

Interactive Systems Group

Research Review



“The start of the 21st century as seen two major advances in the area of informatics. Firstly data-acquisition and distribution technologies have been able to generate and make available massive amounts of potentially valuable data covering everything from the human genome, through how people shop and vote, ecology, economics, taxonomy to history and entertainment. This data is available online *now* and has massive potential to improve people’s lives by contributing to social, scientific and economic progress. The other major advance in computing has been a change in how people are able to interact with computers. The traditional paradigm of a solitary individual interacting with his or her pc is rapidly being replaced by a world where people are increasingly inclined to work together using multiple devices in different environments.

In theory the improved access to data along with the ability of people to work together to make proper use of the data should lead to a democratization of information where the population is able to share data to become more productive and more involved in society. This is not however a reality just yet. Researchers still don’t have a sufficient understanding of how people work together or how to best represent data for the new paradigm of collaborative working. This would require a deep understanding of collaborative working, statistical data analysis, information visualization and interaction design.

Our aim as a research group is to bring these talents together to develop the techniques and understanding necessary for the new breed of accessible data analysis, data exploration and data discovery software. We plan to nurture this understanding with a new generation of young Mexican researchers who will be capable of spearheading the next wave of informatics research and innovation.”

Dr. Paul Craig, November 2013

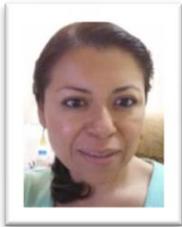
Members



Dr. Paul Craig is leader of the Interactive Systems research group at the Universidad Tecnológica de la Mixteca in Oaxaca Mexico. He graduated with an MSc (Distinction) in Software Engineering from Edinburgh Napier University in 2001 and completed his PhD thesis, 'Animated Interval Scatter-plot Views for the Exploratory Analysis of Large Scale Microarray Time-course Data' in 2006. Paul worked as a Research Fellow at Edinburgh Napier from 2006 to 2010 and has been involved in research projects with the National Science Foundation (USA), Scottish Enterprise (UK) and Conacyt (Mexico) with 20 plus publications including IVJ and BMC Bioinformatics journal papers. His research interests include Information Visualization, Bioinformatics, Information Retrieval and Complex Systems. More information about Paul's work can be found online at paulpapers.wordpress.com.



Néna Roa Seïler is a lecturer and researcher within the Interactive Systems research group at the Universidad Tecnológica de la Mixteca. She is also studying for a PhD at Edinburgh Napier University entitled 'Towards an emotionally intelligent interaction strategy for multimodal ECAs acting as Companions' and holds an MSc Multimedia- Hypermedia from Télécom ParisTech (ENST) (1997) and an MSc in Design & Innovation from Université de Technologie de Compiègne (2006). She has worked at the Cité des Sciences Museum in Paris, was Art Director of the Creative Studio of France Télécom R&D from 2000 to 2004, and a researcher on the EU funded Companions project from 2007 until 2010. Her research interests are Interaction Design, Emotion as Interaction, Evaluations of User's Experience, and Embodied Conversational Agents.



Ana D. Olvera-Cervantes is a lecturer and researcher working in the institute of Physics and Mathematics at the Universidad Tecnológica de la Mixteca and a Ph.D. student at the University of Cádiz in Spain. The title of her thesis is 'Quantile curves and central regions using regions and Archimedean copulas'. She is also a member of the Sistemas Interactivos research group and has an MSc in Statistics from the Department of Mathematical Sciences University of Texas at El Paso (2012). Her research interests include Affective Computing and Statistical Analysis.

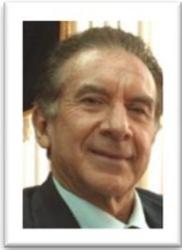


Ariadna Benítez Saucedo is an Interactive Media Masters student at the Universidad Tecnológica de la Mixteca. She is currently writing her thesis entitled "Avatares emocionales en la mensajería instantánea" (emotional avatars for instant messaging). This project investigates the use of synthetic characters working in an instant messaging system. Her research interests include Emotion as Interaction, User Centered Design and Kansei Engineering.



Marcela Martínez-Díaz is an undergraduate student in Computer Engineering at the Universidad Tecnológica de la Mixteca currently writing her thesis entitled "Using an intelligent agent as a tutor on a collaborative learning environment". She has co-authored a number of academic papers and recently presented the poster, "Educational Video Games: an alternative to improve primary education in the State of Oaxaca" at the second Congreso Mexicano de Ciencias de la Complejidad at the Universidad Nacional Autónoma de México. Her research interests are Educational Videogames and Artificial Intelligence.

Associate members



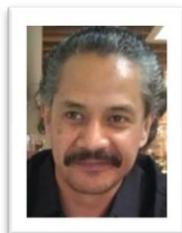
Dr. Felipe Lara-Rosano is head of the Cybernetics and Complex Systems Laboratory at the Centre for Applied Sciences and Technological Development which is part of the Universidad Nacional Autónoma de México. He earned his PhD in Operational Research at the Facultad de Ingeniería in the UNAM in 1973 and has published more than 90 international journal articles, book chapters and conference proceeding papers and another 108 research articles in Mexico. Dr. Lara-Rosano is a member of the New York Academy of Sciences, the Mexican Academy of Sciences, the Mexican Academy of Engineering, and holds an honorary doctorate from the International Institute for Advanced Systems Research and Cybernetics. He was elected to the office of president of the Mexican Academy of Sciences, Arts, Technology and Humanities in 2007 and is a grade three member of the Mexican Sistema Nacional de Investigadores. Dr. Lara is in charge of the CONACYT project: Theory, Methods and Complexity Social Models, is a member of IEEE and fellow and board member of International Institute for Advanced Systems Research and Cybernetics. His research interests include Complex Systems Analysis and Modeling, Artificial Intelligence, Theoretical and Applied Cybernetics, Neural Nets, Fuzzy Logic and applications.



Prof. Jessie Kennedy has published widely with over 90 peer reviewed publication in the areas of database technologies and information visualization. She has had over £1 million in research funding and supervised 11 PhD completions. Professor Kennedy is currently director of the Institute for Informatics and Digital Innovation at Edinburgh Napier University.



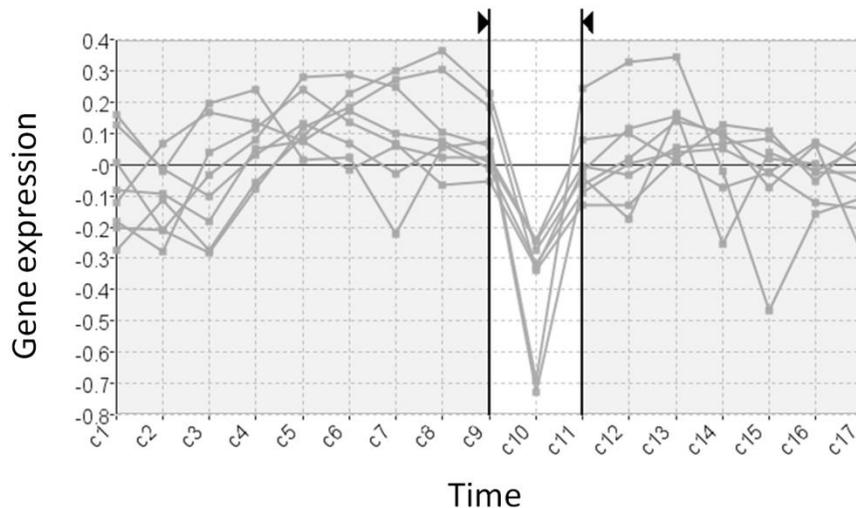
Prof. David Benyon is director of the Centre for Interaction Design, and faculty director for interdisciplinary research at Edinburgh Napier University. He has obtained funding from several European Funding programs and developed a number of novel theoretical ideas on human-computer interaction concerning the sense of self and place in mixed reality environments and also published on semiotics and experientialism applied to new media. David has authored six books and over numerous pivotal papers in the field of human computer interaction.



Dr. Marcelo Hernández Ávila is currently a member of the Mexican national system of investigators with Promep funding for research in the area of material sciences. He obtained his PhD entitled "Study of ternary blends epoxy/PMMA/Montmorillonite: Elaboration and control of morphology and properties" from the Institut National des Sciences Appliquées de Lyon (INSA-Lyon) and currently works developing polymeric composites reinforced with natural fibers.

MaTSE: The Gene Expression Time-series Explorer

High throughput gene expression time-course experiments provide a perspective on biological functioning recognized as having huge value for the diagnosis, treatment, and prevention of diseases. The data is however very large-scale and complex with experiments typically recording the activity of tens of thousands of genes over time. This makes it difficult to find more subtle patterns such as common changes in activity over a limited time frame. Indeed, traditional techniques tend to show a limited view of the data that can only reveal a subset of more dominant patterns in the data. As a result much of the richness and detail in the data is lost. The Time-Series Explorer overcomes this limitation by allowing the user to control an animated scatter-plot. This focuses on different time-intervals of the data and gives the user more freedom to explore their data according their own ideas of what useful patterns it might contain.



A significant pattern occurring exclusively over an interval of time. This filtered subset of genes share a pattern of falling activity from C9 to C10 and rising activity from C10 to C11.

MaTSE uses two coordinated views of the data: a line-chart and a scatter-plot. The line-chart view overlays value versus time representations of the recorded activity of all genes and allows the user to specify an interval of time. The scatter-plot summarizes the data within the selected interval by representing each gene as a single point with its translation along the Y-axis corresponding to its activity over the selected interval and its translation along the X-axis corresponding to its change-in-activity from the start to the end of the selected interval. As the line-chart view controls are manipulated and the selected interval is adjusted, the positions of genes in the scatter-plot are recalculated to adjust for the change in temporal context. Repeated continuous adjustments of the selected interval (where the start and end times of the selected interval are incremented independently or in parallel) results in an animation that allows users to perceive patterns of gene activity over time. A

Craig, P., Cannon, A., Kukla, R., Kennedy, J. (2013). **MaTSE: the gene expression time-series explorer**. *BMC Bioinformatics*, 14(Suppl 19)(S1).

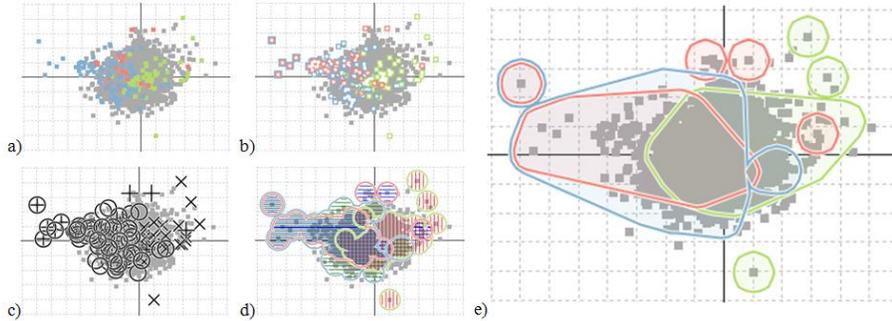
Craig, P., Cannon, A., Kukla, R., Kennedy, J. (2012, October). **MaTSE: The Microarray Time-Series Explorer**. Paper presented at 2nd IEEE Symposium on Biological Data Visualization, Seattle, WA.

Craig, P., Kennedy, J., Kukla, R., Cannon, A. (2010). **Pattern Browsing and Query Adjustment for the Exploratory Analysis and Cooperative Visualisation of Microarray Time-course Data**. In: Luo, Y. (Ed.) *Proceedings of the 7th International Conference on Cooperative Design, Visualisation and Engineering*, 6240/2010. (pp. 199-206). Mallorca, Spain: Lecture Notes in Computer Science.

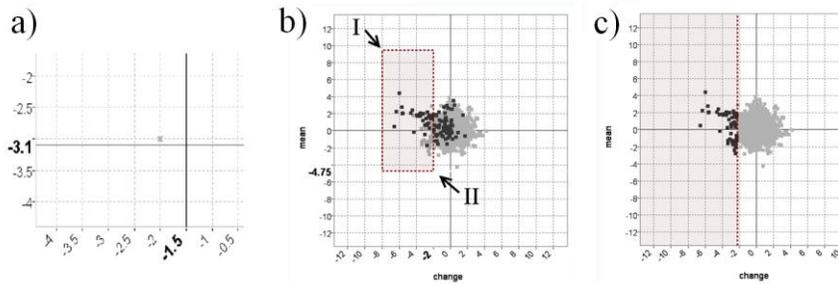
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Edinburgh. The subjects involved in the final evaluation were positive about the potential of MaTSE to help them find unexpected patterns in their data and characterized MaTSE as an exploratory tool valuable for hypothesis generation and the creation of new biological knowledge.

Craig, P., Kennedy, J., Cumming, A. (2002). *Towards Visualising Temporal Features in Large Scale Microarray Time-series Data*. In: *6th International Conference on Information Visualisation – IV2002*. (pp. 427-433). IEEE Computer Society Press.



Methods available for displaying gene groupings in the scatter-plot



Cooperative visualization in MaTSE

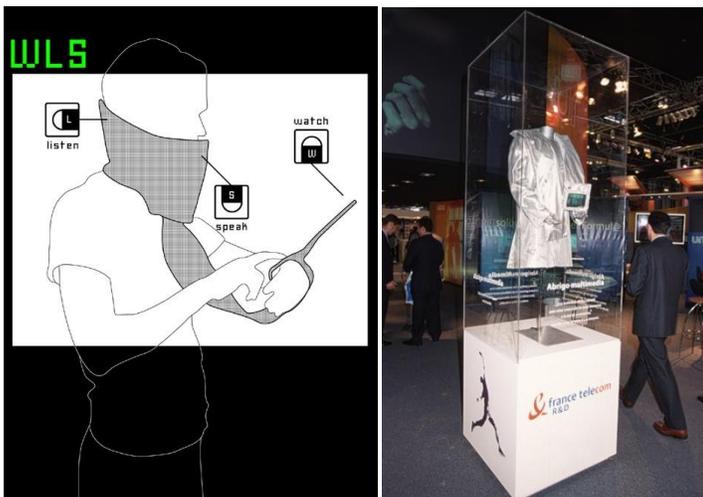
A general conclusion to be drawn from the work is that animation, where time in the data is mapped to time in the visualization, has enormous potential to be used to great effect in an information visualization. While the effects of animation on human perception is less well understood than the effects of a static display, this should not discourage a developer from considering an animated visualization if the benefits of expressiveness and an extra display dimension are required. Many of the problems with the perception of animation encountered during this project were easy to detect during user evaluations and relatively easy to eliminate after they were detected. In this case, at least, the benefits of animation were found to outstrip its disadvantages with the technique developed using animation allowing biologists to find significant patterns they could not previously find using any other techniques. It is hoped that this thesis will guide other developers toward considering the use of animation in their own information visualization applications to achieve similar results.

Smart Scarf (L'Echarpe Communicante)

The Smart Scarf, or Echarpe Communicante in French, is a collaboration between researchers in the Studio Creatif labs (a unique entity within France Telecom R&D's Human Interaction Division dedicated to exploring specific processes for innovation and new services) and a team of young French designers. The team worked together to create various interfaces that facilitate the extension of the senses into the virtual realm so that the wearer is allowed to be present in their own space and virtually present in another remote space at the same time. The scarf has a long, detachable and interchangeable collar draped around the neck that is equipped with built-in multimedia interfaces. These include a voice-activated cell phone, a webcam, and a touch screen that allows them to access email, the Internet, MP3 files, video conferencing and view personally-selected video clips.

The most challenging aspect of the design of the Smart Scarf is the variety of gestures needed to access its various built-in functions. The act of turning up the collar attached to the jacket opens up a telecommunications channel and brings the receiver closer to the wearer's ear. By wrapping the scarf around the neck and face, the speaker comes to rest in front of the mouth and a barrier is created, isolating the wearer from the outside world. Inserting the arm into the other part of the collar, as if through a large bracelet, allows the wearer to access a computer and flexible keyboard.

This concept formed part of the industrial patent: "**Devices and process for communication of emotional states**" deposited at National Institute of Industrial Property (France) under number 03820 on 28/03/2003, Néna Roa Seiler is the sole author and France Telecom Research & Development is the owner.



The Smart Scarf

Presented at

Deaf Festival " 2004 in Rotterdam

Ars Electronica Festival " 2003 in Linz /Austria.

Pressentiments v.1 and v.2 " at the Centre des Arts in Enghien les Bains : Sept. 2002 to February 2003.

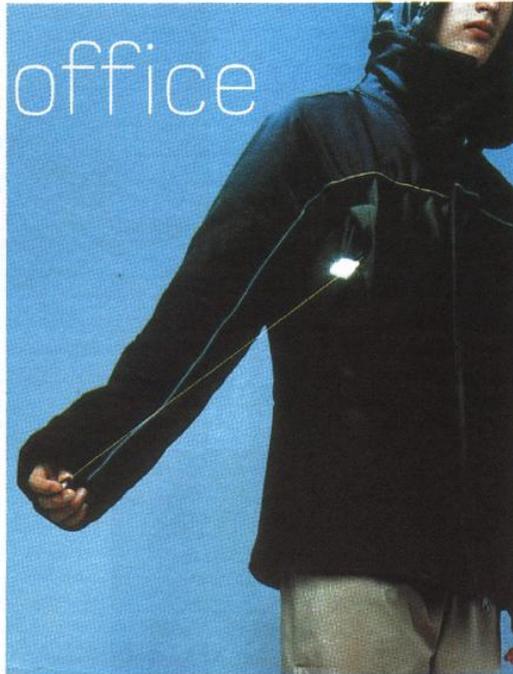
L'homme Transformé " at the Cité des Sciences museum in Paris: May - Dec. 2002.

SIMO 2001 and 200 :
Telecommunication Fair in Madrid.

"Workspheres" at The Museum of Modern Art (MoMA) in New York : Febr. - May 2001.

JNC3 at the Grand Halle de la Villette in Paris : Sept. 2001.

nomadic office



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10.



9.

8 Prada Sport Design Team **Prada Sport**, example from fall/winter 1999–fall/winter 2000 collection. Nylon and other materials. Mfr.: Prada USA, Corporation, 1999

9. Nazha Mestaoui, Yacine Ait Kaci, and Christophe Beaujays with France Telecom R&D/Studio Créatif **Écharpe Communicante** (Communicating Scarf) with computer screen, keyboard, and telephone. 2000. Wool/fabric, length 39 1/2" (100 cm). Prototype. Mfr.: the designers, 2000

10. Robert Brunner and Benjamin Chia **Stowaway Portable Keyboard**. 1999. Injection-molded ABS and stamped and formed aluminum; folded: 5 1/4 x 3 1/4 x 1" (13 x 9.2 x 2.5 cm), unfolded: 5 1/4 x 13 1/4 x 1/2" (13 x 35.2 x 1.2 cm). Mfr.: Think Outside, Inc., USA, 1999

11. Jennie Pineus **Cocoonchair**. 2000. Steel, polyamide fabric, and plastic, 55 1/2 x 35 1/2 x 39" (140 x 90 x 100 cm). Prototype. Mfr.: the designer, Sweden, 2000

12. Bran Ferren and Thomas Ritter **MaxiMog® Global Expedition Vehicle System**. 1998–2000. Various materials, 10' 6" x 6' 8" x 19' 10" (320 x 203 x 604.5 cm). Mfr.: Unicat Fahrzeugbau GmbH, Germany, Associates B Ferren, 1998–2000

Smart Scarf exhibited at the MoMA New York

Emotionally Aware Embodied Conversational Agents

Embodied Conversational Agents (ECAs) are artificial assistants who appear human and move human-computer interaction to a more natural face-to-face setting. In this project we look at the role of emotion in ECA-human interaction. This includes looking at ways to ensure that the emotions expressed by humans are correctly interpreted by Companions and that the emotions expressed by empathetic companions are, in turn, understood by humans.

The overarching goal of this research is to achieve a seamless form of interaction through the use of an affective channel of communication between users and “companions”. This work applies to user experience as a whole and our goal is to expand the results of this research to product design in general and more particularly to new services developed for platforms such as television and mobile phone technologies.



Two versions of Samuela: a prototype emotionally aware ECA

Our current focus is on eliciting the emotional reaction of users to Companions and the empathetic response of Companions toward users. This is known as ‘the affective channel’. The emotional state of users is detected through visual, speech, gesture and voice recognition. The response of the Companions are made via the affective channel using voice, prosody, facial expressions, body posture, and semantic information, according to the user’s emotional state.

Craig, P. and N. Roa-Seiler (2012). **A Vertical Timeline Visualization for the Exploratory Analysis of Dialogue Data. Information Visualisation.** Montpellier, France: 68 – 73. ISSN : 1550-6037 Print ISBN: 978-1-4673-2260-7

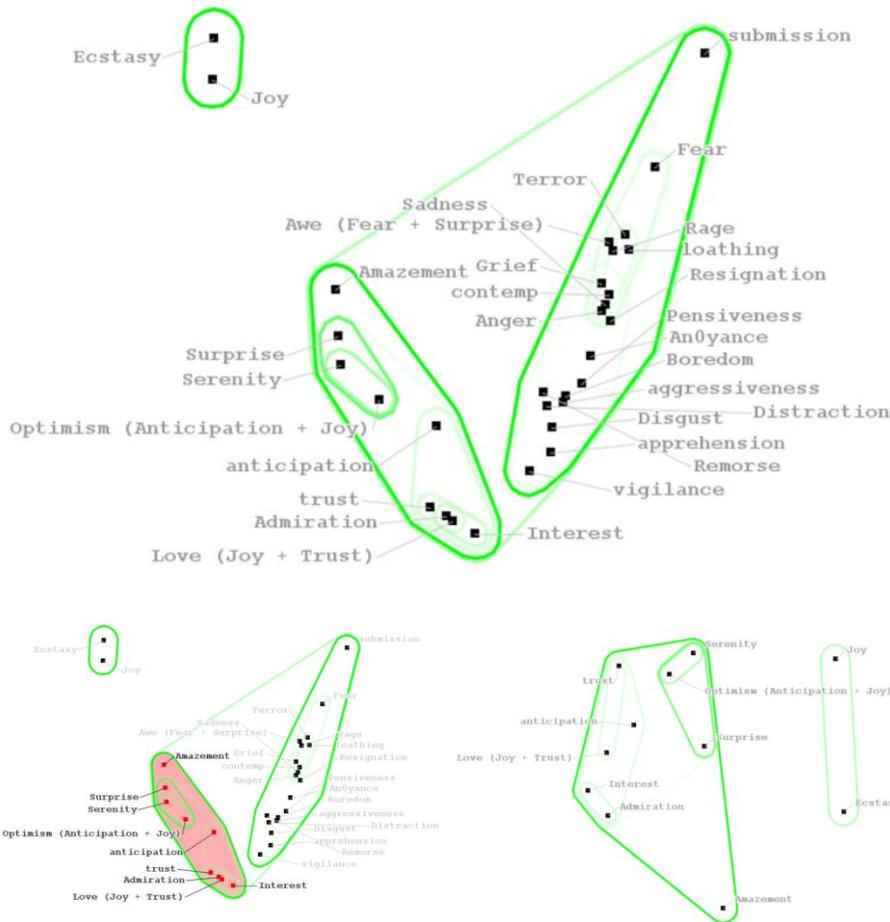
Palacios Villavicencio M., Roa-Seiler N., García Martínez W. (2012). **‘Interacción Social de Niños Autistas con un Agente Corpóreo’** Proceedings MexIHC 2012, fourth workshop on Human-Computer Interaction of ACM SIGCHI, Mexico D.F. , Mexico

Roa-Seiler N., Benyon D., (2010) **‘Designing Companions with Kansei’** in Proceedings Conference on Kansei Engineering and Emotional Research KEER2010, Paris France.

Roa-Seiler N, Benítez, (2010) **‘Virtual Mirror’** in Proceedings Create , Interaction Design Conference, Edinburgh, June 2010.

Roa-Seiler N., Rodriguez Gancedo M.C.(2010) **Samuela o el nacimiento de un ‘Companion’** in Proceedings MexIHC 2010, third workshop on Human-Computer Interaction of ACM SIGCHI, San Luis Potosi, Mexico.

Roa-Seiler N, Benítez, (2010) **Mi espejo virtual emocional,** in Proceedings MexIHC 2010, third workshop on Human-Computer Interaction of ACM SIGCHI, San



Cluster visualizations of human emotions according to appropriate response phrases

In order to evaluate the affective dimensions and Companion interaction requirements we use techniques ranging from ethnographic studies to focus groups. These act to support a user-centered design methodology. To measure usability and user experience we make use of quantitative (e.g. number of errors) and qualitative metrics, often employing information visualization and statistical methods to analyze results. The final prototype will be evaluated using EARL (Emotion Annotation and Representation Language). A statistical analysis of the results will be used to identify significant behavior patterns and draw up new models of users' engagement with Companions at an affective level. This will contribute to a new understanding of interaction strategy design for the next generation of emotionally aware companion interfaces.

Roa-Seiler N., Benyon D., and Lepître G. (2009), **An Affective Channel for Companions**, Empathic Agents Proc. of 8th Int. Conf. on Autonomous Agents and Multiagent Systems AAMAS, Budapest, Hungary.

Roa-Seiler N., Benyon D., and Lepître G. (2009). **Samuela, the birth of a Companion** FECCI Postgraduate Conference at Napier University, Edinburgh.

Roa-Seiler N., (2009) **An Affective Channel for Companions** poster, presented at European Future Technologies Conference and Exhibition (FET) in Prague, Czechoslovakia.

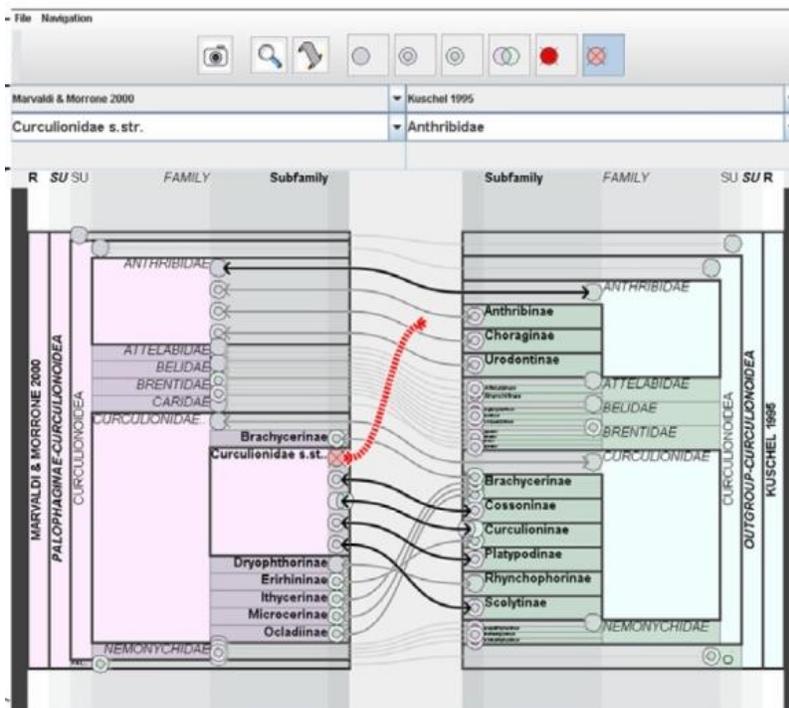
Mival, O., O'Keefe, B., Bradley, J., Roa-Seiler, N. & Benyon, D.(2008) **Photopal : Companionship, sharing and the Digital Echo**, in Proceedings Collocated Social Practices Surrounding Photos Workshop, CHI 2008, Florence, Italy.

Roa-Seiler, N., Benyon, D., & Mival, O.(2008) **An affective channel for Photopal**, in Proceedings 4th Workshop on Emotion in HCI of the Annual Human Computer Interaction Conference, Liverpool, United Kingdom.

Roa-Seiler, N., Benyon, D. & Mival, O.(2007) **Emotional Companions**, in Proceedings 3rd Workshop on Emotion in HCI of the Annual Human Computer

The Concept Relationship Editor

The Concept Relationship Editor is an interactive visualisation tool designed to support the specification of relationships between hierarchical taxonomic classifications. The tool operates using an interactive space-filling adjacency layout which allows users to expand multiple lists of taxa with common parents so they can explore and add relationships between two classifications. The visualisation uses a layout optimised for readability and animation to smooth the transition between views.



Screenshot of the Concept Relationship Editor interface.

The layout of the classifications attempts to make the labelled names of taxa readable by assigning them appropriate amounts of horizontal and vertical space for horizontal or vertical text. Here priority is given first to selected taxa, then the children of selected taxa, then the siblings of selected taxa and finally the siblings of ancestors of selected taxa. These nodes require priority for navigation and relationship addition. When a user selects a new taxon, priority is appropriately reassigned and the layout changes. During the transition, animation is used to provide visual cues and aid reinterpretation. During an informal evaluation of the interface users found it easy to navigate the hierarchy of classifications and add relationships between taxa.

Craig, P., Kennedy, J. (2008). **Concept Relationship Editor: A visual interface to support the assertion of synonymy relationships between taxonomic classifications.** In: Börner, K., Gröhn, M., Park, J., Roberts, J. (Eds.) *Visualization and Data Analysis 2008, Proceedings of the SPIE*, 6809. (pp. 680906-680912). San Jose, CA: Society of Photo-Optical Instrumentation Engineers, Bellingham, WA, ETATS-UNIS .

Graham, M., Craig, P., Kennedy, J. (2008). **Visualisation to Aid Biodiversity Studies through Accurate Taxonomic Reconciliation.** In: Gray, A., Jeffery, K., Shao, J. (Eds.) *Proceedings of British National Conference on Database Systems: Sharing Data, Information and Knowledge*, 5071/2008 (LNCS 5071 ed.). (pp. 280-291). Cardiff, UK: Springer-Verlag.

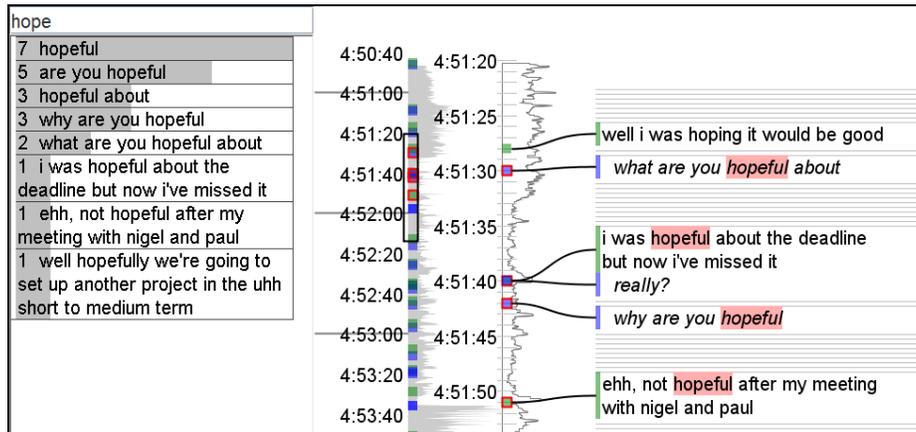
Craig, P., Kennedy, J. (2007). **Concept Relationship Editor: A visual interface to support the creation of relationships between taxonomic classifications (poster).** Paper presented at InfoVis2007, Sacramento, CA.

The Dialogue Explorer

The Dialogue Explorer is a novel vertical timeline information-visualization technique developed to support the analysis of human-computer dialogue data. The technique uses combined linked views including distorted views to effectively communicate the timing of dialogue events while presenting text in such a manner to be easily readable.

The display of the Dialogue Explorer is divided into four separate component views arranged horizontally from left to right. These are the search/term-frequency component, the timing overview, detail timing view and the distorted text detail view. Clicking and dragging on the overview detail box of either of the detail views allows the user to move through time. The principle goal of the design is to support the analysis of dialogue data through the combination of an effective graphical representation for timing data and an easily readable textual representation of speech.

Craig, P. and N. Roa-Seiler (2012). **A Vertical Timeline Visualization for the Exploratory Analysis of Dialogue Data.** *Information Visualisation*. Montpellier, France: 68 – 73. ISSN : 1550-6037 Print ISBN: 978-1-4673-2260-7



The Dialogue Explorer interface.

To ensure the readability of speech we use a vertical timeline layout in preference to the standard horizontal layout. This allows the text to be displayed in a single long column that can be read without the user having to readjust to different horizontal alignments as they move their focus from the text of one utterance that of another. The text of the dialogue is contained in the distorted text detail view of the application. This assigns enough vertical space as is required for each utterance to be easily readable and uses a regular time-scale for the pauses between utterances. This allows us to communicate the length of pauses alongside legible text of the dialogue. The Dialogue Explorer prototype was evaluated with dialogue data generated for the analysis of the Embodied Conversational Agent (ECA) Samuela. Overall the users were encouraged by early results and are planning to use the application for the analysis of the results of several upcoming experiments.

The Mexican History Browser

This application facilitates discovery and the exploration of geo-temporal event data search results by clustering result sets and overlaying cluster summaries onto coordinated timeline and map views. Users can explore and interact with search results by selecting clusters to filter and re-cluster the data.



Clustered and labeled results

Craig, P., Roa-Seiler, N., Leplâtre, G., "A Situated Cognition Aware Approach to the Design of Information Retrieval Systems for Geospatial Data" in European Conference on Cognitive Ergonomics, Edinburgh, UK, 2012.

This technique demonstrates a number of advantages over alternative methods for displaying and exploring geo-referenced search results and spatio-temporal data. Firstly, cluster summaries can be presented in a manner that makes them easy to scan. Listing representative events from each cluster also facilitates discovery by presenting diverse search results. Finally, clicking on visual representations of geo-temporal clusters provides a quick and intuitive way to navigate across space and time simultaneously and removes the need to overload the user with the display of too many event labels at any given time.



Evaluation

The technique was evaluated with a group of ten users and compared with an equivalent text based exploratory search engine. These results suggested that a visual analytics approach could resolve many of the problems of exploratory search for similar large complex data sets.

Collaborative face to face Computer Supported Learning Games

Studies show that face to face collaborative videogames have a great potential to improve the quality of education in the classroom of the future. Educational games can help pupils increase cognitive skills, increase motivation and reduce the time taken to reach learning objectives. When these games are used in a group environment they can enrich the learning experience further still by helping develop group social skills and exploiting social dynamics toward achieving a common learning objective. However, despite these advantages the uptake of collaborative games as learning tools in the classroom is still relatively low. While collaborative working has proven advantages they also suffer from an incompatibility with the ingrained individualism of traditional education. Moreover, collaborative working can disadvantage introverted students, suffer from conflicts within a group or allow less motivated students to avoid making a contribution. This work investigates the viability of these disadvantages being managed through the intervention and mediation of an intelligent embodied conversational agent, with awareness of group activity acting, as a virtual tutor.



The games room

In order to investigate the role of embodied conversational agents (ECAs) in collaborative learning games we undertook an experiment that allowed us to observe children using a variety of collaborative games with and without the assistance of an ECA. Before and after the experiments the children were given written tests to assess specific learning objectives and during the tests we recorded audio and video. We also asked the students to complete questionnaires to determine how they felt about the level and quality of collaboration.

*Néna Roa Seiler, Ana Delia Olvera, Cervantes, Paul Craig, Marcela Martínez Díaz and Felipe Lara Rosano (2013), **El uso de los videojuegos colaborativos y los Agentes Corpóreos Conversacionales como alternativa para mejorar la educación en la region Mixteca en Oaxaca: Un caso de estudio en una escuela rural en Acatlima** to appear in Revista TEMAS de Ciencia y Tecnología Universidad Tecnológica de la Mixteca.*

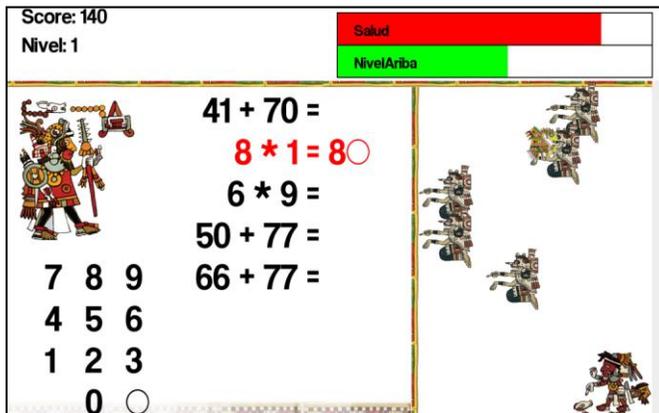
*Craig, Paul, Roa-Seiler, Néna, Martínez Díaz, Marcela, & Lara Rosano, Felipe. (2013). **Assessing the potential of collaborative video games to improve education in la mixteca region of mexico.** Paper presented at the Third International Conference on Cognitronics, Slovenia. (Draft version)*

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Controlling the WoZ

Three educational games were developed for our experiment. In order for the games to be both accessible and challenging for children with different levels of learning, we tried to incorporate a gradually increasing level of difficulty. Other key aspects of game design were cultural relevance and age appropriateness. Here we tried to ensure that the games were non-violent and did not enforce gender stereotypes while encouraging the children to identify with elements of their native Mixtec and Mexican culture. An example of this was the use of native Mixtec codices used as sprites to represent game characters.



Math game



Reading game

Craig, Paul, Roa-Seiler, Néna, Rosano, Felipe Lara, & Díaz, Marcela Martínez. (2013). *The role of embodied conversational agents in collaborative face to face computer supported learning games*. Paper presented at the 26th International Conference on System Research, Informatics & Cybernetics, Baden Baden, Germany. Winner of the Outstanding Scholarly Contribution Award

Martínez García, D., Craig, P., Roa-Seiler, N. and Benítez Saucedo, A., "Validación de una estrategia de interacción de un agente corpóreo conversacional a través de la técnica del mago de Oz," presented at the MexIHC, Mexico City, Mexico, 2012. ACM ISBN: 978-1-4503-1659-0

Martínez García, D., Craig, P., Roa-Seiler, N. and Benítez Saucedo, A., "Validación de una estrategia de interacción de un agente corpóreo conversacional a través de la técnica del mago de Oz," presented at the MexIHC, Mexico City, Mexico, 2012. ACM ISBN: 978-1-4503-1659-0

The children's performance did not improve much immediately after their session with the games. This was most likely due to the children being tired and over-stimulated after playing the games for two hours. When the students were tested again, four days after the tests, there was a significant improvement in their performance. This improvement was particularly marked for mathematics where the student's performance showed an increase of 21.9%. The improvement for languages was 4.3% and the students regressed slightly in their reading (by 2.1%).



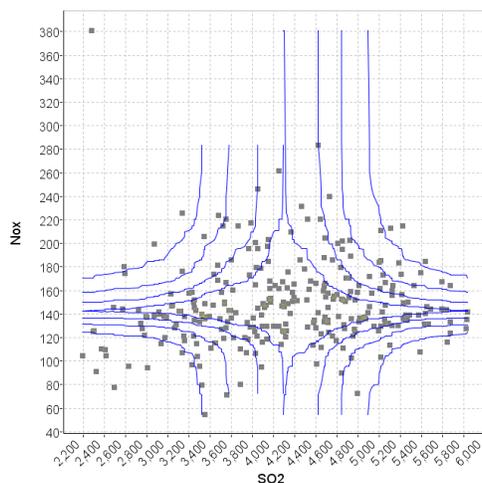
Children's reaction to the games

The experiments show the potential of an embodied conversational agent (ECA) to improve the level of collaboration for students using interactive learning games. Since collaboration is known to improve the achievement of learning objectives in the long term and the ability to work in a team is an important skill in itself, we strongly believe there would be significant benefits to the introduction of intelligent ECAs in collaborative learning environments.

Quantile Curves Distortion for Correlation Detection in Multidimensional Data

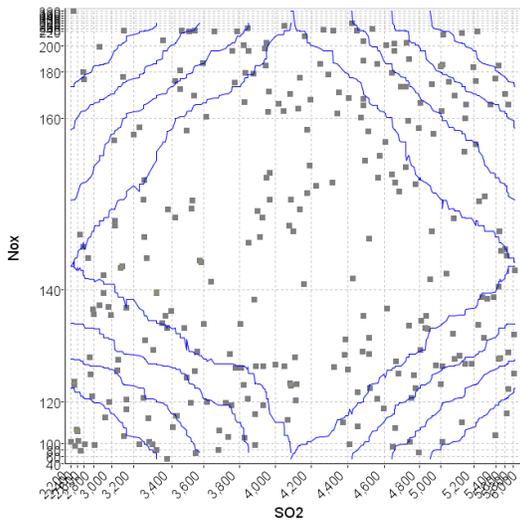
A great deal of research in areas such as social sciences, economics and biology involves searching for causal relationships. Data is collected, plotted and causal relationships are assumed to be evident from correlations observed in the data. For example, if we wanted to find out what makes students achieve higher grades we might record the grades achieved by each student and check how this correlates with other factors such as the time spent reading, hours spent studying, and the amount of exercise taken at the weekend etc. The detection of this type of correlation from raw-data generally involves the application of statistical methods such as the calculation of a correlation coefficient or graphical methods such as plotting attribute values on a scatter-plot. The disadvantage of statistical methods is that a lot of the richness and complexity of the data is lost. Graphical methods, on the other hand, can fail if the data has an abnormal distribution causing the data to be skewed or pushed into the corner of a plot. The advantage of applying quantile curve statistics to distort a scatter-plot is that it improves the distribution of data values in a way that correlations are immediately apparent.

Effectively the quantile curve distortion method works to reveal correlations in data regardless of the statistical distribution of the data across either axis. This is a project currently in the early stages of development and we plan to develop a full case study using data from material sciences. The basis of the technique is demonstrated using the following graphics.

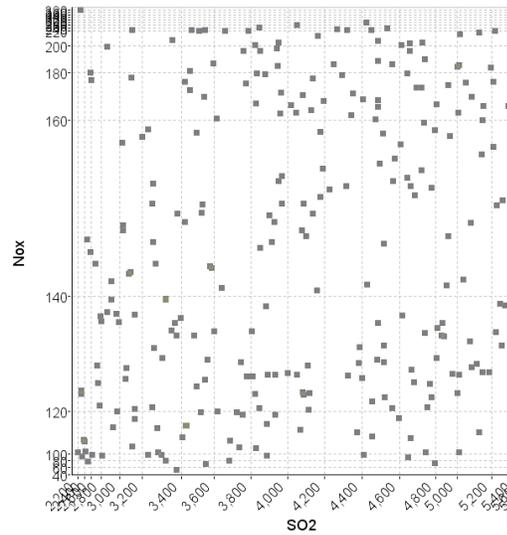


Step 1: Quantile curves are calculated so that 50% of data points are inside the 50% quantile curves, 60% are within the 60% curves, 70% within the 70% curves etc.

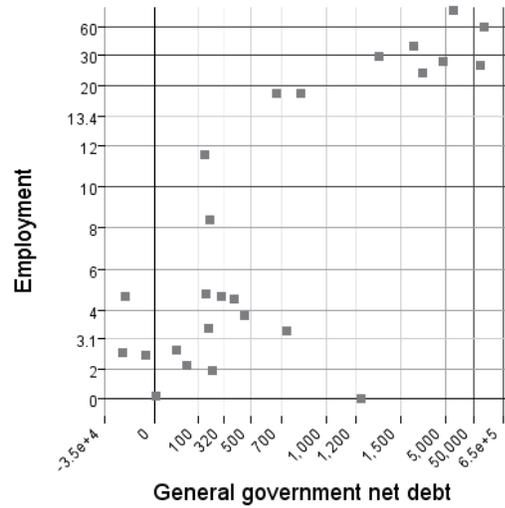
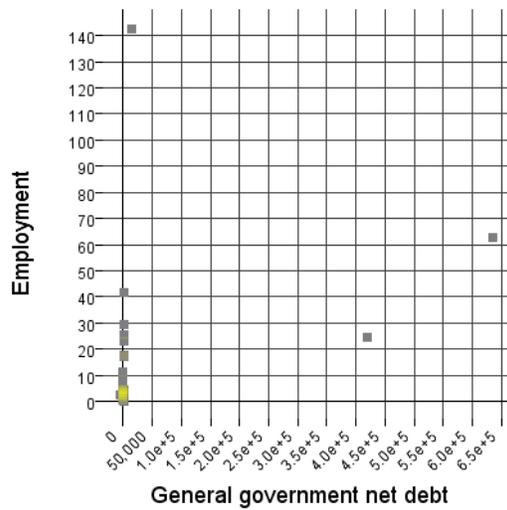
*F. Belzuncea, A. Castaño, A. Olvera-Cervantes, A. Suárez-Llorens, **Quantile curves and dependence structure for bivariate distributions**, *Comp. Stat. & Data Analysis*. Volume 51 Issue 10, June, 2007*



Step 2: The display space is distorted so the 50% quantile curves occupy 50% of the display space, the 60% curve takes up 60% of the space, the 70% curves 70% of the space etc.



Step 3: Correlations should be easy to see when the distorted data is viewed without the quantile curves.



Employment versus net debt among European countries: We can see that the correlation is apparent in the distorted view (right) but not with the original projection (left).

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Industrial Patent

Industrial Patent Name: "Devices and process for communication of emotional states" deposited at National Institute of Industrial Property (France) under number 03820 on 28/03/2003, Néna Roa Seiler is the only author, France Telecom Research & Development is the owner.