ASTRA Publishable Executive Summary

ASTRA examines mediated interpersonal awareness, addressing the need to stay in touch with family and friends or the need to be reassured regarding their well-being. Important aspects of communication are examined, such as connectedness or plausible denial of presence, with the ultimate aim to define a framework for supporting the design of Pervasive Awareness systems intended to support social relationships. The framework consists of:

1. A theory to guide the design and the evaluation of pervasive awareness systems for supporting social communication.
2. Supporting technology (service oriented architecture, tools and applications that support communities to appropriate Pervasive Awareness applications).

1.1 Project objectives

1. To develop an integrated "theory of connectedness and awareness".

ASTRA develops a theory that describes the phenomenon of 'connectedness' and 'staying in touch' with friends and family, and the role of 'awareness' therein. ASTRA theory shall describe the nature of these needs, how they are met and how people reach saturation of awareness/connectedness seeking isolation or privacy instead. Eventually, this work should lead to a model for predicting usage, adoption and appropriation of awareness systems for social use.

A theory of connectedness developed in ASTRA aims to bring conceptual clarity in what is currently a theoretically rather amorphous set of notions, extending our understanding of social properties and providing a basis for developing measurement tools that will allow comprehensive assessment of the affective costs and benefits of awareness systems in a valid, reliable, and robust way. As part of theoretical work measurement tools for evaluating awareness systems with regards to how they help meet the needs of their users, will be defined. This work will extend further the ABC-Q (Affective Benefits and Costs of communications Questionnaire) for assessing the degree to which users experience affective benefits and costs.

2. To develop a descriptive model and a design theory/framework for awareness mechanisms.

A *formal model of how awareness is formed* and recruited through the use of awareness systems is being developed within ASTRA. This model provides an appropriate set of concepts for describing the operation of a broad class of awareness systems in terms of the content of the information exchanged and elementary user behaviors pertaining to sharing information about themselves or perceiving information about others. This model provides the semantics used in the ASTRA SOA, Ontology, and Tools. The basis for the model will be the 'Focus and Nimbus' (developed initially by T. Rodden), which provides a descriptive taxonomy of how observers and observed person share awareness information. It derives from virtual collaborative environments but can be applied to various types of computer-mediated communication. Its advantage is that a small set of primitives helps describe succinctly a range of situations for sharing information. In

ASTRA we shall seek to define a descriptive model that will meet the following requirements

a) Asynchronous communication,
b) Peripheral awareness,
c) Distinction of implicit and explicit input of awareness information,
d) Privacy when sharing information.

A *design framework* based on the concept of social intelligence will be conceived and developed for informing the design of awareness systems or analyzing their usage. Social intelligence is a person's ability to get along with people and social technique. Social intelligence is a critical concept in the development of awareness systems, as it reflects the requirement from these systems not to disrupt the existing social fabric of life, i.e., the implicit social rules and norms that underlie harmonious social interactions.

3. To design an integrated service oriented architecture and implement a platform for supporting end-user development of awareness systems.

The ASTRA service oriented architecture will offer awareness services (composition, notification, communication, inference and reasoning, etc) and support the design, creation and management of pervasive awareness applications. The project shall develop a platform that shall utilize existing networking infrastructure and shall be capable of adopting emerging protocols (i.e. UWB). Architecture implementation includes the experimental use of prototypical awareness information capture and display appliances.

In order to address various issues that arise during the design, development and experimental use of pervasive awareness applications, an ontology will be created to encode awareness service terms, context representation and user activity representations. The ontology will also encode theory concepts and model policies thus serving as a connecting layer between theory and concrete applications. The ontology and the operations that components will support will derive directly from the model of awareness mechanisms defined above. This ontology will be designed, and later integrated in the ASTRA system in order support end-user development of awareness applications.

4. To design and develop a set of tools that will support the composition of awareness applications by end-users.

End User Tools are software mechanisms that will support the creation of awareness applications by end users. These mechanisms can be implemented in a number of interface modalities (thus different interfaces can be supported). Adopting varied levels of transparency, rather than a black box approach will be pursued. Interactions will be designed based on the semantics of the descriptive model, and supported by the ontology.

Methods integrated within the end user tools will seek to adapt the needs of novice (help to initially familiarize themselves with the system), advanced users (more complex patterns of use), and the community (to collaboratively manipulate awareness applications). The end-user programming tools will be developed iteratively in a participatory manner, with an underlying vision to spawn innovation stemming from people.

5. **To develop proof-of-concept awareness applications by end-user communities using the experimental ASTRA technology.**

Applications supporting awareness through mobile and fixed devices will be developed by communities of individuals who will be using experimentally the ASTRA platform and tools. The experimental usage of ASTRA by a user community will serve as a means to validate the connectedness theory and associated measurement instruments as well as to reify the awareness platform. Enabling the user community to program awareness services ASTRA hopes to spawn the development of many new services and concepts.

1.2 Work performed and results achieved

During its first year, the project has

- Developed an ASTRA descriptive model (based on the Focus and Nimbus model)for pervasive awareness applications
- Towards the theory of awareness the project in the 1st year has further developed the ABC questionnaire, as an evaluation / measurement tool
- Developed a first version of the Design Framework for Awareness Applications
- Developed a set of awareness scenarios (as an aid to conceptualize the system and understand system requirements)
- Described and documented the system requirements following a structured software engineering approach (use cases).
- Decided on the component architecture of the SOA, defined the interfaces between the components and developed most of these components
- Described the requirement specifications of the End User tools on concepts of the ASTRA descriptive model, and developed an functional prototypical example application for rule editing, using a partly functional version of the editor to create the mappings.
- Developed Aware Modeling Language (AMeLi), as an experimental validation tool for Focus Nimbus Model. AML will be further investigated for providing underlying semantics for the end-user programming tools.
- Defined a preliminary version of and ASTRA ontology, based on the Focus Nimbus model
- Defined an preliminary plan for ASTRA evaluation

1.3 Expected results of next period

During the next period (2nd project year), the following results are expected

- Further development of the theory of awareness and the ABC questionnaire, as measurement tool.
- Further development of the Design Framework for Awareness Applications
- Further development and integration of the Service Oriented architecture, into the deployment for evaluation, and completion of the SOA.
- Further development and integration of the mechanisms and interfaces for End User tools
- Further integration of ontology (based on concepts steming from the Focus Nimbus Model)

- Deployment of a functional prototypical example application (of SOA and TOOLS) for the evaluation.
- Conduct the first ASTRA evaluation and report its results with feedback for the Awareness theory, model, SOA and tools.
- Further development of the Focus Nimbus Model and continued experimentation with the Aware Modeling Language

1.4 Expected end results

Expected results from ASTRA are the following:

1 A theory of connectedness and awareness.
2 A descriptive model and a design framework for mechanisms that realize mediated awareness.
3 An ontology of awareness services, enabling service composition.
4 An integrated service oriented architecture that supports the development of awareness applications.
5 Specifications, design and implementation of tools aimed at end users, which support community driven development of awareness applications.
6 Participatory design of awareness applications by end-users.
7 Evaluation of the derived models and validation of the theory of connectedness through user-studies.

1.5 Dissemination and publication activities

General information about the project can be found in the ASTRA website:
http://www.astra-project.net/

A project logo and document templates are created for project reporting.

The ASTRA project logo

Project knowledge during the first year is disseminated via a number of publications:
Journals:

- Special Issue HCI journal on Awareness Systems Design, January 2007 – Lorence Earlboum Inc. B. de Ruyter, P. Markopoulos.
- Romero, N., Markopoulos, P., Baren van, J., Ruyter de, B., IJsselsteijn , W., Farshchian, B. Connecting the family with awareness systems. Personal and Ubiquitous Computing, Springer-London, August 2006, 1617-4909 (Print) 1617-4917 (Online)

Books

- De Ruyter, B, Huijnen, C., Markopoulos, P., IJsselsteijn, W.A., (2006) Creating Social Presence through Peripheral Awareness. In Aarts, E., Diederiks, E., (Eds.) Ambient Lifestyle, BIS Bright, 69-71.
- End User development book; chapter: Challenges in End User Development in Intelligent Environments. Eds: Lieberman, Patterno, Wulf. Authors: B. De Royter, R. Van de Sluis.
- P. Markopoulos, B. De Ruyter, W. Mackay book: Awareness Systems – advances in theory methodology and design. Publisher : Springer Verlag, HCI series – 2008

Conference Publications:

- Aware of What: A formal model of awareness systems that extends the focus – nimbus model. Enginnerind HCI (EHCI conference , IFIP), 22-25 March 2007. P. Markopoulos, G. Metaxas.
- Social Intelligence as the Means for achieving Emergent Interactive Behaviour in Ubiquitous Environments, By: Ioannis Zaharakis, Achilles Kameas, HCII 2007.
- End User Tools for Ambient Intelligence Environments: an overview. Irene Mavrommati HCII 2007 Beijing
- An Integrated Framework for Developing Distributed Hybrid Systems. Christos Goumopoulos, Achilles Kameas and Brendan O'Flynn. 4th International Conference on Ubiquitous Intelligence and Computing (UIC-07), Hong Kong, July 11-13, 2007
- Awareness applications for connecting mobile students. By: Eli M. Morken, Otto Helge Nygård, and Monica Divitini. IADIS International Conference On Mobile Learning 2007, Lisbon, Portugal, July 5-7 2007 .
- Poster: Preliminary requirements and approach for Tools that configure pervasive awareness applications: the ASTRA case. HCII 2007 Beijing

1.6 ASTRA Participants

ASTRA brings together researchers from three countries (Greece, the Netherlands, and Norway), and 5 organizations, of which two companies, two are universities and one is an academic research institute. The ASTRA partner organisations are:

- Research Academic Computer Technology Institute (CTI), Hellas
- Eindhoven University of Technology TU/e Netherlands
- Telenor ASA (TELENOR), Norway
- Philips Research (PHILIPS), the Netherlands
- Norwegean University of Science and Technology (NTNU), Norway.

Researchers involved in ASTRA:
CTI: Irene Mavrommati, Christos Goumopoulos, Achilles Kameas, John Zaharakis, John Calemis
TU/e: Panos Markopoulos, Winand Ijsselsteijn, George Metaxas
TELENOR: Erik Berg, Babak Farshchian
PHILIPS: Boris De Ruyter, Elly Pelgrim
NTNU: Monica Divitini, Otto Helge Nygerd

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