive and efficient experience of personalisation in web environments. One underlying thesis of my research is, that current web-based user interfaces are not designed for and do not work with personalised content. Their design is rigid and static, layouted in grids and tables, with rows and columns that blur the borders between information and navigation, between tools and content. Perceptual Bandwidth is continuously increasing [7], and when looking at phenomena like banner blindness [8] and second-visit blindness [9] it is easy to conclude that conventional interfaces represent a burden [10] and are more likely to confuse users than assist them in finding relevant information or services. Current efforts towards the provision of personalised content (like Google's personalised homepage, Windows Live or My Yahoo) lead the direction of future developments in this area. Nevertheless, this research is based on the hypothesis that the aspects mentioned above [7, 8, 9] represent critical drawbacks for effective personalisation like addressed nowadays by Google & co. and that the Focus-Metaphor approach will be able to provide a solution to these problems. By shifting the information architects) towards a more contextual explorative interaction [11] there might be the ability to create a new paradigm for a personalised Internet.

The planned work especially addresses

How can video-games deliver educational content in an intelligent fashion?

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models, are based on artificial intelligence techniques. The efficiency of ITS that are both ognitively and emotionally intelligent has been studied producing some interesting effects (Lester, Converse et al. 1997; Rebolledo-Mendez 2006).

Research Proposal

Although we do not question the effectiveness of ITS in enhancing, sometimes significantly, the children's performance we believe their use is confined to short interaction times, normally happening during school hours. Video games, in a striking counter position, prove to be a more engaging medium and seem to captivate children who effortlessly spend many hours in front of them. One of the reasons for this could be the child's perception of the video game as an extracurricular, fun activity. Another reason could be the context; as tutoring systems are normally used in the classroom, they might be perceived as "school stuff". It would also be interesting to study why children appropriate video games. Based on our experience, we have observed that children normally "own" video games and often share game-related situations with friends, whereas intelligent tutoring systems tend to be overlooked and do not receive the same degree of attention. To try to shed some light onto these issues, we have defined a set of four hypotheses:

1. Games are perceived by children as "fun", extracurricular activities.
2. Tutoring Systems are perceived as educational activities or "school stuff".
3. Games are more easily appropriated by children than educational software.
4. Children engage more intensely with video games than they do with tutoring systems.

Because of the intrinsically motivating nature of video games, we propose to examine the characteristics that make video games fun and develop a video game to deliver educational content and evaluate its effectiveness. Our approach to developing a video game, however, is unique as we propose to include cognitive and motivational modelling techniques borrowed from artificial intelligence. Our video game would be "intelligent" in the sense that it should be able to adjust the game experience considering the learners' state of cognitive development and motivation, just as successful ITS's do. The resulting product would be advertised as a video game with the hope that children perceive it as an extracurricular activity. By developing an intelligent video game, we could exploit the motivating benefits of video-games and at the same time retain successful, adaptive cognitive and motivational scaffolding te@tUm3@5qg7hebl ThTckeri :l+7c@ irmet

a. Identification of Science topics for year 5 that prove to be particularly difficult for children.
b. Identification of suitable game paradigms/stories/activities for these topics. The resulting activities should be suitable for different ability groups (according to SAT) and different motivational groups.
c. Although possibly different in structure (due to ability and motivational considerations) the various video-games' prototypes will share common objectives, thread and emphasis.

2. Development of a video game.
    a. Employment of learner-centred design methods for developing the video game, keeping in mind particular needs according to the child's cognitive and motivational development.
    b. Programming of a single game into a multiplatform CD to be used at home or at

well-structured task, such as multiple choice questions, they are likely to be accurate in their estimate of their performance, even if they have a relatively simple understanding of the knowledge. Using tasks that require students to represent their knowledge in ways that bring out the complexity of it, such as concept maps, may have the potential of improving their ability to successfully assess the current state of their knowledge.

The present research aims to address the following questions:

- Does knowledge monitoring of ill-structured subjects involve different processes to the monitoring of well-structured subjects?
- How does students' epistemic cognition impact on their knowledge monitoring of ill-structured subjects?
- What methods can be developed to assess students' ability to monitoring ill-structured subjects?

Metacognition in Ill-Structured Domains

Metacognition, broadly defined as 'thinking about thinking' has been widely recognised as an important aspect of learning. Researchers disagree as to what processes should be conceived of as components of metacognition and there is no universally accepted theoretical framework. However, the process of monitoring the state of one's knowledge is generally considered a metacognitive skill in current frameworks (Pintrich, Wolters & Baxter, 2000).

Although there is a substantial amount of research that has studied knowledge monitoring processes, it has largely focused on assessment of performance on well-structured problems. *Well-structured* problems are problems where the initial and goal states can be defined and there is a limited set of operations that can be applied on the initial state to reach the goal. An example is solving an algebra problem. In *ill-structured* problems, on the other hand, the initial state is not well-defined and there are unlimited ways of getting from the initial to an acceptable goal state, though the question of what constitutes an acceptable goal state is also debateable. An example is deciding whether recent climate change is due to the activities of humans. All scientific domains are ill-structured. However, at the novice level, learning in domains such as physics and mathematics involve predominantly well-structured problems in contrast with domains such as psychology and politics.

It has been argued that different processes are involved in solving well-structured and ill-structured problems (Kitchener, 1983; Jonassen, 2000). However, very little empirical research has attempted to investigate this. It is hypothesised that solving ill-structured problems is different in that it requires the learner to assess the epistemic nature of the problem and consequently their epistemic beliefs will influence their proposed solution.

Epistemic cognition

A person's epistemic cognition is the way they perceive the nature of knowledge and knowing. There is no single theoretical framework for conceptualising epistemic cognition (Hofer & Pintrich, 1997) and a number of different schemes have been developed for classifying different 'levels' of sophistication along a continuum of increasing complexity (e.g. Perry, 1970). In general terms, a person with a simple epistemic cognition perceives knowledge as absolute and 'discovered', whereas a person with a complex epistemic cognition views knowledge as relative and socially constructed. Recent research indicates that students' epistemic cognition plays an important role in learning (Hofer & Pintrich, 1997; Laurillard, 2002). A more complex epistemic cognition has been associated with more sophisticated thinking and problem-solving skills, higher motivation, and persistence (see Hofer & Pintrich, 1997 for a review).

Pilot study

The initial pilot study was carried out with a different set of research questions. However, the results helped inform the current line of research. The study was designed to explore the impact of epistemic cognition on how students collaborate in assessing their current knowledge, the gaps in this knowledge and what strategies to use in order to cover these gaps. The study was carried out in two phases, the first in an experimental setting with psychology students, and the second in a class setting with students taking a masters course in Interactive Learning Environments.

Participants

of knowledge on a topic. Different representations, such as concept maps, may support students in structuring the different pieces of knowledge thus making it easier for them to estimate their knowledge as a whole. On the other hand, estimating one's knowledge is dependent on an understanding of the wider scientific literature. The students who participated in the pilot study appeared to have a sophisticated understanding of the relationship between theory and empirical evidence. They were confident in their knowledge of the material they had read and demonstrated a deep understanding of it, but were not confident that this knowledge was complete.

Summary & Future research

Traditionally, researchers have assumed that solving well-structured and ill-structured

Metacognition in Context: a Study of Metacognitive Activity in a Pair Programming Class

Edgar Acosta Chaparro

been well established [8]. Resulting from their engagement in collaborative activities, individuals can often master something that they could not do before the collaboration [5, 9, 10]. From a Social Constructivist perspective, learning will occur in social environments which support rich interaction between a learner and his/her peers [11].

In the classroom, effective collaboration with peers has proved itself a successful and powerful learning method [10, 12]. Students learning effectively in groups encourage each other to ask questions, explain and justify their opinions, articulate their reasoning, elaborate and reflect upon their knowledge, thereby motivating and improving learning. These benefits, however, are only achieved by active and well-functioning teams [13]. Regardless of the subject area, placing students in a group and assigning them a task does not guarantee that the students will engage in effective collaborative learning behaviour [4, 10, 13]. This contradiction helped to motivate researchers to seek conditions in which collaborative learning might or might not be efficient.

Many conditions may affect the efficiency of collaborative learning. One factor is the composition of the group, which encompasses several variables [4, 14]. The group could have people with different skill levels (social, related to the task, etc), ages, gender, backgrounds, and so forth. Thomas, Ratcliffe and Thomasson [15] have looked for the importance of skill level in learning programming. They found that grouping people with similar expertise seems to be better. A previous studied conducted by Webb [16] with small groups found similar results regarding the ability of solving mathematical problems. Authors have also shown that social skill could impact on the collaboration. Crook [17], for instance, holds that there are features of interaction that are central for a successful collaboration, among them: intimacy among participants and histories of joint activity. Studies have also shown that collaboration varies according to the task [14, 18]. For example there are tasks that are essentially distributed and lead group members to work on their own, sometimes completely independently from each other. Another important variable is gender. Underwood and Underwood [19] in their study also looked at gender in children’s collaboration. They found that, for pairs, the combination girl-girl seemed to be more efficient.

Indeed, there is not one single variable that could be considered responsible for the failure or success of collaborative learning. Moreover, one of the problems is that most of the variables presented above actually interact with each other. For instance, the effect of gender on group composition is not the same with different group sizes or with different tasks. Therefore, research has to look at the mechanisms by which collaboration is efficient [14].

Metacognition and Collaboration

Flavell [20] defined metacognition as the notion of thinking about one’s thoughts. It refers to the active monitoring and consequent regulation of our cognitive processes. Putting it in simple words, it is thinking about thinking [21 p.1]. The development of metacognitive skills has proved to be beneficial in different areas of learning, such as reading comprehension [22], mathematics [23], combinatorics [24].

Research on how peer interaction could improve metacognitive strategies is limited and has produced contradictory results [25]. Eizenberg and Zalavsky [24], for example, examined the effect of collaboration in solving combinatorial problem on the extent to which control processes were employed. They noted that student who worked in pairs showed more metacognitive control, and performed better than students who worked individually. They reinforced the relation between collaboration and metacognition, suggesting that success in collaborative problem solving might depend on the extent where the peer interaction could generate metacognitive strategies, such as monitoring and regulation. Goos [25, 26] had similar findings; however she also noted that peer interaction is not always beneficial. She argued that there are some situations where paired decision making could hinder metacognitive decision. In her opinion, if during the collaboration students fail to share metacognitive roles such as idea generator, calculation checker, procedural assessor, etc the interaction could result in what she called metacognitive failure.

These conflicting results illustrated a gap in the literature. More need to be explored on the interplay between metacognition and collaboration. Does collaboration only exists in an interaction with signs of metacognition? Does metacognition always promote beneficial results? Therefore, this study aims to explore the relation of metacognition and collaboration in learning programming.

Pair Programming

Programming in pairs is not a new idea, but dates at least from 1970 [27]. What is new about Pair Programming is the way it has been structured in the eXtreme Programming[1] literature, enforcing its use in all phases of software development.

Essentially, Pair Programming is a situation where two programmers work side by side, designing and coding, while working on the same algorithm. According to Cockburn and Williams [28], who observed the method in academic environments, Pair Programming improves the quality of the software design, reduces deficiencies in the code, enhances technical skills, improves team communication, and it is considered to be more enjoyable for the participants. According to Cockburn and Williams [28], who observed the method in academic environments, Pair Programming improves the quality of the software design, reduces deficiencies in the code, enhances technical skills, improves team communication, and it is considered to be more enjoyable for the participants. Moreover, other studies [29-32] that compared the performance of Pair Programming students and solo students showed that the former were more likely to hand in solutions for their assignments.

However, literature has shown that similar to other collaborative learning situations, it is not always successful. Tessem [33], for example, showed that some students found the experience irritating, extremely inefficient and very exhausting. Gittings and Hope [34] found very similar results in their study where participants described the experience with Pair Programming as demanding and sometimes frustrating.

Conclusion

The present research aims to investigate the metacognitive activity of students who are learning programming in a collaborative context. Thus, this work intends to search for the evidence of metacognitive talk (monitoring and self-regulation) when students are Pair Programming. The main hypothesis driving the research is that collaborative programming, in this case Pair Programming, could enhance the students' monitoring skills to pursue programming problems, together with an improvement in self-regulation skills on cognitive strategies used to solve programming problems.

The outcome of this work could provide additional understanding on the topic for practitioners and programmian

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Social and Affective Processes in Collaboration: Building an Affect Sensitive Foreign Language Learning Community

Madeline Alsmeyer[1], Judith Good[1], Rose Luckin[2]

The focus of this project is the development of an environment which will support interactions and collaboration between language learners in Germany and in the UK. As a consequence, the remainder of this paper will focus on the affective and social issues which stem from learning collaborations between people and how technology might be used to support collaborators better.

2 The Social and Affective Aspects of Collaboration

The success of CSCL environments has been somewhat varied. Although a number a of CSCL-based research studies have described positive results and increased learning gains (Hallet, 1997; Von der Emde, 2001), there are equally a number of research studies which have reported negative results, including reduced learning gains, low levels of collaboration, low participation, and high drop-out rates (Belz, 2003; Ware, 2005).

Kreijns et al (2002) have hypothesised that the cause of these negative results is related to the lack of support provided by these environments to the affective and social side of the collaborative learning process.

Support for this hypothesis may be found in research which details the inextricable link between cognition and affect (Bower, 1992; Damasio, 1994; Schumann, 1997). Certainly, if a link between cognition and affect can be forged, then by definition any learning resulting from social interaction will also be dependent on the affective states of those involved, since the quality of interactions will be influenced by how much the collaborators trust one another, what risks they are prepared to take, and among other things, how motivated they are to collaborate and learn (Crook, 2000; Jones, 2005; Wegerif, 1998).

One approach which addresses the affective and social processes involved in collaborative learning is group dynamics, which is concerned with the scientific analysis of the behaviour of small groups.

According to group dynamics there are five main stages that any healthy group will go through, these are: *group forming*, *group storming*, *group norming*, *group performing* and finally *group adjourning* (Dörnyei, 1997). The processes that occur at each stage are wide ranging and need to be supported in a variety of ways. For example, within group forming the participants are likely to feel anxious, overwhelmed and lack confidence, they will be within a new group, but will not be certain of what is expected of them and what they can expect from the group. To support the group adequately through this stage, resources and tasks will need to be organised to help the participants become acquainted with one another and develop group norms. Methods which have been appropriated in face-to-face learning environments include: encouraging the sharing of genuine personal information, seating the students next to one another and providing contact outside the normal learning context (Dörnyei, 2003).

3 Supporting Group Dynamics through Technology

There are a number of well documented techniques that might be used in face-to-face learning environments to support group dynamics (Dörnyei, 1997, 2003; Dörnyei, Malderez, 1999; Hadfield, 1992), however of central interest to this paper is the way in which the group dynamics of learners collaborating at a distance from one another can be supported by technology. This section will focus in particular on the role of technology in supporting the groups through the *group forming* stage, emphasising in particular how technology might support trust building and friendship forming processes.

There has been some research on how trust and friendship can be developed in online collaborative business environments (Jones, 2005; Preece, 2004), but as yet there is very little research investigating how trust

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Does the improvement of affective state enhance the quality of student's answers?

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As, this paper is the continuation of our previous study (Yusoff & du Boulay, 2005), we present the result of a user centred approach experiment which was conducted to study the correlation between the improvement of student’s negative affective state and the quality of student’s answers. Positive results from these studies have yielded some evidence to support the need of domain-independent strategies integration into an intelligent tutoring system.

2.0 Experimental setup

The main research question of the experiment is to find the correlation between students’s positive affective state and student’s negative affective state with the quality of student’s answer in using the ESA framework. There were 28 unpaid students taking part voluntarily in this experiment.

The participants were asked to complete two experimental tasks. At the beginning of the experiment, participants were asked to self report their affective state at two learning stages: at the beginning of the lesson, and at the end of the lesson using the PANAS questionnaire. The PANAS questionnaire consists of 18 different positive and negative emotions in a scale of 1 to 5 used to gauge the level of student’s positive and negative affective state. It was then followed by a 15 minutes learning session. During this session, students were asked to select and answer their preferred learning topic. To assist the students, notes of the selected topic which include selected examples were provided.

3.0 Results and discussion

The study of the relationship between student’s affective state and the

Correlations

		Quality	Positive Affect
Quality	Pearson Correlation	1	.152
	Sig. (1-tailed)		.220
	Sum of Squares and Cross-products	8.024	1.807
	Covariance	.297	.067
	N	28	28
Positive Affect	Pearson Correlation	.152	1
	Sig. (1-tailed)	.220	
	Sum of Squares and Cross-products	1.807	17.569
	Covariance	.067	.651
	N	28	28

Figure 5: Correlation between the positive affect and the quality

Correlations

		Negative Affect	Quality
Negative Affect	Pearson Correlation	1	-.348*
	Sig. (1-tailed)		.035
	Sum of Squares and Cross-products	32.527	-5.627
	Covariance	1.205	-.208
	N	28	28
Quality	Pearson Correlation	-.348*	1
	Sig. (1-tailed)	.035	
	Sum of Squares and Cross-products	-5.627	8.024
	Covariance	-.208	.297
	N	28	28

*. Correlation is significant at the 0.05 level (1-tailed).

4.0 Conclusion

Results from the experiment have provided evidence that the improvement of student's negative affective state significantly contribut

Designing a Prospective Memory Aid for Cognitively Impaired Elderly Individuals

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ABSTRACT

This paper introduces a technology mediated prospective memory aid for elderly individuals with memory impairments. The design of this device utilizes the user centred design approach, aiming to involve the users in every step of the design process from design conceptualisation to operation. The purpose of this research was to develop a usable piece of technology to act as a surrogate memory for those individuals with prospective memory problems enabling them to live relatively independent lifestyles.

INTRODUCTION

This paper presents the concept for the design of a memory aid for cognitively impaired elderly individuals. The proposed device is a prospective memory aid for elderly individuals whom are reliant on external aids to help them remember to perform future tasks. The concept was to design a tool to help individuals with very mild to early Alzheimer’s disease (AD) to help prolong an independent lifestyle. The proposed device will be a mobile memory aid, which displays reminders appropriate to the users needs (i.e., text, alert sound, voice over) at particular times. This reminder can be accepted and confirmed when the task is completed, postponed or ignored, in which case the carer will receive a message that the reminder was not seen.

Although prospective memory aids have already been developed in modern technologies, for example functions on mobile phones, computers etc., the design of these devices are not appropriate for the physical, cognitive and social factors common with aging. Therefore the current research takes these issues on board to help construct a usable and efficient device for the elderly population. It is important that the design is inclusive for all users so that it can be used by carers as well as memory impaired elderly individuals.

Technology for the Elderly

The interest in designing technology for older adults is increasing. This has in part to do with the increasing life expectancy of people and the rapid aging of society that is predicted in the 21st century. Demographic studies have estimated that the percentage of older adults in Ireland will have doubled from the year 2000 to the year 2050. The fastest growing subgroup represents those over 80 years of age, increasing by 5.2% in 50 years. According to population projection, this aging trend will be seen across Europe, with older adults almost 35% of the population by

Prospective Memory

Prospective memory involves remembering to do things at the right time and prospective memory tasks are pervasive to daily living (Driscoll, McDaniel, & Guynn, 2005). This ability is vital for everyday living and failures in prospective memory can result in a range of consequences, from missing appointments to forgetting to take medication. Individuals who have impairment in their prospective memory have to depend on other individuals or external aids to help them remember to do things in the future.

Studies investigating age-related effects of prospective memory have revealed suprising results. The majority of these studies implement telephone or mailing tasks in which the participant is required to contact the experimenter at particular times. Although it was predicted that younger participants would perform better than older participants, in the majority of these studies a positive age effect was found (Henry, McLeod, Phillips, & Crawford, 2004). It is believed that older individuals outperform their younger counterparts by using external aids or reminders. Several studies have also shown that individuals, even in the late stages of AD, can benefit from the use of external memory aids in their environment (Nolan & Mathews, 2004)

It is believed that difficulties in prospective memory tasks could be an early indicator for the onset of AD (Huppert & Beardsall, 1993). Huppert & Beardsall proposed that in contrast to retrospective memory tasks where participants with mild Alzheimer's perform at a level between normal and more demented participants, individuals with mild Alzheimer's perform just as poorly as demented participants on prospective memory tasks. This finding suggests that remembering to execute intended actions may be particularly disrupted in the early stages of AD.

Related Work

It appears that the bulk of the research into electronic prospective memory aids focuses on the development of technology for patients with acquired memory impairments to manage prospective memory failures. The methodologies used in these studies included case studies and clinical trials following brain injured patients' treatment and training using various technologies prospective memory aids (Wilson, Evans, Emslie, & Malinek, 1997; Thöne-Otto & Walther, 2003). Neuropage (Wilson et al.) was designed as a portable paging system for memory impaired patients. Users are reminded through an alarm/vibrator alert with explanatory text and control the device with a single large button. The simplicity and ease of use of this memory aid is an obvious benefit to a brain-injured patient. It also however restricts the systems flexibility. For example, the device fails to provide a feedback and reminder delay function and any schedule changes have to be made through a paging company. Thöne-Otto and Walther compared two standard devices as memory aids, a palm organizer and a mobile phone and found some common usability problems. Patients reporg t5h an alarm(clin bu7tto6l 06 Tc 0.1ad)-1to A9(e)1cp81t6(m) 0 0 12 let8ca experienced by the impaired individuals and the strategies they used to help them. Some answers were widely varied and often dependent on the individuals living status, physical impairments and financial well being. From these methods several points were highlighted. It was found that the majority of the participants had little technological experience and that they believed new technologies were too complicated for them to use. The most commonly used external aids were calendars, written notes, putting objects in conspicuous places and asking someone to remind them. The majority of carers believed that the proposed device would be useful for when they could not be present on the condition that it accommodated their physical needs (e.g. voice reminder for blind user). Overall these findings provided a positive attitude towards a prospective memory aid from both groups and pointed out the issues that where important to the user including cost, ease of use and design requirements.

FUTURE WORK

The information from initial interviews and questionnaires will be used for the design of the prospective memory aid prototype. Before designing the prototype, a layout analysis for the design interface and structure will be carried out with elderly participants, to gain an idea of preferred styles, layout and functions. This data will be used for the first prototype design and following an iterative process will lead to a fully functional prototype to be tested and evaluated by potential users.

CONCLUSION

Prospective memory problems have been shown to be one of the first symptoms of AD and also the most frustrating for both sufferers of the disease and their carers (Huppert & Beardsall, 1993). Although prospective memory aids have been developed and have shown to have a positive effect on performance, these devices do not cater for the limitations common with aging. The current study is a work in progress; to design a technology mediated prospective memory aid which meets the capabilities and limitations of the older user as identified in the user centred design process.

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Hermes@Home: Keeping in touch with the home

Finally, it should be noted that there has previously been some research in issues related to communication, such as awareness and intimacy. In [10] the writers are discussing awareness issues with elderly family members living separately from the rest of their family, while [11] discusses interesting ideas and designs for interactive systems supporting intimacy

System Description

Hermes@Home is a system which allows people to send messages to their home (these we call the 'away' users). People at home (the 'home' users) can also send messages to people away, through a custom-built unit, which is deployed in the home and also handles displaying received messages. A sketch of the system architecture is displayed in Figure 1 below.

Figure 1: Hermes@Home system architecture overview

The 'home' unit is currently a modified TabletPC running Windows XP. The software is written in Java, and uses the Java Media Framework for webcam access allowing for cross-platform deployment. The touch screen on the TabletPC provides for more intuitive interaction than the traditional mouse and keyboard input methods, especially for members of the household that might not be experienced or comfortable with computers. This is important as such users can be commonly expected to use the system in the home environment. The unit is also equipped with WiFi, meaning it is also portable within the home, at least for as long as battery life permits it.

Figure 2: The Hermes@Home Graphical User Interface for the home unit.

The 'home' interface (see Figure 2) takes up the whole display area and allows users to navigate through received messages on its left half and acknowledge the ones they have read. To send a message they can simply scribble it on the yellow pad on the right and send it with a single click, adhering to the requirement for a simple design. This expressivity and character of 'handwritten' notes, created through an 'always-accessible' system, are areas where Hermes@Home complements other commonly used communication technologies, such as e-mail and SMS.

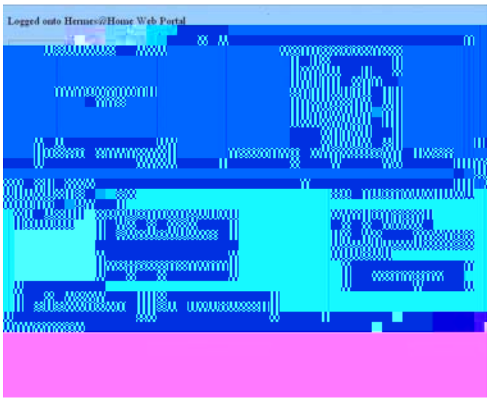

Figure 3: The Hermes@Home interface for the away user

The 'home' unit can also be equipped with a webcam, which can be set to take regular pictures of a set location. This webcam is, of course, optional as privacy issues can easily arise. It can, however, provide the away user with a pleasant, up-to-date reminder of home, which promotes awareness, that can couple as a monitoring device, e.g. for periods the house is empty.

The 'away' user interface (see Figure 3) for sending and viewing received messages is accessible online removing the need for a second unit. The interface is available wherever there is Internet access, whether this is an Internet café, WiFi access in a conference, or potentially WAP on a Smartphone, etc. This interface is currently under redesign, in order to improve usability. Throughout, we are adopting a HCD approach, by informing this redesign by feedback from past users, which have identified a number of flaws in the design.

Human-Centered Design in the Hermes@Home System

The Hermes@Home system is a communication tool, for use in real homes, enabling the study of communication patterns. The services offered by the system, however, are expected to suit certain households more than others, as different households can have different established methods of communication. To ensure the validity of this study, system

CCTV Control Room Collaboration and Communication: Does it Work?

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Abstract

Despite the increased usage of surveillance systems and the technological advances, there is currently no conceptual basis and little evidence to assess how well CCTV actually works for the purposes for which it is deployed. It is important to identify whether CCTV systems and applications meet stakeholder goals, and support human operators effectively, in attaining the goals for which the system is set up. This exploratory paper highlights the early findings found in CCTV control rooms. A series of ethnographic observations along with semi-structured interviews were carried out at six CCTV public surveillance control rooms – six managers, six supervisors and 25 operators were interviewed. Findings reveal that current control room systems are not designed to support operator and system communication and collaboration when performing their tasks. Poor linked technology and a lack of task coordination was evident between operators and external agencies such as police operators and local businesses. Several Human Computer Interaction (HCI) issues were uncovered from the fieldwork. Findings will be used to form a set of best-practice CCTV control room design recommendations.

1 Background

1.1 Research Problem

A number of studies have investigated how dynamic systems and processes are managed by operators in control room environments such as air traffic control and nuclear power plant control centres. Despite this, there appears to be very little HCI research in security and surveillance control rooms. In the last decade, we have seen several changes take place in security - with a rise in crime rates, and the type and severity of crime events have also changed. Consequently the public's perception and fear towards crime have also changed. More funding is available for CCTV and more advanced CCTV technology is also available. These changes have led the research discussed in this paper to form a number of important questions: How are CCTV control room managers managing new digital technologies? Do operators understand how to use digital technology and multiple systems/tools? The overall question this research attempts to tackle through exploratory cognitive ethnography is: Are public surveillance control rooms operating effectively and efficiently. This research focuses on the difficulties operator face with control and co-ordination of surveillance tasks. The relationship and performance of communication and collaboration between operators and external agencies, information management and task performance effectiveness and efficiency were explored using cognitive ethnography techniques (see Hollan, Hutchins and Kirsh., 1999).

1.2 Previous Control Room Research

Luff and Heath (1999) examined how control room operators used CCTV and other technologies within an underground transport control room environment. Luff found that the control room technology was difficult to manage because there were "*so many separate interconnected* *systems…and the use of these systems are thoroughly embedded within the many disparate activities of the personnel."* From this study, various user-system interactions were considered, however very little focus was placed on the HCI barriers to task operaderedba times. An observation checklist of ideas and areas of interest to the observer was followed (tasks, equipment, communication, workspaces etc.) which was used as structured protocol for the observation exercise. Operators and supervisors throughout the observation period were informally asked questions about 'what was going and why they did tasks in that way.' Responses were recorded and supported the observation notes.

2.1 Technology and Setup: Mapping Geographical Information

A recurring problem found in a majority of the control rooms was the way in which operators' located CCTV screen(s) when attempting to follow a vehicle or person. Operators used paper-based geographical street maps with lists indicating the street names and camera numbers. Many of the operators said for this type of task, *"having good local area knowledge was important."* Despite this, a minority of the operators lived in the areas they observed on-screen. Operators regularly shouted to colleagues across the room if they were stuck and could not recall the camera number or its location. Operators shouted louder and in a panic-like tone particularly when communicating with police operators via telephone or radio to follow targets of interest on-screen. The use of physical paper maps is a risky, ineffective, and inefficient method for searching and tracking targets. Paper maps can go astray and losing a map would lead to guess work, which adds unnecessary time to the task. Several managers reported that considerable funding was granted by senior councillors and the Home Office for adding additional CCTV cameras to their systems. Many of the operators complained that there were *"too many cameras to cope with"* and found these additional cameras were often not updated onto the paper maps and camera lists.

A method to improve the efficiency and effectiveness of searching and selecting cameras would be to link the camera monitor views with a graphical user interface (GUI) linked to a geographical map of the surveillance areas linked to a comprehensive database of camera names and street locations. Such a method would avoid operators mishearing numbers and locations when shouting information across the control room; it would also avoid the risk of confusion. A simple coordinated tool can be used to allow operators to communicate with a common understanding of the situation.

2.2 Reactive Surveillance: Information Overload and Poor Radio Language

Often, control rooms are thought of as small, dark underground rooms filled with surveillance cameras wall to wall, with a handful of operators idly waiting for something to happen on video monitors. This is untrue. In fact, tasks are not so much video driven and are more audio driven. Operators perform two key surveillance tasks - proactive surveillance (watching and waiting for something to happen) and reactive surveillance (responding to alerts from outside control room to react to a crime or suspicious event). From the two, the most frequent surveillance task operators perform was the reactive surveillance task. The most heavily used communication tool used for this task was the police and business radio. Close observations of operator actions and operator remarks showed that there were clear signs of cognitive overload with radios and telephones. Several operators commented that *"the control room radio has too many different channels assigned and sometimes it can be too confusing what's going on, especially when the phone is going off as well."* Operators also complained that business radio users such as city centre shop managers gave too much unnecessary information and that they did not give clear descriptions of targets. Excessive radio groups and poor information flow between users are two of the most common causes of cognitive overload: (1) too much information supply and (2) too

permitting, for example, frequent shifts of attention and side-by-side comparison of documents, while electronic documents on a screen do not. Electronic documents offer a few benefits: they support up-to-date interactive content; they allow more complex interaction such as hypertext, alternative visualizations, and keyword searching; and they are easy to store, access and distribute securely and quickly.

Paper documents are therefore the superior medium for document-centric meetings in which the participants are co-located. They provide a shared visual workspace that all participants can see and in which participants can easily navigate documents and make gestures and annotations. However, geographically-separated participants cannot use paper in this way, and they can achieve a shared workspace with electronic documents only by using a conventional computer screen with an application-sharing system such as Microsoft NetMeeting. These systems suffer the problems of electronic documents described in the studies above.

Virtual Paper on a Large Tabletop Display

We aim to use a large tabletop display to create a system that allows users to interact with electronic documents in a way that overcomes the shortcomings identified in the studies above. Our system will support document-centric meetings involving co-located and remote participants by providing a shared workspace in which participants can interact effectively with electronic documents. The design we describe here is motivated by findings from our preliminary work and the studies described above.

Electronic documents will be projected on the display as life-sized sheets of virtual paper. Documents will show two pages at once, rather like an open book (Figures 1, 2 and 3). As with real paper documents, participants will use bimanual hand gestures to flick through pages one at a time, to move documents around the table surface for side-by-side comparison, and to add bookmarks. Each participant will have their own stylus with which they can add free-form digital annotations to the documents.

Remote or mixed-presence collaboration will be possible between two geographically-separated groups. Each group will collaborate around its own display, and the two displays will be linked so that both show the same shared view of the task. Thus each participant will be able to navigate the documents and create annotations for the other participants to see. Telepointer traces or some other form of embodiment will follow each participant's hand and pen positions (Figure 4) allowing participants to gesture remotely to each other and to parts of the text. An audio channel connecting the two sites will allow the participants to hear each other.

As preliminary work, we have implemented a system based on the Escritoire project [2] to support virtual paper documents and hand input for remote but not co-located collaboration (Figures 1 to 4). Our early observations indicate that participants are comfortable using hands and a stylus to gesture to remote participants via telepointer traces, and that hand gestures are likely to be an effective way to navigate long documents if the gesture recognition system is reliable. We are currently implementing the full system proposed here.

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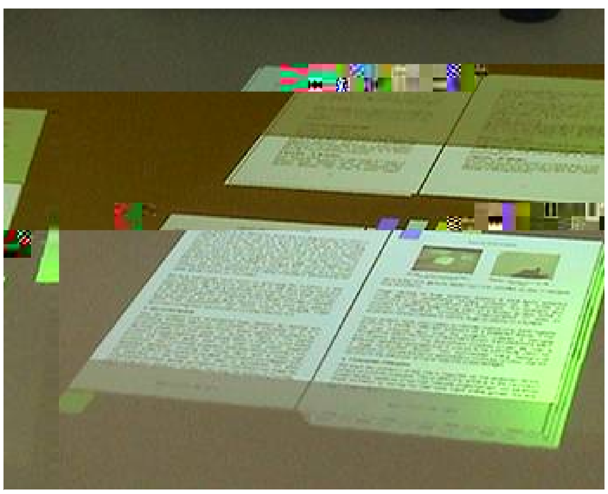

Figure 1. Virtual paper documents on a large display.

Figure 2.

Participatory Design, Artistic Tools and Severely Disabled Participants

Cian O'Connor

Politically we need to consider on whose behalf we are designing new systems. Given the challenges of communication, it would be easier to rely upon the expertise of disability professionals (e.g. doctors, social workers, psychologists). However, these informants will have their own prejudices about the participant's capabilities/needs formed by their professional training, and this may conflict with the views of the participant. The expert may assume (and this is particularly likely if the participant has a learning disability) that certain things are beyond, or inappropriate for, the participant. Given how profoundly technology could transform the lives of disabled people, we should be trying to give them as much control over this process by involving them as much as possible in the design.

Pragmatically, the gulf between the designer and the disabled user will be greater than that there would be with an able-bodied user. While research methods such as ethnography can yield insights into the disabled experience (e.g. [1,3]) – the experts will be the disabled users. Many inappropriate systems have been designed for disabled people, because disabled people were not consulted in the design process [2]. If we want to design effective systems, representatives from our disabled user base should be involved in as much of the design process as possible. This is particularly true when designing ludic, or artistic, tools – as the only criteria for success is whether the tools are seen as relevant by the disabled user.

Philosophically, there is a significant experience gap between designers and disabled people, and this will cause significant communication prob

There is no way of the designers to test whether the participant has understood an explanation. This means that if there are problems using a prototype, we will not know if the problem is understanding, or the functionality/purpose of the tool.

Through the evaluation, we learnt that he was interested in reviewing and selecting video from previously shot footage. We also learnt, to our surprise, that he was as interested in creating still images from the footage, as he was in defining shorter video clips. This suggests that not only can we use simple prototypes to test our assumptions, but also to gather requirements about our participant's requirements.

Current Work

The work described in the previous section suggests that for these speculative prototypes to be successful as, they needed to be simple and give immediate feedback. This would allow the purpose of the tool to be learnt by the participant through use. It is likely that one reason for the failure of the Video Assembly Probe was that its only feedback was through changes to an abstract representation of an assembled movie (the storyboard). This change in representation is essentially meaningless to anyone who has not already learned what this metaphor represents. I plan to address this problem at a later date.

Building upon this work, I have built a tool that allows my participant to mix video loops in real time. It has three controls: left, right and select - the latter control causes a new clip to be projected on a separate screen. The tool is both simple, with appropriate and immediate feedback. If early trials are successful we plan to use it in a variety of different contexts ranging from personal (as the basis of conversation with friends), to club nights. This tool will both help us to understand what our participant's requirements are, while educating him about the possibilities of video.

Conclusion

In this paper I have discussed how I have adopted a PD approach to designing artistic tools for profoundly disabled users. Given the profound challenges of communicating with profoundly disabled users, I have used speculative prototyping to allow my