

ERCIM “Alain Bensoussan” Fellowship Scientific Report

Fellow: Panagiotis Germanakos
Visited Location: CNR, Italy
Duration of Visit: 12/01/11 – 11/01/12

I - Scientific activity

According to the EU Autism Action 2010, the ASD is a significant public health challenge. Current estimates are that approximately 1% of the US and UK population has Autistic Spectrum Disorders (ASD), which, if one were to extrapolate, means five million people in EU member state countries are on the autism spectrum. ASD is a complex lifelong disorder that has an intense impact on a person’s development, predominantly demonstrating strong deficiencies in many types of social behavior, social imagination and communication.

The complexity of these disorders necessitates the development of a range of systems and services that are tailored to the needs of families and the individual with ASD. In this respect, and given my experience in previous years in adaptive and personalized systems, user modeling and adaptive collaborative environments, I have been involved into the analysis and design of ASD-centric collaborative systems, adaptive user interfaces and systems, as well as on the development of enhanced user profiles for persons with ASD. During my stay in CNR, I had the opportunity of working and collaborating with experienced researchers, therapists, professionals and institutions in that particular field, yielding significant and innovative work. More specifically, main research outcomes, among others, drawn upon the following activities:

The analysis and design of,

- (a) a comprehensive ASD (Autistic Spectrum Disorders)-centric User Model (considering e.g. cognitive and emotional characteristics, clinical/diagnostic medical records, intervention assessment records, personality characteristics, etc.);
- (b) an ASD-centric Adaptive and Personalized System Model that supports effective one-to-one treatment interaction during a goal-directed ASD therapy;
- (c) an inclusive model of ASD-centric services (like collaboration services, care and wellness services, socialization services, treatment approach, continuing monitoring services, etc.);
- (d) an ASD-Centric Computer Supported Collaborative Treatment Architecture (using Virtual Care Teams, dynamic workflows and an inclusive set of services), that enhances continuous treatment and service provision, communication, decision making and prompt error handling; and
- (e) an ASD-centric Open and Dynamic Framework, composed of multidisciplinary and multilevel dimensions and variables (i.e. technological and physical support, structural teaching, (enforced) collaboration, personalization content dynamics, adaptive control factors, evaluation metrics, etc.), adaptable on a given situation of an individual with ASD during a treatment process.

II- Publication(s) during your fellowship

- P. Germanakos, M. Buzzi, & M. C. Buzzi, “A Proposed ASD-Centric Framework: The Case of ASDAPT”, *Proceedings of the 11th International Conference on Interaction Design and Children (IDC 2012)*, Bremen, Germany, June 12-15, 2012, ACM, New York, NY, USA. (in reviewing process)

Abstract: As the number of individuals diagnosed with Autism Spectrum Disorders (ASD) rises, the need for providing one-to-one treatment increases significantly. ASD is a complex lifelong disorder that has an intense impact on a person’s development predominantly demonstrating strong deficiencies in many types of social behavior, social imagination and communication. Although people with autism share some common characteristics (such as social interaction characteristics, unusual behavior characteristics, unusual patterns of attention and learning characteristics), no two individuals are the same. In this regards, computer-based treatment approaches should always be emphasizing on the abilities, individualistic characteristics and preferences of a person with ASD. Early structured and intensive intervention in small children is proved to be more effective than eclectic late therapeutic approaches. Computer-based intervention improves efficiency and might favor learning since usually children are attracted by electronic devices. In this paper, we propose an ASD-centric adaptation and personalization framework, namely ASDAPT, that utilizes an extended user profile which attempts to capture inclusively the attributes that could formulate a strong basis for the apt identification of an individual with ASD. Main aim of ASDAPT is to provide a unified adaptive approach to the learning process over a computer-based environment for children with ASD. Finally, we discuss possible content transformations and enhancements based on the impact of the person’s profile in the information space, taking place during the dynamic adaptation process supported by a real life case scenario.

- M. Belk, P. Germanakos, P. Zaharias, & G. Samaras, “Adaptivity Considerations for Enhancing User-Centric Web Experience”, *Proceedings of the 5th International Conference on Advances in Computer-Human Interactions (ACHI 2012)*, Valencia, Spain, January 30 – February 4, 2012.

Abstract: This paper explores the influence specific cognitive factors may have on user experience (UX) qualities to be used as adaptivity factors for personalizing and improving users’ experiences in commercial Web-sites. User Experience design relates to the creation of interaction models that affect user experiences while interacting with a product or system while the incorporation of cognitive factors in the personalization process of Web environments might provide a more user-centric approach. A user experience evaluation was conducted where 96 students navigated in an existing commercial Web-site for a problem-based task. A user experience measurement was performed so as to assess users’ perceptions regarding the pragmatic, hedonic and attraction qualities of the environment. It has been observed that specific cognitive factors have considerable influence on specific qualities of user experience. Subsequent results also reveal that all UX qualities had rather minor positive tendency indicating that the environment needs improvement in terms of usability efficiency, effectiveness and attractiveness. To this end, such findings are encouraging for further investigation of the possible impact of cognitive factors in terms of enhancing the personalization process of commercial Web-sites so as to achieve better user experience.

- N. Tsianos, P. Germanakos, M. Belk, Z. Lekkas, G. Samaras, & C. Mourlas, “An Individual Differences Approach in Designing Ontologies for Efficient Personalization”, A chapter in: Springer Series *Studies in Computational Intelligence*, edited volume *Semantic Hyper/Multi-media Adaptation: Schemes and Applications*. I. Anagnostopoulos, M. Bielikova, P. Mylonas, & N. Tsapatsoulis (Eds.), Springer-Verlag Berlin Heidelberg, 2012.

Abstract: This article discusses the potential role of cognitive individual differences in the context of designing ontologies for personalization on users’ characteristics. The theoretical framework of the proposed approach is derived from the long tradition of psychometric testing, incorporating implications from the field of differential and cognitive psychology. The current state of the identification and systematization of mental abilities is depicted, with additional emphasis on the constructs of working memory and cognitive style, on which a proposed ontology is based upon. Also, a summary of previously conducted relevant empirical work is presented, providing support to the notion of introducing personalization into educational and commercial websites. To that end, the main argument of this work is that the enrichment of ontologies with cognitive factors may lead to efficient personalization and measurable benefits for users.

- P. Germanakos, D. Georgiadis, M. Buzzi, M. C. Buzzi, & C. Fenili, “Enhancing Collaboration in ASD-Centric Treatment Environments: A Proposed Architecture”, *Proceedings of the 7th Conference on Information Quality in eHealth (USAB 2011)*, Graz, Austria, November 25-26, 2011, LNCS 7058, Springer-Verlag Berlin Heidelberg, pp. 225-244. (18% acceptance)

Abstract: There is a growing body of evidence that people diagnosed with Autistic Spectrum Disorder (ASD) is increasing each year. ASD is a neurodevelopmental spectrum disorder with overarching characteristics the abnormal social interaction, communication ability, patterns of interests, and patterns of behavior. Individuals with ASD are characterized by unique and divergent needs and requirements which make a generalized treatment approach obsolete. Early diagnosis and interventions in persons with ASD, along with a consistent and continuous monitoring of their situation by the dedicated care team may increase their learning abilities and social inclusion. In this respect, we propose an ASD-centric Computer Supported Collaborative Treatment Architecture which employs the notion of Virtual Care Teams and dynamic workflows. We analyze its various components and outline a set of services that have been adjusted on the qualities and limitations of the ASD sector. Through this architecture a continuous treatment with updated exchange of information, effective communication, prompt error handling, and improved decision making, can be achieved within and between the members of a care team. Finally, we present a real life case scenario which employs the particular architecture, encapsulating the arisen benefits of the proposed approach.

- P. Germanakos, D. Georgiadis, M. Buzzi, M. C. Buzzi, & C. Fenili, “A Proposed ASD-Centric Collaborative Treatment Environment: The Underlying Role of Virtual Care Teams”, *Proceedings of the 6th Mediterranean Conference on Information Systems (MCIS 2011)*, Limassol, Cyprus, September 3-5, 2011.

Abstract: Every year an increasing number of individuals are diagnosed with Autism Spectrum Disorder (ASD). ASDs involve difficulties with self-initiation of social behaviors, possibly due to motivational issues, as well as language and behavioral impairments. Given the complexity and the abnormal development of this disorder one-to-one multidisciplinary treatment approach under a common dynamic collaborative environment is considered of paramount significance. This paper proposes an ASD-centric Computer Supported Collaborative Treatment Environment/model which employs the notion of Virtual Care Teams for supporting continuous treatment and service provision adopted on the unique qualities, interests, personality traits and

contextual characteristics of a person with ASD. Furthermore, it proposes a set of services adjusted to the peculiarities and values of the ASD field. With the successful implementation of this collaboration model, an increased communication, effective decision making and prompt error handling can be achieved to the benefit of the individual with ASD; that is, increase to its intellectual capabilities, social inclusion, and self-motivation.

- P. Germanakos, “Framing the Theoretical and Technological Context of mLearning Environments – Issues and Concerns”, *Proceedings of the 6th Mediterranean Conference on Information Systems (MCIS 2011)*, Limassol, Cyprus, September 3-5, 2011.

Abstract: The development and adoption of wireless technologies is rapidly increasing around the globe. The use of mobile, portable, and handheld devices is gradually embraced across every sector of education. Based on these phenomena, mobile learning (mLearning) has a growing visibility and significance in an attempt to offer functionalities and alternative support to the pedagogical approaches and teaching strategies, for enhancing the learnability process and satisfaction of individuals. Even though there are various potentials and opportunities like anytime, anyhow and at any place access on content, collaborative learning settings, personalized and interactive environments, guided and efficient learning engagement through multimedia intelligent environments, etc., the concerns and hindrances for ubiquitous, transparent and secure development of mLearning applications and systems are still numerous. These problems could be generally perceived as conceptual, that is the challenge of developing consistent interdisciplinary user-centric models based on the unique individual/learner needs, psychological (social, cognitive, and affective) intrinsic characteristics, and the conventional pedagogical models and teaching approaches; and technological, where the constraints (like memory limitations, small screen sizes, restricted computational power, limited battery life, small storage capacity, wireless networks instability, insufficient protocols standardization, etc), are still in place. In this regards, main scope of this paper is to review key theoretical and technological considerations of mLearning, that could lie under the overarching terms of human factors, context, activity, and educational technologies classification.

- Z. Lekkas, N. Tsianos, P. Germanakos, C. Mourlas, & G. Samaras, “Emotional Web-based Design: The Concepts of Emotional Experience and Emotional Expression”, *Proceedings of the IADIS International Conference on Interfaces and Human Computer Interaction (IHCI 2011)*, Rome, Italy, July 24-26, 2011. (22% acceptance)

Abstract: For many years people have been trying to measure differences between individuals. Over the course of time, a combination of developments in statistical know-how and the evolution of thought within psychology enabled the refinement of measures, and subsequently the assessment of more specific factors in the field of individual differences like different kinds of ability, affect and emotion. This knowledge has been used in many areas within psychology and at the same time the advancement of technology has enabled the development of web-based systems that measure specific factors relevant to specific situations. Our research focuses on the emotional mechanisms that drive human behaviour in general and how we can implement a set of rules to web design so that we can promote system adaptability on the very important field of human emotions which is at the same time extremely difficult to describe and define. In this paper we introduce our model of emotion regulation and we present our first experimental results that concern the concepts of emotional experience and emotional expression and their effect on decision making and problem solving styles. Furthermore, we present the implications that these theoretical and empirical representations can have in web applications and design.

- Z. Lekkas, N. Tsianos, P. Germanakos, C. Mourlas, & G. Samaras, “The Effects of Personality Type in User-Centered Appraisal Systems”, *Proceedings of the 14th International Conference*

Abstract: The basic objective of this paper is to make an extensive reference of a combination of concepts and techniques coming from different research areas, Psychology and Web personalization technologies, both of which focus upon the user. It has been attempted to approach the theoretical considerations and technological parameters that can provide the most comprehensive user profile, under a common filtering element, supporting the provision of the most apt and optimized user-centered web-based result. It further underpins the significance of the comprehensive user profile that incorporates not only the traditional user characteristics, but other intrinsic values of the user such as user psychological preferences (affect, personality and emotional processing parameters). Eventually, this paper introduces our first experimental results that concern the concept of personality and its effect on decision making and problem solving user profiles.

- P. Zaharias, M. Belk, P. Germanakos, & G. Samaras, “User Experience in Educational Virtual Worlds”, *Proceedings of the 1st European Workshop on HCI Design and Evaluation*, Limassol, Cyprus, April 8, 2011, pp. 7-12.

Abstract: This paper explores user experience (UX) in educational Virtual Worlds. A two-month user experience evaluation was conducted where 37 learners used an educational Virtual World for a problem-based learning task. Two user experience measurements were performed at two distinct phases so as to assess users’ perceptions of the Virtual World environment over time. Results reveal that all UX qualities were rated lower at the second measurement mainly due to the many technical problems that users faced throughout the study. However, only the decrease in pragmatic quality was found to be statistical significant. To this end, results indicate that the environment needs usability improvement in terms of efficiency and effectiveness and technical stability so as to provide a better user experience.

III -Attended Seminars, Workshops, and Conferences

- USAB 2011: The 7th Conference on Information Quality in eHealth, November 25-26, Graz, Austria.
- MCIS 2011: The 6th Mediterranean Conference on Information Systems, September 3-5, 2011, Limassol, Cyprus.
- Internet Festival event, May 5-8, 2011, Pisa, Italy.
- W3C Multilingual Web Workshop, April 4-5, 2011, Pisa, Italy.

IV – Research Exchange Programme (12 month scheme)

Swedish Institute of Computer Science (SICS), October 24–28, 2011, Stockholm, Sweden.

During my first visit in Mobile Life Centre, SICS, I had the opportunity to cooperate with Prof. Kristina Höök who is the Director of the Lab and other research scientists in the lab. I had really interesting discussions with regards to affective health, interaction design, mobile interaction and social interaction through smart devices and systems. I participated in demonstration of systems and projects and exchanged ideas and experiences with regards to the particular research fields. Indicatively, I got familiarized with Lega system, a hand held device

for physical sharing of experiences during art exhibition; the Affective Health project which explores mobile services that empowers people to monitor and understand their own stress levels vis-à-vis their everyday activities, by providing users with inspiring visualizations of data captured from body sensors bio-feedback loops are created; and with projects concerning mobile collaborative live video mixing and generalized software infrastructures that allow the ease construct of image and location-based services for multi-application domains.

Medical University Graz (MUG), November 24 – December 2, 2011, Graz, Austria.

During my second visit in Human-Computer Interaction for Medicine and Healthcare Research Unit, Institute of Medical Informatics, Statistics and Documentation (IMI), Medical University Graz (MUG), I was hosted by Prof. Andreas Holzinger. We had extensive discussions with him and other researchers in the unit with regards to eHealth methodologies and applications. Also, I gave a presentation on my post-doctoral research and exchanged ideas, as well as analysed scientific issues concerning adaptivity in the eHealth domain, the incorporation of human factors in the personalization process of medical systems for the maximization of decision making and effective treatment of patients as well as the efficient design of tele-medicine environments. Furthermore, we generated research ideas with regards to the prediction of cognitive overload of users (patients and/or doctors) while interacting with mobile health applications and interfaces with high complexity.