Dr Leila Alem

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OVERVIEW

I am a passionate and entrepreneurial principal researcher in Human Computer Interaction with a drive for designing and delivering innovative digital products, services and user experiences of compelling values to create novel and competitive business models in the digital economy.

I have recently joined ThoughtWorks as a Principal Consultant & Principal HCI scientist. I have , for over two decades, been Principal Research Scientist at CSIRO and for the past 7 years Research Team Leader of the User Interaction and Collaboration team. I hold an Adjunct Professor position at UTS/FEIT at the Human Centered Technology Design research laboratory.

My formal training is in artificial intelligence and cognitive psychology. Over the past 23 years of my career at CSIRO , in a client facing capacity I have actively integrate user research into industry funded projects to deliver impact. Operating in a multi disciplinary team I have designed and evaluated various advanced user interfaces for domains including mining, aviation, automotive and health. My main research draws on cognitive psychology, social science and human-computer-interface research to investigate the media factors, the cognitive factors and the social factors at play in video based collaborative ICT environment. My most recent interest is to explore new frontiers of Human Computer Interaction (HCI) research to enable novel digital services using emerging technologies such as mobile, wearable technologies and augmented reality. My focus is on designing collaborative ICT solutions to support the delivery of new digital services that are easy to use , that offer compelling users experiences and that enable new business models in the digital economy. My international profile & science citizenship is strong and sustained as evidenced by numerous invitations as salaried visiting professor to a number of overseas HCI research groups, editorials, member of editorial teams of international journals & books, keynotes at international conferences, PC member of international conferences on collaboration technologies & HCI , reviewers for international journals (Int journal of applied cognitive psychology, International journal on computers and human behaviour, International journal on Advances in Human computer Interaction).

I have, over the past 7 years, lead the User Interaction and Collaboration research team within CSIRO Digital productivity and services flagship program. My team's research has

been focused on designing collaborative technologies to enable the delivery of innovative B2B digital services to achieve impact . This effort has been recognized externally, my team achievements and recognition , all under my leadership, include:

- Winning 3 state innovation awards : Insect Scan won 2014 ACT iAward in R&D, ReMoTe won 2013 NSW iAward in R&D (my own work) and RIDES won 2009 ACT iAward in e-health.
- successful commercialization of two of our collaborative ICT technology platforms.

My team has successfully contributed to the delivery of innovation in digital services in a range of industry sectors.

The contribution to the delivery of digitally enabled services in the mining sector includes:

- The development and demonstration of tele operation of two mining equipments (tele operation of the rock breaker and teleoperation of the shiploader, two projects externally funded by Rio Tinto),

- The development of the remote mining engineer platform to allow an off site mining engineer to remotely deliver their services to their onsite clients.

- The development of remote mobile tele assistance platform (ReMoTe) to allow an offsite specialist to assist in real time an onsite maintenance operator at their customers site.

The contribution to innovation in the digitally enabled health services include :

- The development , deployment and evaluation of a telehealth system to allow a remote specialist to consult a patient at the emergency department of a hospital in order to reduce cost of patients transfer(Viccu a telehealth platform commercialised to Telstra) and reduce cost related to patient's access to health services (RIDES tele health platform)

- NBN tele monitoring of chronic disease patients : A multi state multi sites national trial to reduce use of health services (visit to GP and hospital) through the remote monitoring of chronic disease patients. Project funded by DoHA, 3m value.

- Remote and Rural health Services project : a study of the delivery of health services to remote and regional Australia.

The contribution to innovation in digitally enabled training and education services :

- VCEAM project funded by Boeing (1.5 million) consisted of the development of a tailored Remote mobile collaboration platform (www/csiro.au/remote) to Boeing needs. As a result of the success of the

project, Boeing is undertaking to use ReMoTe for its training and maintenance operations.

- The 3D educational project is allowing school students all over the country to virtually visit cultural institutions while learning STEM skills. This work is done with the department of Communication (1.5 million) it draws on tele immersive technologies to generate 3D online education experiences.

As an individual, I have been successful in building positive relationships and trust through strong on-time delivery of R&D projects and high quality work with both internal and external stakeholders. I have been successful in proposing , securing external research funding and leading as the principal investigator of over a dozen major research projects in Australia, USA, France, Italy and Spain. I have over 20 years of experience in the successful delivery of multi disciplinary R&D projects in the mining, manufacturing, health industries as well as for government departments. Most recently I lead a project for Boeing Research and Technology in Seattle. The project demonstrated the feasibility and value of deploying ReMoTe (www.csiro.au/remote) for the delivery of training and engineering services. The success of this project has lead to the commissioning by Boeing of two units of ReMoTe. I won the 2013 NSW State Innovation Award in R&D for this research work.

I have a strong track records in initiating, defining, securing funds and delivering international research collaborations. I have over 10 years of leadership of strategic projects for industries such as Mining, Manufacturing and Health.

EDUCATION

- Opportunity Evaluation: one subject of the Master in Entrepreneurship and Innovation , Swinburne University, Melbourne, Australia (2002).
- PhD in Artificial Intelligence. University of Nice Sophia-Antipolis, France (1991).
- Postgraduate degree in signal and image processing. University of Nice, France (1987).
- Masters in Electronics and Automation. University of Nice, France (1986).
- Bachelor (1983) In Mathematics and information science. University of Poitiers, France

AWARDS and PROFESSIONAL AFFILIATIONS

- Adjunct Professor at the Faculty of Engineering and Information Technology, University of Technology Sydney (Oct 2014).

- Winner of the State NSW Innovation Awards in 2013 for the work on remote mobile tele assistance (www.csiro.au/remote).

- CSIRO Staff Award 2012 from CSIRO Future Manufacturing Flagship in recognition of the delivery of VCEAM project to Boeing BR&T under tight time frames and challenging operational circumstances .

- Nomination for Julius Award by CSIRO MDU in 2009.
- Adjunct Senior research fellow at the department of computer science of the Australian National University (since 2009).
- Honoured member in research by Princeton Premier in 2008.
- Adjunct Senior research fellow at the computer human adapted interaction group, school of information Technology at the University of Sydney. (2007 to 2012).
- Adjunct research fellow at the Faculty of Information Technology UTS Sydney (2006-2007).

KEYNOTES and INVITED TALKS

- Keynote ICEC 2014 : International Conference on Entertainment Computing , Sydney 1-3 Oct 2014.
- Invited Talk at the Advanced Mining Technology Centre, University of Chile, Santiago" The Augmented Maintenance workers using Wearable and Augmented reality technologies " (Sept 2014)
- Invited Talk at the University of Nice Sophia-Antipolis, France." Collaborative systems using Wearable and Augmented reality technologies : a HCI perspective" (July 2014)
- Keynote: IEEE ISMAR 2013 Workshop on Collaboration in Merging Realities , Adelaide , Oct 2013.
- Keynote : " Human Factors in Telepresence" Innovative Technologies program of the Scuola Superiore Sant'Anna, Pisa, Italy , Sept 2011.
- Invited talk as part of SIGCHI Toulouse local chapter "Human Factors and augmented reality systems" IRIT, Toulouse, France ,Sept 2011.
- Invited talk as part of SIGCHI Toulouse local chapter "3D collaborative UIs : an exploration of interaction techniques", Toulouse, France, Oct 2009.
- Invited talk as part of the International Masters on Telerobotics of the Scuola Superiore Sant' Anna, " 3D UIs for supporting remote collaboration" Italy, Pisa (Oct 2009).

FUNDED INTERNATIONAL VISITS

- Salaried visiting professor at University of Nice Sophia Antipolis (July 2014)
- Salaried visiting professor at SSSA, Italy (June 2012)

- Salaried visiting professor at the University of Paul Sabatier (June 2011)
- Salaried visiting professor at University of Valencia, Spain (2005)
- Salaried visiting Professor at INRIA Sophia Antipolis, France (2001-2002)
- Salaried visiting Professor at IREMIA , France (2000)

GRANTS

- Visiting Professor grant of the University of Nice Sophia-Antipolis (June 2014).
- Visiting professor grant of the Scuola Superiore Sant'Anna , Pisa, Italy (June 2012).
- Visiting Professor grant of the University of Paul Sabatier (June 2011).
- Visiting Professor grant of Valencia University of Technology, Spain (2005).
- Visiting Fellowship/Specialist grant of INRIA Sophia Antipolis for one year (2001-2002).
- Visiting Fellowship grant of IREMIA, France (2000).
- CSIRO MDU Flagship Collaboration funds to help develop collaboration with Preco Lab, SSSA / Pisa (2010).
- CSIRO MDU Flagship Collaboration Funds to help develop collaboration with CMU Robotic Lab, USA. (2009).
- International Collaboration Grant from Spanish Government (20K Euro)for collaboration between Valencia University and CSIRO ICT(2008-2009).
- ARC grant for post doctoral research at Sydney University , about $35.000 gross for one year (1991).
- Grant for PhD studies from the French Research Ministry (MRT), about $40.000 gross per year over 3 years (1987-1991).
- ARMINES (Ecole Nationale des Mines de Paris) grant for postgraduate studies (1986).

SCIENCE CITIZENSHIP

- Member of The Human Factors & Ergonomics Society of Australia Inc (since 1996)
- Member of The International Ergonomics Association (IEA)
- Member of SIG CHI
- PhD examiner for thesis at Scuola Superiore Sant'Anna (2013)
- PhD examiner for Thesis : Body Language Availability in Video conferencing, by Cameron Teoh. University of Otago, Dunedin, NZ (2011)
- PhD examiner for Thesis : Understanding remote collaboration by Jorg Hauber University of Canterbury, NZ. (2008)

- PhD examiner of Thesis : Methodology for the design of intelligent decision support systems by Andrew Blair, UTS. Australia (1996)

SUMMARY OF PROFESSIONAL EXPERIENCE

- Research Team Leader User Interaction and Collaboration at CSIRO Digital Productivity and Services (since 2007).
- Project Leader Visual Clues for effective aircraft maintenance, a project within CSIRO Future Manufacturing Flagship (2012-2013).
- Project Leader Human System Integration a project within CSIRO Minerals Down Under flagship (since 2009).
- Research Leader of the Human factors in Telepresence Team CSIRO ICT Sydney (2004-2006).
- Project Leader Technologies for supporting information sharing. Site Manager. CSIRO Division of Information and Communication Technology, Australia, Melbourne.(2002-2004).
- Senior Research Scientist: AI in e-commerce. CSIRO Division of Mathematical and Information sciences, Australia, Sydney (1997-2000).
- Research Scientist: computer supported Learning and HCI. CSIRO Division of Information Technology, Australia, Sydney (1992-1997).
- Research Assistant at the Department of Architecture and Design Science, University of Sydney (1991-1992).
- PhD fellow at INRIA Sophia Antipolis , Lecturer at the University of Nice, France (1987-1991).
- Research fellow at l'Ecole Nationale des Mines de Paris, France (1986).

POSITIONS AND DUTIES at CSIRO

- **Research Team Leader , User Interaction and Collaboration at ICT Centre, CSIRO, Canberra and Sydney, Australia, 2007-2014**

In my role as Research Team Leader, I lead the User interaction and Collaboration (UIC) Team which comprises 8+ research staff, 6 PhD students and over 12 distinguished visiting scientists and interns. The research team was split between Canberra and Sydney and research projects typically involve staff from the team as well as staff of other CSIRO Divisions.

My team leadership role consisted of a leadership of capabilities role as well as a customer facing role. l built and managed relationships with external stakeholders. I drove creativity and innovation to deliver impact. I developed deep collaborative

relationships with external stakeholders in order to become their business partner of choice.

The User Interaction and Collaboration team explores new frontiers of HCI research to design, implement and evaluate advanced collaborative technologies drawing on wearable computing, mixed reality and 3D UI. The team investigates advanced tele-collaboration technologies in order to enable new digital services that are easy to use and adopted by users. We study users while they interact and collaborate with others in ICT mediated environments with the aim to enhance users experience. We focus on designing collaborative solutions to support the delivery of new digital services in health, maintenance and education domains. In the last 5 years, the team has won 3 state innovation awards and one of the collaborative platform developed by the team has been successfully commercialised. We are one of the few research group in the world with the capability to build deployable Collaborative Platforms that allow people to perform physical tasks (e.g tasks requiring manipulation of physical objects or tools) regardless of their physical work environment. We are one the very few research teams to have successfully deployed our technologies in workplaces such as hospitals, manufacturing sites and bio-security research environments in order to achieve impact.

Our science impact is around reducing cost and improving productivity through novel ICT enabled services .

Our contribution to enhancing the productivity of the **mining sector** includes:

- the development and demonstration of tele operation of two mining equipments (tele operation of the rock breaker and teleoperation of the shiploader, two projects funded by Rio Tinto),
- the development of the remote mining engineer platform to allow an off site mining engineer to remotely collaborate with onsite clients.
- The development of remote mobile tele assistance platform (ReMoTe) to allow an offsite specialist to assist in real time an onsite maintenance operator.

Our contribution to innovation in the **digitally enabled health services**

- The development , deployment and evaluation of a telehealth system to allow a remote specialist to consult a patient at the emergency department of a hospital in order to reduce cost of patients transfer(Viccu a telehealth platform commercialised to Telstra) and reduce cost related to patient's access to health services (RIDES tele health platform)
- NBN tele monitoring of chronic disease patients : to reduce use of health services (visit to GP and hospital) through the remote monitoring of chronic disease patients. Project funded by DoHA, 3m value.
- Remote and Rural health Services project : a study of the delivery of health services to remote and regional Australia

Our contribution to innovation in **digital enabled manufacturing services**

VCEAM project funded by Boeing (1.5 million) consisted of the development of a tailored Remote collaboration platform (www/csiro.au/remote) to Boeing needs. As a result of the success of the project, Boeing is undertaking to use ReMoTe for its training and maintenance operations.

Our contribution to innovation in **digitally enabled education services** :
The 3D educational project is allowing school students all over the country to virtually visit cultural institutions while learning STEM skills. This work is done with the department of Communication (1.5 million) it draws on tele immersive technologies to generate 3D online education experiences.

My main achievement in the past 7 years as a Leader of UIC research team include :

- Established strong multidisciplinary research projects with 3 flagships research programs : Mining, Manufacturing and Digital productivity and 2 Transformational capabilities initiative (CCS TcP and Transformational Bio TcP) and the Australian Animal Health Laboratory in Biosecurity).
- Established 5 international research collaborations with INRIA/France, CMU/USA, SSSA/ITALY, University Paul Sabatier/France and Technical University of Valencia/Spain.
- Achieved a 3 time increase per year in the team journal publications and 2 time increase in the team conference publications.
- Securing , since 2008, 50% of the research team budget from external contracts, engagements with industry and government agencies.
- A 5 time increase in co-investment from CSIRO flagships. Since 2008, 50% of the research team was contributing to strategic research projects within 3 CSIRO flagships.
- 4 successful promotion cases within the research team, one at a most senior research level e.g. Principal Research Scientist.
- Sustained external recognition of team's research impact . My team won 3 state innovation awards : Insect Scan won 2014 ACT iAward in R&D, ReMoTe won 2013 NSW iAward in R&D and RIDES won 2009 ACT iAward in e-health.

My most recent personal achievement include

- Promotion to Principal Research Scientist, the promotion is based on sustained delivery of science output and science impact (June 2011)
- Personally responsible for securing external research contracts with industry and government. Most recent external contracts that I have secured include:
    - Visual Cues for Efficient Airplane Manufacturing . Industry partner: Boeing Research and Technologies. Funding valued at 1 million . 2012-2013.
    - Visual Communication of Massive Sensor Data for Intelligent Mining. CSIRO MDU flagship. Funding valued at $250,000. 2013.
    - Remote collaborative trouble shooting using smart phones funding valued at $20,480 2013.

- Remote Mining Engineer Project funded by Echelon Mining Services, and the Australian Government Department of Industry, Innovation, Science, Research and Tertiary Education. Funding valued at $90,000. 2011.
- Human factors in drilling automation project funded by BoartlongYear. Funding valued at $50,000. 2010

- Personally responsible for the overall development and delivery of all clients projects as well as the external and internal communication of my team's science impact .

I have developed and lead a range of strategic research projects over the years the most recent projects include :

- **Project Leader Human System Integration project (2006-2014)**

In my role as Project Leader of the Human System Integration Project , I lead a multi disciplinary team of 7+ staff comprising researchers, engineers and interns located between Sydney, Brisbane and Canberra with cross divisional research expertise in: HCI , Visualisation, Sensing, mixt reality, networking

This project is a strategic research project funded by CSIRO Minerals Down Under flagship program. It investigates the utility and value of various emerging User Interfaces including: mixed reality UI, immersive environment, 3D UIs wearable computing and Augmented reality UIs, for mining operations.

Project members have also directly contributed to the successful delivery of the following commercial projects :

- Tele operation of Rock Breaker : a project funded by Rio Tinto of 1 m value.
- Tele operation of Ship Loader : a project funded by Rio Tinto of 1.5 m value
- Remote Mining Engineer : a project funded by Echellon Mining to investigate the use of collaboration technologies to allow a mine engineer to deliver their services to mine sites from Echellon Mining head office.
- HMI for Automated Drilling : a project funded by Boart LongYear (500K).

ReMoTe a collaboration platform to allow an off site specialist to assist in real time an onsite maintenance operator into repairing a mining equipment has been developed (www.csiro.au/remote)

ReMoTe is an example of digital platform technology for service innovation and productivity. While initially developed for the mining industry, its use are key to many digital productivity areas ReMoTe technology was showcased at the launch of CSIRO Digital Productivity and Services flagship in 2012. ReMoTe won the 2013 NSW state innovation award in R&D. ReMoTe has been sucessfully trialed at a mine site in South Australia.

ReMoTe draws on the latest research in wearable computing and Augmented Reality to support remote collaborations on physical tasks (e.g collaborations requiring manipulation of physical objects and tools) with a focus on useability and enhanced user's experience. It is the focus the HCI focus that has been key to the development and

testing of ReMoTe in a way to promote end users adoption and hence impact. This research is word leading and addresses a research gap in the literature as evidenced by two books we have recently edited with Springers in the area of mobile collaborative augmented reality and Human Factors. This research is the next enabler for digital services in areas such as training, engineering, maintenance and health. The focus on HCI and human factors (useability, spatial awareness, mobility support, etc) is key to the delivery of the transformational services that will drive productivity, efficiency and effectiveness in the digital economy.

The work has been intensively published in the Human Computer Interaction science area as well as in mining and resources space:

- Alem L.,Ranjan R., Gaire R. and Cutmore N. Improving maintenance operations and practices in the mining sector through flexible delivery of the right information and real time assistance. In Australian Resources and investment magazine www.resroucesandinvestment.com.au

- **HCI Principal research leader of the NBN Telemonitoring for Chronic Disease (2013-present) a project funded by Department of Health and Aging DoHA (3 million)**

  The project undertakes the first multi state, multisite home monitoring trial in Australia. It aims to involve 150 test patients and 300 controls. I am leading the clinical evaluation and trial implementation evaluation research program of this trial . Beyond general usability and usage issues, we investigate the effect the intervention has on patient 's quality of life, mental health, ability to manage own condition, medical adherence etc. We also investigate the factors at play in implementing the tele monitoring trial , current health practices, the health service as experienced by test patients, tele monitoring nurses and GPs.

- **Project Leader Satellite Health project (2012-2013)**

In my role as Project Leader of the Human System Integration Project , I lead a multi disciplinary team of 5+ staff comprising researchers and interns with research expertise in HCI , Cloud Computing, Telehealth, Security and privacy.

This project investigates new cost effective health services for remote and regional Australians using a range of tele collaboration, tele guiding and tele monitoring technologies. This project has lead to the production the following CSIRO white papers which have been used to engage with the health services industry in Australia.

- Dods, S., Freyne, J., Alem, L., Nepal, S., Li, J., Jang-Jaccard, J. (2012) Caring for the Last 3%: Telehelth Potential and Broadband Implications for Remote Australia, CSIRO Whitepaper, 2012, http://www.csiro.au/satellitehealth.

- Dods S., Hansen D., Boyle J., O'Keefe C., Alem L., Celler B., Freyne J., Kanagasingam Y. (2014) A digitally enabled health system. CSIRO Whitepaper, 2014, http://www.csiro.au/digitalhealth

- **Project Leader Visual Clues for effective aircraft manufacturing (2011-2013)**

A project funded by Boeing Research and Technology to investigate the feasibility of using ReMoTe technology for the remote delivery of maintenance and training services . A successful trial of the technology has been conducted at one of Boeing Seattle training site, 5 Users case have been developed and ReMoTe technology has been tailored to Boeing specific needs. As a result of the success of this project Boeing has commissioned two units of ReMoTe and is undertaking to use this technology for its maintenance and training operations.

- **Project Leader Human Factors in Telerobotics for CSIRO Mineral Down Under flagship program (07- 10)**

I have defined the human factors in mining research program of value to CSIRO research flagship in Mining (named MDU). The research program consisted of a number of short to medium scientific goals and a plan/pathway for developing the human factor research capability within the flagship that leverages existing CSIRO ICT telerobotic and telecollaborative expertise and is in alignment with other research proposals for this theme.

I have developed a proposal for MDU collaborative fund cluster with a professor from University of Queensland. The proposal was submitted and accepted. The collaboration investigates the user interface requirements of the continous miner application. This investigation was the first step for engaging with the mining industry.

I have secured, lead and delivered the following commercially funded projects

- Remote Mining Engineer : a project funded by Echellon Mining to investigate the use of collaboration technologies to allow a mine engineer to deliver their services to mine sites from Echellon Mining head office.
- HMI for Automated Drilling : a project for Boart LongYear (500K)

I have contributed as Principal scientist in Human Computer Interaction to the following projects for the mining industry

- User Interface design of systems for the tele operation of mining equipments , based on operators needs : Teleoperation UI for the Rock Breaker project (commercial project for Rio Tinto, 1.2 million value) and Tele operation UI for the Ship Loader project (commercial project for Rio Tinto , 1.6 million value)
- Study of drilling operators : their practices, their motivations and the implications for the design of drilling automation (commercial project for BoartLongYear, 500,000 value)
- Study of mining engineers practices and the technical implications for

delivering their services remotely : the design of the remote mining engineer platform (commercial project for Echellon Mining, 40,000 value)

- The development of CSIRO ReMoTe platform , a remote collaboration platform developed to support the changing role of mining operators . ReMoTe allows a remote expert to assist in real time an onsite maintenance operator. ReMoTe aims to reduce equiment down time, increase productivity while enhancing maintenance operators skills set.

- **Research Leader of Human Factors in Telepresence (05-07)**

My brief was to develop this new research area in the centre through: the identification of potential research directions and goals, the identification of potential research experiments to be conducted by the group, an initial plan for attracting critical mass in this area, and delivering scientific outcomes at the required level.

Within a year I have defined HFIT research agenda, put in place processes & strategies for developing capabilities in evaluation within the team, and have defined three research projects which are currently being worked on.

An initial study investigates the extent to which the SUS measure of presence correlates with factors identified to influence presence such as control factors and personal factors.

A second study investigates the effect of camera view on social presence using Networked Mind social presence measure. In this study participant's emotional state are assessed (pre and post experiment) and their facial expression are analysed.

A third study investigate the relationship between situation awareness and social presence in the context of remote interaction, using Networked Mind measure of social presence and Ensley method of assessing SA. In this study we are also interested in understanding visual behaviour using gaze tracking methods and how this relates to people's sense of presence.

- **Project Leader : Knowledge Sharing for CSIRO's Water for Healthy Country (WfHC) Flagship Program (03-04)**.

The aim of this project was to develop effective ICT to support informed participation for natural resource management decisions. I was responsible for developing and delivering the Knowledge Sharing Project within the WfHC Flagship Program.

One of the challenges in developing the project was to find and engage with a farming community in Australia in which science meets the community and where members of the community were already involved in a water quality improvement program. Once the community had been identified the next challenge was to engage with key players of the community and develop an appropriate strategy for technology

development that engaged participants. Developing this project required developing strong linkages with key scientists from other CSIRO divisions (CLW, CSE), with leaders of other cross cutting research projects within the flagship, liaising with the flagship chief scientist and the flagship director, and establishing linkages with the community in far north Queensland, (Mayor, Council members, extension officers, farmers), as well as potential funding institutions (LWA, Environment Australia).

From a scientific perspective, our hypothesis was that a knowledge-sharing tool "under designed" to source and provide access to diverse information bases, as well as different types of knowledge (e.g. local, informal, formal, scientific, etc.), could be of value to members of the community in at least two ways. First, we anticipated that the "under designed" nature of the environment would allow participants to input their knowledge and over time collaboratively map what they know in the context of what other members of the community know. Secondly, we anticipated that such an environment would equip members of a community to better understand the perspectives of other community members and stakeholders, and in doing so fulfilling the prerequisites for informed participation.

An initial prototype has been developed. Its design is centred around a knowledge map (concepts and relationships) and search queries attached to concepts. An initial evaluation of the prototype was conducted in a laboratory environment, with students from the GIS centre at Monash University. Initial results of the evaluation show a positive learning gain. A broader type of evaluation looking at social economic integration issues related to our work with this community, has been conducted in collaboration with two social scientists from CSIRO Minerals (a contribution to the SEI emerging science area).

Size of the project = 7 staff across 3 organisations and locations, duration = 10 months, budget = 500K

- **Project Leader : The Automated Trainee Evaluation and Exercise Generation (ATEEG) project of the CRC Intelligent Decision Support.**

This project involved CMIS, University of Melbourne, AAII, Adacel and Thomson Radar Corporation (TRAC) as industrial partners. I was responsible for developing the R&D plan of the project, leading the research and delivering the project to the CRC board.

In this capacity I developed strong linkages with the various institution involved, and have developed a plan that maximises available expertise (multi agent systems, intelligent learning environment, user model, aviation expertise etc). I had a key role in getting TRAC to becoming an official partner of the project. TRAC sponsored a PhD study (under my supervision) in the context of the ATEEG project.

The aim of the project was to design an intelligent simulation based learning environment allowing Air traffic Controllers to practice their skills in separating aircrafts, handing over aircrafts and forward planning. The two main research

challenges were: how to evaluate/assess student skill development level (student model issue), how to tailor the sequencing of training exercises to the specific needs of the learners so that their skills are consolidated (curriculum planning for operational skill training).

The resulting intelligent learning environment was a complex and distributed system designed and implemented as a multi agent system.

Research in this area makes the following contribution:

- It proposes a model of operational skill development as the basis for the design of the intelligent learning environment.
- The learner acquisition algorithm implements the characteristics of the operational skill development model and is a combination of overlay and cognitive models.
- Curriculum planning/task sequencing algorithm uses case based reasoning techniques.

This novel approach to both learner modelling and task sequencing has led to more refined pedagogical decisions. It enabled the recommendation of follow up pedagogical objectives that assist in the consolidation of the skill to be acquired.

A prototype system has been developed and demonstrated to the CRC board and the two industrial partners. Many research papers, workshops at international conferences and one PhD thesis resulted from this project.

Size of the project = 9 staff across 5 organisation and 3 locations, duration = 2 years

- **Project leader : Method for evaluating computer supported learning technology for ACCESS Pty.**

ACCESS provided useability testing services of computer based information systems and saw an emerging demand for assessing the learning aspect of theses systems. They contracted CSIRO for developing the method and tools for learning effectiveness assessment.

As an initial step, I developed a set of learning effectiveness principles that span a variety of learning and instruction theories. This set of principles was used as the basis for the design of the learning effectiveness assessment framework. The framework include an initial product briefing, an expert review method and instrument, an evaluator review method and instrument, and a report generation. The LEA method and related instruments have been reviewed with respect to the existing procedures of ACCESS Testing Centre, and are currently implemented as an efficient and effective service.

- **Project Leader : An intelligent tutoring system for sonar operators for AUSSYS (a subsidiary of Thomson CSF).**
  In this project I have designed an intelligent learning environment to train sonar operators in identifying vessel class. The learning system monitored student's

performance, provided tailored explanations upon request and generated a final marking upon completion of the tutorial.

- **Coalition formation among e-trading agents**

This was a strategic research project. I explored means for supporting the formation of coalition among on-line agents. My research in this area makes the following key contributions:

- It proposes a model for coalition structure, coalition utility and agent's payoff for bounded rational and fully autonomous agents. Such agents are operating with incomplete information and limited resources.
- It proposes an algorithm for coalition formation among agents in a mixed bargaining setting in which agents competitively negotiate over which coalition will form.

A prototype system has been developed in the area of car trading online.

- **Project Leader : Study of targeting and profiling practices for Australian Custom Services**

I managed and led this project. It required engaging with ACS and AQIS staff at a very senior level.

A study for Australian Customs Systems (ACS) consisting of: 1) a number of meetings with ACS staff from both central and regional offices along with AQIS, in order to understand current targeting/profiling practices 2) identifying major issues related to existing reactive alert/targeting practices, 3) identifying areas for improvement and 4) proposing a reactive alert/targeting and proactive profiling framework that addresses some of the identified improvement areas. The issues identified included risk management methodology issues (data recording and data collection practices) as well as organisational issues (training and education, knowledge sharing).
The second stage of the project consisted of the identification of a number of advanced technologies, including Artificial Intelligence techniques that could be employed by Customs to implement the proposed reactive alter/targeting and proactive profiling framework and a set of recommendations based on the identified issues/areas/techniques. Nine recommendations have been made covering the following four areas: data quality and data warehousing, reactive alert/targeting, proactive profiling and performance analysis.

- **Project Leader :Respiratory Advisory System for 3M Australia**

This was one of the success stories of CSIRO DIT. An expert system to assist 3M helpdesk staff recommend appropriate respiratory mask to use and wear based on personal characteristics and context of use. This system has been used in Australia and 3M USA expressed interest in using this system globally. I led the research team

and contributed to the design, development and rigorous testing of the knowledge based system.

LANGUAGES

English, French and Spanish

REFFEREES

Under request

Selected Publications (since 2006)

Refereed International Journals/ Edited Journals

Lukosch S.,Bellinghurst M. and Alem L (eds) "Collaboration in Augmented reality "a special issues of the Journal of Collaborative computing and work practices . (2014)

Sloot P., Wang L., Ranjan R., Kolodziej J. Zomaya A and Alem L. (eds) "Software Tools and Techniques for Big Data Computing in Healthcare Clouds" a special issue of the Journal Future Generation of computer Systems (2014).

Huang, W., Alem, L. and Albasri, J. (2013) Prototyping and Evaluating a Wearable System for Mobile Distributed Collaboration. Communication and Networks, Vol. 5, 554-562.

Huang, W. and Alem, L. (2013) Gesturing in the Air: Supporting Full Mobility in Remote Collaboration on Physical Tasks. Journal of Universal Computer Science..

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