COMMIT

PROJECTPLAN

WORKPACKAGES

DELIVERABLES

BUDGET

INTERACTION TECHNIQUES (P02)

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1. Background

Now that more processes and services move from the 'real' world to synthetic worlds, both virtual and ambient, distant collaboration and distributed meetings are becoming regular practice, and the social interactions of humans become increasingly mediated through ICT. The quality of interaction in training and simulation environments, distributed meeting rooms, future workspaces and social virtual communities is still far from perfect. Technologies to identify and interpret human behaviour, to generate natural social experiences are needed to enrich the social life of citizens and to develop their social skills and well-being.

Our goal is to investigate and develop technologies that can create and support rich social experiences; that will enable users to participate fully in society. Technologies will be developed that will help people engage which one another, that can train them in their social skills in their daily activities and empower them to interact with their physical, social, and digital environment. The technology should achieve that goal regardless of the social class, ethnicity, and education or (physical and cognitive) abilities. Today, *not everyone has the same opportunities* for accessing ICT content, and *ease of interaction* is still limited. Future technologies should be sensitive to what the user needs and wants and the social context of the interaction. Sensing devices in the environments can keep track of activities and the mental state of the user and interpret these to provide services and support to the user. The project will advance the state of the art in sensing and interaction by building further upon the results of a number of EU Networks of Excellence and FP6/FP7 projects in which the consortium is active. The research goals imply a focus on the social well-being, social engagement and security experiences of people. It involves (longer-term) interaction between users and their social and digital environment, in the sense of their socio-geographical context. It will make use of the current MultimediaN N2 project results (researched by TNO and TUD) on multimodal interfaces, such as navigation support for older adults, social robots or avatars (incl. emotion) for older adults and children.

In the last decennium, affective and context-aware computing received a lot of attention in the field of human-computer interaction, providing new interaction paradigms and technologies. In parallel, research on universal accessibility has provided guidelines, standards and technologies to improve user interfaces for Internet and mobile devices. By combining these two research lines, this project will provide innovative user interfaces that persuade citizens to learn and act in their social environment (via avatars) and that accommodate both the cognitive and affective aspects of communication. Furthermore, it will improve current user-centered design methods, by providing a methodology and best practice for the situated design of such user interfaces.

Apart from MultimediaN N2, the project also relates, among others, to the Bsik projects ICIS and BioRange where UT has developed techniques and methods to build collaborative environments with intelligent behavior that help humans to (pre)process large amounts of digitized information and to cope with changes in dynamic environments. The BioRange project amongst others

investigates co-located collaboration between scientists in front of large displays in high tech laboratories or meeting rooms. This project is also related to a large number of FP6 and FP7 EU projects and NoE´s, and national programs such as IOP MMI.

2. Problem description

This project focuses on the creation of technologies that engage people in rich social interactions. To enable this, systems needs a better understanding of participants' activities and their social cues. Reactions of the system should be timely and reflect the kinds of synchrony that occurs in human-human interactions. On a more global level, this project focuses on the human-media interaction to enhance the self-efficacy of citizens to engage in social interactions involving media-mediated communication & collaboration in virtual environments (for training social skills) and ambient augmented real worlds (such as playgrounds, for instance). Hence, a general research questions is: How to enhance the accessibility and sharing of multimedia information concerning the self-efficacy, social engagement and security awareness of a heterogeneous population? The following are examples of the questions that will be investigated: How to provide natural interaction and natural collaboration in distributed virtual and augmented reality worlds? How to apply Virtual Reality (VR) that lets citizens experience their neighbourhood and fellow citizens to improve their social well-being? How to improve the accessibility of ambient VR environments via sensing devices and speech? How to develop game-based learning methods using virtual humans to acquire social skills?

3. Objectives

Project's goal

Our goal is to investigate and develop technologies that can create and support rich social experiences; that will enable users to participate fully in society. Technologies will be developed that will help people engage which one another, that can train them in their social skills in their daily activities and empower them to interact with their physical, social, and digital environment. The technology should achieve that goal regardless of the social class, ethnicity, and education or (physical and cognitive) abilities. Today, not everyone has the same opportunities for accessing ICT content, and ease of interaction is still limited. Future technologies should be sensitive to what the user needs and wants and the social context of the interaction. Sensing devices in the environments can keep track of activities and the mental state of the user and interpret these to provide services and support to the user. The project will advance the state of the art in sensing and interaction by building further upon the results of a number of EU Networks of Excellence and FP6/FP7 projects in which the consortium is active. The research goals imply a focus on the social well-being, social engagement and security experiences of people. It involves (longer-term) interaction between users and their social and digital environment, in the sense of their socio-geographical context. Planning of all dimensions

Planning of all dimensions

10 important end goals of the project:

- Insight in how technologies can create and support rich social experiences and help social inclusion
- Technologies will be developed that will help people engage which one another, that can train them in their social skills in their daily activities and empower them to interact with their physical, social, and digital environment
- Insight in what the important factors are that determine how humans interacting with artificial agents perceive the affective and social signals of these agents.
- Demonstrator : serious game for learning social skills
- Demonstrator:
- Contributions towards more natural means of interaction with new media and devices for a broader public.
- Annotated Corpus of Floor Control Behaviors and other Social Signals; valuable data for human behavior research.
- Insight in how storytelling techniques can be applied for development of serious games and how they can be used to support training.
- Broaden the interest in studies on the intersection of behavioral sciences, human media interaction and computer science
- Make clear to a broader public how ICT can be used for improving social inclusion and participation in society.

Results

Most important results are:

- public annotated corpus of natural human interactive behavior parallel with a corpus of natural interactive human-agent behavior within a well-defined scenario
- a demonstrator showing the use of artificial embodied interaction technology in augmented environments for learning practical, social skills.
- theoretical results published in scientific journals about the topics covered in the project, such as ICT for social inclusion, methodology for human behavior modeling and perception studies in human media interaction.

Deliverable Impact and Valorization

The demonstrator software, actively developed by the HMI group of the UT, is released under the GPL 3.0 license. In order to facilitate and ease the transfer of such software to a commercial environment, our aim is to change this into LPGPL in the future. The software platform is therefore potentially useful for a number of companies and institutions focusing on (serious or non-serious) games, or human computer interaction, and interfaces where human avatar technology is important. Projects where we already expect to use this technology include internal projects within the UT as well as projects like the Smarcos project, where Philips is interested in

using this type of technology, and where UT is a project partners. Future projects, in the areas of health and well being, coaches, and virtual guides are being planned, and are expected to build upon this software.

Deliverable Dissemination

COMMIT results will be disseminated through the public media and demonstrations at CEBIT, ICT Delta, and similar events. Exposure within organizations like the police, or the Dutch army is planned. The professional fields covered by the project will be informed of the projects results through workshops, conferences and journal publications, as well as via a project website (project deliverables , public corpora, software available under GPL)International Imbedding

Deliverable Synergy

The existing knowledge on BML and its realization has been obtained, and will be further worked on within the UT HMI group by existing staff and PhD students within the Dutch GATE project. We expect synergy with Commit project P4 on Social Animation; and Affective Body Animation; and project P5 , work packages related to People in the Loop. It is expected that such cooperation and synergy will be realized within the techniques, methods, and software components created for incorporation into the demonstrator.

4. Economic and social relevance

Both nationally and internationally, awareness is strong that new innovations in ICT are needed. New developments are needed to keep the information explosion manageable, but also to improve e-inclusion, giving all people the same access to information (social awareness) and the same room for participation in society. The IST FP6/FP7 programmes mention strategic objectives and key challenges such as information disclosure, (natural and adaptive) advanced interaction techniques and new ICT developments for inclusion. These objectives should lead to a design-for-all technology that improves inclusion and equal participation and prevents digital divides. The time chart of the Microsoft 2020 report mentions the data deluge as one of the great challenges in science. With the enormous growth of the internet, this also holds for all other information. Access to information, then, is an important topic for ICT innovation. The special 2020 issue of Nature targets the data deluge not only as a challenge. The increasing activity and information generation of people using the internet is also an opportunity. In order to tap this source, natural and universal access to information and innovations for collaboration and (social) networking are needed. On a national level, we see the same call for research into human-machine interaction and accessibility in strategic documents such as the ICT Master plan of the IPN and the ICT2030 report. The IIP/Create strategic research agenda notes how the creative sector is growing; social interaction and participation in communities are seen as potential fields where this sector can have a large impact. To ensure its impact on economy, and success of innovation (both currently still small), IIP/Create defines spear points of new developments. Again, the themes stress natural interactivity, accessibility of information, and collaboration, in real and virtual worlds

("everything starts and ends with interactivity"). Given the themes of “natural interaction” and “universal accessibility”, this project will address both social and economic problems. It will:

- help to prevent that specific groups of citizens are “disconnected” from the information society,
- support neighborhood contact,
- provide media-interaction and methods that improve citizens’ self-efficacy and district’s cohesion,
- provide innovative multimodal user interfaces that allow for the development of novel types of interactive applications in training, entertainment and collaborative environments.

Both for industry and government, the project results will help to approach heterogeneous groups of consumers and citizens via interactive multimedia technology, addressing their interaction adequately. The project will deliver a method for cooperative design to improve industry’s user requirements analyses, and uptake of universal accessibility knowledge, guidelines and standards. Industry will be involved in the development of multimodal interaction methods and the corresponding user interfaces. The market potential will be explicitly investigated, transferring innovative interaction concepts to business cases. This will be done through the two Golden Demos defined elsewhere in this proposal, but will also happen through the involvement of the various industrial partners in the consortium, who all have extensive past experience in developing new products using advanced technologies and new media, and bringing those products to actual customers and users. A number of interactive edutainment/entertainment installations will be developed as research demonstrators. They will actually be deployed in public places such as playgrounds, schools, and gym halls. A coherent software suite for collaborative learning and experiencing the urban neighborhood will be developed, and evaluated using in-depth field studies in actual neighborhoods. Market and design knowledge will be gained by better understanding multimedia platform needs and expectation of specific population segments. The project will provide a best practice on inclusive design to enhance the participation of a heterogeneous group of citizens in their social environment. Via Internet, this result can be experienced by interested parties, such as governmental organizations, citizen communities and software designers.

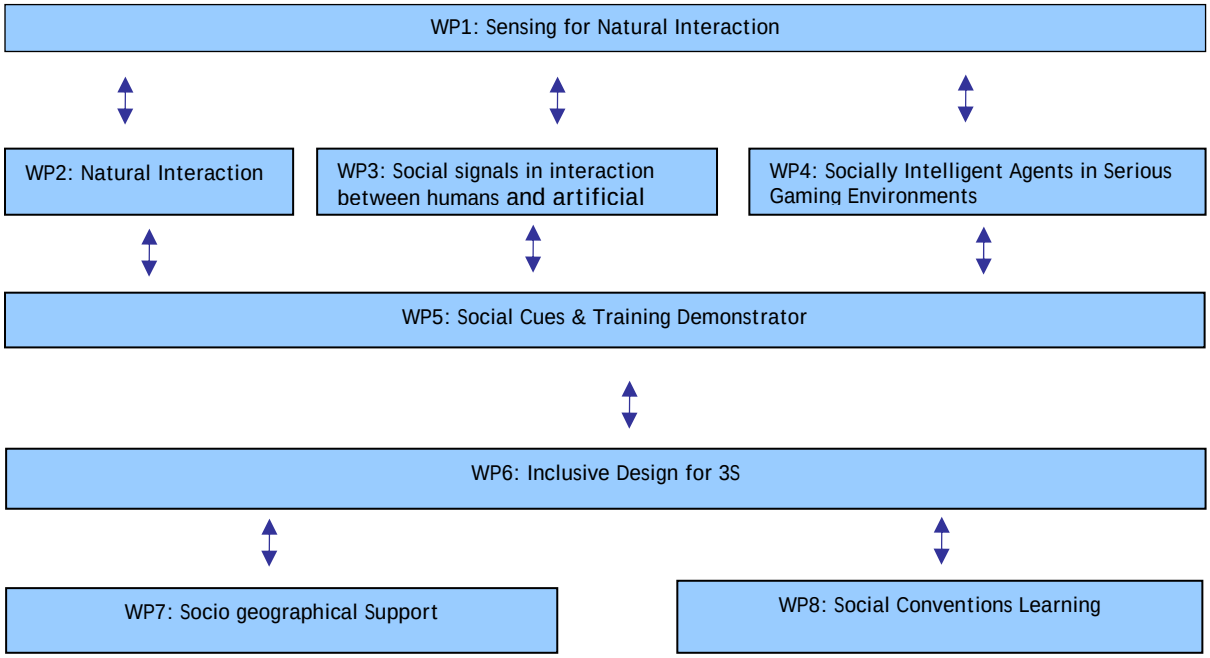
5. Consortium

The multi-disciplinary team has roots in science, technology and society. The scientific partners UT, TNO, TUD participate internationally in a large number of EU FP6/FP7 projects and EU Networks of Excellence, on topics closely related to this proposal. We aim at consolidation of results by selecting industrial partners with specific expertise that match the topics from the work packages. The industrial partners are all interested in developing advanced interfaces and natural interaction, and in environments for cooperation and training/simulation. They will participate in the research activities, as well as contribute serious effort in developing research prototypes and demonstrators used for experimental evaluation. Some partners will receive subsidy (see

"resources and budget") and will contribute proportionally more effort, as can also be seen in the number and type of deliverables for which they are responsible

With all industrial partners mentioned below there has been collaboration in the past with UT, TNO, and/or TUD, or there is collaboration that will start soon, in the context of other approved (European and national) projects. VicarVision (WP1) develops state-of-the-art solutions and products for computer vision based reading of the face of humans. KITT Engineering (WP1,WP2) has extensive experience in developing and deploying interactive edutainment systems. They will develop both the hardware and interaction concepts for novel entertainment installations. Noldus (WP 1, 2, 3) is specialized in technology, experimental setups, and process support, for experiments with behavior observation and analysis. Re-Lion (WP3,5) are experts in simulation and training applications in virtual environments. They will contribute heavily to the development of the training prototypes. T-Xchange (WP4,5), specialized in developing and coaching/supervising serious games for complex decision making processes, participates in development activities and provides a testing ground with users for the training prototypes. KLPD (WP3,4,5) is the national organization of the police with extensive experience on advanced interfaces for training environments. They will collaborate in developing advanced interfaces for training environments, and provide an actual usage environment for the training prototypes. Broadfield Security Services (WP6) is specialized in security consulting and training. They will bring in their security service and their contacts with professionals and end-users, and will focus on developing best practices. Thales (WP7) have expertise in modeling and using social situational awareness, and scenarios and communication support in tactical planning and scheduling of action. They will support the work on a number of the deliverables by providing expertise and guidance (e.g. through participation in repeated discussion session, reviewing of documents, selecting relevant literature, providing coaching and on-the-job training in the use of dedicated tools and techniques that also have their interest such as use of concept mapping to build and navigate socio-geographical maps). Almende (WP7) will contribute with their sensor platform, which integrates personal devices, and technology integrated into the house, to monitor and support individuals, and to facilitate sharing of information in social groups (e.g. family, school, district, and friends). Cinop (WP6,8) has extensive previous experience with the development and validation of the Dutch integration test, which is a fully automatic language and knowledge test. They will contribute to development of innovative applications of this technology. Cybermind (WP8) is a leading distributor/ manufacturer in Europe for head mounted displays and motion sensor hardware. They will contribute to WP8 with consultancy on which kind of VR equipment to use.

6. Workplan



The work plan centers around creating new knowledge, new design methods, software and algorithms, and a series of prototypes. Detailed information can be found in the WP descriptions and the overview of deliverables.

The prototypes vary in number of users, whether the interaction scenario is open ended or more specific / task oriented, and whether the interaction is focused on a few users or on the larger socio-geographic context surrounding the users. They will be developed in iterative processes involving various work packages, starting from a design based on annotated corpora of users interacting in relevant settings, through several iterations of the prototype, ending in evaluations of the result in real-life settings with actual users.

The main prototypes are (1) an interactive entertainment installation in which the coordination between users and/or between user and system plays a major role; (2) a virtual environment with advanced techniques for detection of social signals, user interaction, story telling and generation and animation of social signals by means of non-verbal behavior; (3) a serious game in which storytelling techniques are applied to support training, featuring an 'emergent narrative' approach to storytelling, where the trainee (player) interacts with intelligent artificial agents ("non-player characters"); (4) a software tool box for inclusive design methods for various target groups, including best practices for developing support tools for enhancing self-efficacy, social engagement and security awareness; (5) a Socio-Geographical Support prototype focusing on supporting district members to participate in social district events, such as Queen's day, carnaval, "intocht Sinterklaas", and football world cup; (6) a mixed reality application for social convention learning which allows the target group (people of low literacy and non-native citizens), based on

what they have learned in the virtual reality environment, to engage in real interaction with other district members.

Projectnumber P02	
WP leader	Mannes Poel (Human Media Interaction), Marten den Uyl (VicarVision)
WP title & acronym	WP1 – Sensing for Natural Interaction

Objectives

The objectives of this WP are to develop methods and techniques for the automatic detection and interpretation of non-verbal social signals in the context of multi-party natural interaction between humans and virtual humans in a serious gaming-like scenario. Sensors, which include cameras, microphones, tactile, position and (neuro)physiological sensors are more and more becoming part of sensor-extended PCs, sensor-equipped environments, smart rooms and homes, augmented reality, mixed reality and virtual reality environments. The availability of these sensors introduces the opportunity of context-dependent detection and interpretation of a user's or visitor's interaction relevant social signals and activities, such as persuasion, rapport, disagreement. In a joint conversational activity between humans or between humans and virtual humans, social signals regulate the flow of conversation, for instance floor changes and turn taking. These social signals are generated by, among others, head movements, body movements, hand and arm gestures. Detection and interpretation of such social signals and activities allows virtual humans participating in the joint conversational activity to interact in a natural way with the user by reactively and pro-actively providing (context-dependent) feedback, including the adaptation of the environment. In general, social signals can provide cues of the affective state, cognitive state and social awareness. Detection of such social signals is relevant in many applications ranging from E-inclusion, social well being and assisted living. Research Questions The main research question of this work package is "To what extent can computers detect social human behavior?" Of course this research question is much too broad in terms of which social human behaviors and of the environment in which the behavior takes place. We consider a smart environment setting in which there is a multi-party natural interaction between humans and virtual humans in a serious gaming-like scenario. Moreover we focus on the multi-modal combination of nonverbal human behavior and audio, especially social signals conveyed by body movements and speech. When convenient, other sensors, such as pressure sensors in chairs, will also be taken into consideration. A data-driven approach will be taken for the design and evaluation of the detectors. The first one and a half year will mostly be dedicated to setting up a corpus of annotated social human behaviors. The requirements, context and scenarios will be defined in close cooperation with the other WPs. The annotations will also be used to determine which nonverbal behaviors can be interpreted as social signals independent of context (non-ambiguous signals). To determine the role of context in the interpretation of intrinsically ambiguous signals, a perception experiment will be conducted.

Projectnumber P02	
WP title & acronym	WP2 – Natural Interaction in Ambient Entertainment
WP leader	Dennis Reidsma (UTwente), Andries Lohmeijer (KITT Engineering)

This WP concerns research into measurement of behavior coordination and active support of behavior coordination in social and entertainment (human-human & human-computer) interaction.

In natural (face to face) interaction people coordinate their behavior, not just the content but also the timing (movement synchrony). Adaptation of the timing of nonverbal behavior to each other is strongly correlated with positive evaluation of the interaction and interaction partner. In human-machine interaction this mutual coordination of behavior is still largely absent. Giving interactive systems capabilities for such temporal coordination will enhance the quality of human-machine interaction. Temporal dynamics of natural human-human interaction have only recently started to be addressed in human-machine interaction research. There are still many research questions to be answered before these mechanisms can be applied productively in interactive systems. (Automatically) measuring the degree of synchrony in interaction may yield valuable insights into many qualitative aspects of the interaction, such as the quality of the interaction, the degree of cooperation displayed by the people involved, and the effectiveness of the interaction. Interfaces that implement mechanisms of synchrony in (multimodal) interaction can improve the quality of human-computer interaction. Engaging a user in mutually coordinated multimodal interaction should make systems more robust, pleasant, and efficient to use.

The focus of activities is on: 1. Developing (and evaluating) algorithms for measuring coordination, synchrony and interaction flow in human-human and human-machine interaction. 2. Implementation of mechanisms of movement synchrony and other temporal coordination in interactive (entertainment) installations. 3. Evaluation of user perception of (the quality of) interaction with such systems The WP focuses on use cases in entertainment applications with co-located multiparty interaction, like interactive playgrounds, museum installations, or interactive installations in public spaces.

Research Questions 1. What are suitable approaches to *measuring the degree of synchrony and coordination* in human-human and human-machine interaction? 2. How can one build interactive systems that *intentionally implement mechanisms of synchrony* and coordination? 3. What is the possible role of such mechanisms of coordinated interaction in *interactive entertainment installations*?

P2	WP3 - Social signals in interaction between humans and artificial agents
WP leader	Rieks op den Akker, Job Zwiers (UT)

This work package focuses on the interpersonal and contextual (i.e. situation and task-related) aspects of turn-taking and floor management in conversational encounters. In this work package we build models of turn-taking and floor management for artificial conversational agents that display appropriate behaviors when they are involved in a conversation. We develop models that help: a. to understand communication between agents that participate in a joint conversational activity, how participants by their individual contributions and expressions coordinate this activity, what signals they send out and receive and how the (temporal patterns in) these signals are related to perceived qualities of the interaction according to the reports of the participants themselves as well in the eyes of outside observers (friendliness, formality, conflicting, stressfulness). B. to design artificial agent behaviors intended to be perceived as coordinating interactive behavior when interacting with other artificial agents or with humans and that fit the type of conversation, the specific joint activity, and roles that the agents are involved in. The work that is carried out involves: scenario specification, data collection and analyses, perception studies, interaction modeling, behavior generation for conversing artificial characters and evaluation.

When humans are co-present, involved in a conversation while performing a joint task, they will coordinate their contributions to the conversation by exchanging all sorts of signals. Such coordination takes place either deliberatively and intentionally, or unintentionally. They show by means of gestures, head movements and eye gaze what their focus of attention is, whether they want to take turn, whether they expect the other to say something, who they address when they say something, and what their stance is towards the others. The ability to display appropriate expressions and behaviors when taking turn, when yielding the turn or when interrupting the speaker are often considered as important requirements for artificial agents will they be accepted as social and believable characters, that can take part in a smooth interaction. But what is still acceptable and what isn't is unclear. In particular, it is unclear what the most prominent features of embodied interface agents in a given situation are that have the most impact on how human subjects perceive the artificial characters and the interpersonal qualities of the interaction. Theoretical studies and controlled perception studies in this project will contribute to clarify this. Target use cases that we focus on are serious games and interactive story telling where artificial human-like characters play a role in realistic scenarios and where human subjects play the role of an outside observer of simulated social behavior presented by characters in a virtual environment or where human subjects are themselves participants interacting with the artificial characters. It is important to know how human subjects perceive such behaviors and what factors (properties of characters, graphics style, conversational content, timings, tasks, scenario, role, human subject's personality) influence how the artificial characters are perceived. Turn-taking patterns are an important fingerprint of a social encounter: the way that participants organize their contributions, how and when they direct themselves to others, the flow of the conversation, is strongly related to the type of encounter and often reveals the type of interpersonal relationships between the agents as well as what is going on between the participants. Various theoretical perspectives –-from different disciplines–- on turn-taking in face-to-face conversations exist. How do these perspectives and the corresponding models contribute in building models for design and realization of artificial social interacting conversational agents? Conversations are often embedded in a joint activity. The (shared) knowledge of the task and the role that agents play in the task largely determines the flow of joint activities in the conversation. How important are observable non-verbal signals produced by the artificial agents for the engagement and fluency of the interaction and the performance of the joint task? Social signals, including those signals that regulate the flow of the conversation, are best studied in the concrete practical context where they naturally occur. Hence, we focus on the interactions between the behaviors of the individual participating subjects, not on isolated behaviors of the subjects. We collect data in well-defined scenarios, including descriptions of specific tasks and roles, so that social signals can be interpreted within that scenario. We will restrict our studies to these specific scenarios and focus on a selection of interesting social behaviors that occur, and on those qualities of social encounters that show to be important in the selected scenarios. We will perform perception studies of conversational interactions where subjects are either outside observer or participant and report about how they perceive and assess the interaction and the agents' behaviors. We will build virtual human behavior and validate the usefulness of the underlying models by means of similar perception experiments where users interact with or observe the virtual humans showing the simulated behavior in the same scenario.

P2	WP4 - Socially Intelligent Agents in Serious Gaming Environments
WP leader	Mariët Theune (Human Media Interaction), Johan de Heer (T-Xchange)

In this WP we investigate the use of interactive storytelling techniques in serious games used for training purposes. Our focus is on providing artificial agents ("non-player characters" in the game) with social intelligence to support training. That is, the agents need to be able to send social signals and react to social signals sent by other characters in the game. These other characters can be either other non-player characters, or (avatars controlled by) human trainee(s). Social signals refer to aspects of social relationships between people that interact: agreeableness, dominancy, distance, acceptance, etc. Mostly people are not aware of how social signals affect their behavior or judgment of a situation; they are recognized on a subconscious level. Social signals are not deliberately sent out as a result of some cognitive process. In this WP we focus on social signals that are related to people's interpersonal relationships or attitude, for example interest or aggression. The main objective of the WP is to model the interpretation and generation of social signals by artificial agents to support training. An iterative approach will be followed to develop increasingly sophisticated models of social behavior interpretation/generation for use by socially intelligent agents. This involves investigating the following questions about social signals presented by avatars (controlled by artificial agents) in a specific scene in a serious game used in a tutoring scenario. A. How can believable social behavior be generated by avatars in a serious game? B. How can social behavior by artificial agents be used to support training in serious games? C. Do the social signals of the agents contribute to successful identification of the situation by the trainee? D. How should feedback to the human trainee's social behavior be presented? Another important challenge is to devise techniques to keep the game optimally adaptive to the user's actions while still incorporating specific training challenges. This will require the agents to have some meta-level understanding of the training goals, enabling them to reason about the best actions to take in order to fulfill the game purpose, while still remaining believable in their interactions with the trainee(s) and each other. The results of the WP should be applicable in different types of training games. These could be social behavior training games, where trainees learn to react appropriately to social signals by others, but they could also be games with different training goals in which social signals nevertheless play an important role (for example to establish interpersonal relationships between players).

For our work in this WP we will build on our experience in building artificial agents for interactive storytelling. There is a close link between interactive digital storytelling and serious gaming. Interactive storytelling is aimed at providing human users with the dramatic experience of being a character in a story that unfolds based on the actions they take in a simulated story world. Serious gaming has the same elements of human players acting in a simulated world, in which they can try out the consequences of their actions. The main difference between the two is that serious gaming aims at providing the player with an educational rather than a dramatic experience. Emergent narrative is an interactive storytelling approach that lends itself well to serious gaming applications. In this approach, autonomous intelligent agents create a story in a simulated environment, in interaction with a human user or users. The story is not given in advance but emerges from the interactions between the human user(s) and the agents. This means it will develop differently depending on the players' interaction with other characters in the story (played by other humans or by artificial agents). This enables human users to directly experience the effects of their own actions, including their social behaviors. Note that in this approach the human user has full agency, which goes far beyond making choices at selected points in the story to determine its outcome (as in simple "branching narrative" approaches). The emergent narrative approach is used in the Virtual Storyteller system developed at the University of Twente, which will form the starting point for the research in this WP. So far, the Virtual Storyteller has been oriented toward entertainment, but here we will investigate its use for serious gaming and in particular, for serious training games.

P2	WP5 – Social Cues and Training Demonstrator
WP leader	Job Zwiers (UT) & Chris Haarmeijer (Re-Lion)
A main focus of the WP5 work packages is social interaction by means of multi modal signals, including recognition, interpretation, and generation of speech and language as well as various non-verbal signals. The WP5 work package is meant to create a demonstrator where many of these techniques can be shown in an integrated way. A second major objective is the transfer of knowledge between industrial partners and academia, by creating products mainly by our industrial partners. Requirements capturing is done by the creation of use case scenarios, mostly by KLPD, in cooperation with other partners. On the basis of this, a serious game will be developed by T-Xchange, partly based on research done by T-Xchange in work package WP4. An implementation and realization of the use cases will be done by Re-lion. Finally, an extensive form of evaluation will be done by regular user testing and evaluation by all partners. The content of the use case is intended to focus on aspects that are relevant in police training. Mental wellness, social engagement and security awareness are part of the training activity of social workers, police and others, often operating in small teams. An intelligent virtual environment will be created in which policing activities can be prepared and where scenarios can be tested and evaluated. The focus lies on the intelligent security of neighborhoods, and includes training situations for police teams to handle challenging social situations. Current simulators as for instance the Virtual Infantry Trainer, under development by Re-Lion provide a good starting point, and offer a full fledged VR environment with a fair amount of visual richness and realism. Based upon this existing expertise, a representative environment will be created that incorporates smart sensors like cameras, heat sensors, microphones, tactile sensors, position and (neuro)physiological sensors. Automatic detection of relevant or strange behavior and activities will be supported, including scenario generation where such activities can be specified by human instructors. High quality interaction between trainees, human instructors, and virtual characters is one of the goals of the training aspect of the simulator. Smart sensing will be used to interpret behavioral aspects, like stress detection, back channeling frustration from the human part, or for signaling agreement or disagreement in dialogue. Among the techniques to be used we count interpretation of hand gestures or pose recognition. The response of the system, towards the humans, will consist of verbal as well as nonverbal behavior, including character animation for sending social cues.	

P2	WP6 – Inclusive Design for 3S (Self-efficacy, Social engagement and Security)
WP leader	Anita Cremers (TNO)

The objective is to enhance the self-efficacy, social engagement and security awareness of diverse citizens in a district via interaction with personal applications and services.

More and more, (local) authorities expect citizens to take responsibility of their own lives. This means that citizens are expected to solve their own problems as much as possible, and, if necessary, to take the initiative to ask for support. Many citizens are able to meet this expectation. However, there are also groups that are not as able to meet the demands of the (information) society, for instance the elderly, children, people of low literacy and non-native citizens. If the self-efficacy, social engagement and security awareness of these groups are enhanced, they are expected to be able to function better in their district and have a better quality of life. Interaction with personal applications and services is expected to support the groups in achieving these goals. These services should address the diversity in information content, use context and users, in a sound and structured way. In order to involve the groups in the design process, an inclusive design method should be developed. The method involves both the citizens and other stakeholders in the design process (participative design) in playful and explorative concept design sessions, and systematic interaction design and test activities. The inclusive design method should be exemplified with best practices of user-driven, scenario-based design of new, easy-to-access, services and applications. The "best practice" development should make use of and integrate market standard user interaction platforms (Facebook, LinkedIn, twitter, etc.). Currently, no theory exists on how the self-efficacy, social engagement and security awareness of diverse citizens can be enhanced by mobile and virtual reality applications. As a result of this project, we will contribute to this theory.

The focus of activities is on: A. Developing and applying, in an iterative fashion, an *inclusive design method* (in the form of a software tool box), that incorporates universal accessibility guidelines and deploys interface solutions from WP2B (mobile context-aware interfaces) and WP2C (virtual social environments). B. Exemplifying the inclusive design method with *best practices* of user-driven, scenario-based design of new, easy-to-access, services and applications. We will start from a scenario in the domain of (perceived) public security, focusing on the elderly target group. Later we will extend the scenario to the other target groups and applications (mobile and virtual reality). C. Building up knowledge on needs, abilities, and requirements of four specific *user groups* (elderly, children, people of low literacy and non-native citizens) and generalizing the findings. D. Contributing to a theory, in an iterative fashion, on how the *self-efficacy, social engagement and security awareness* of diverse citizens can be enhanced by mobile and virtual reality applications.

Research Questions 1. How can the self-efficacy, social engagement and security awareness of diverse citizens in a district be enhanced via interaction with personal applications and services? 2. What does an inclusive design method to achieve the project objective consist of? How can the method be exemplified by best practices? 3. What does a theory on how the self-efficacy, social engagement and security awareness of diverse citizens can be enhanced by mobile and virtual reality applications consist of?

P2	WP7 – Socio-Geographical Support
WP leader	Willem-Paul Brinkman (TUD)

This WP focuses on the navigation through socio-geographical environments with multimedia-enriched support. A neighborhood is not only experienced through the layout of the streets and squares, but also by the perceived social threats and opportunities. This WP focuses on human navigation support, helping citizens to form relevant mental models of the structure of their social and geographical environment, helping them to feel safe and secure. The WP starts with young elementary school children (6-12 years), who have just moved to a novel neighborhood, and for whom it is important to ease the geographical and social integration. Among other things, the study will provide insight in what problems children experience when having to integrate in their novel environment, and how to solve such problems via media-mediated navigation. Using a distributed approach, members of a district become key actors in discussing important issues or events in a district and building social cohesion of their community. Allowing them to use multimedia elements (text, pictures, and video) to annotate geographical maps of a district, would create a real-time environment, accessible on mobile platforms. These platforms would give users on location information related to their location. The focus of the first year will be identifying key design factors that influence social acceptable interaction strategies which support district members to exchange autobiographical information about their district. The second year will initially focus on analyzing and disseminating results of the field study. After this, work will focus on district navigation support targeting young elementary school children new to the neighborhood. The tool aims at supporting this target group with becoming familiar with social and geographical environment of an unfamiliar district. The inclusive design method developed in WP6 will be applied in this design iteration. In year 3 the focus shifts towards the support of real time situational awareness of the district and its members. In the last year focus will be on socio-geographical support in the context of a specific event in the district. An important factor to increase cohesion in the district is the participation of local events such as Queens day, carnaval, "intocht Sinterklaas", and football world cup.

The general research questions are: 1. How do people learn and maintain awareness of the spatial and social structure of their environment with is dynamics? 2. How do they learn to identify the social risks (strangers in the proverbial "dark alley") and rewards (potential friends)? 3. What support systems can make the socio-geographical inclusion process more efficient?

P2	WP 8 - Social Conventions Learning in Mixed Reality
WP leader	Judith Kessens (TNO)

This work package aims at helping citizens (in particular people of low literacy and non-native citizens) to obtain appropriate experience to develop skills, attitudes, knowledge and behaviors needed to overcome barriers that otherwise hinder social engagement in a district, by representing social interaction norms and manners in a recreated social scene.

Nowadays, citizens are expected to solve their own problems as much as possible, and, if necessary, to take the initiative to ask for support. People who have limited Dutch language skills (in particular non-native citizens and people of low literacy) are not fully able to meet this expectation. However, they need these language skills as well as knowledge of social interaction norms to achieve social engagement in the district (e.g. interacting with health, educational or public safety institutes in a district). This target group probably requires a specific approach to persuade them to adhere to social conventions. Persuasive technology is considered to be helpful in this respect. However, it is not clear yet how persuasive technology should be designed for this target group.

The focus of activities is on: 1. Developing mixed reality learning environments, where users can navigate through their district and communicate with its virtual inhabitants naturally with speech-enabled user interfaces. Also, reading skills will be trained. 2. Developing situated learning in recreated social situations by including life-like characters (avatars) in the virtual scene. 3. Encouraging users to actually step into the real world, carrying support tools for applying the skills developed in the virtual world with them.

Research Questions 1. How can social interaction norms and manners that help citizens to obtain appropriate experience to develop skills, attitudes, knowledge and behaviors needed to overcome barriers that otherwise hinder social engagement in a district (e.g. interacting with health, educational or public safety institutes in a district) be represented in a recreated social scene? 2. How can life-like characters (avatars) in the virtual scene stimulate situated learning? 3. Can users be stimulated in the virtual world to step into the real world, carrying mobile support tools? 4. How should persuasive technology be designed for the target group of people of low literacy and non-native citizens?

DELIVERABLES

Number of important journal paper
14

Number of important conference contributions
27

Products

1. D4.2 (Corpus of annotated recordings (UT and Noldus)

   This corpus is the finalization of the corpus of year one (D1.5 of WP1). It contains recordings of social signals in natural interaction together with annotations of the relevant social signals. This corpus will serve as the basis and an international benchmark for the automatic detection of body posture and movement related social signals.

   - WP 1 YP 2014

2. D4.5 (Second prototype of interactive entertainment installation (KITT)

   The second of two prototypes of an interactive entertainment installation in which the coordination between users and/or between user and system plays a major role. The interactive installation will be inspired by the playground setting that has been selected, and analysed using corpus recordings, in the first year. The prototype will use a computational method for automatic analysis of coordination between users, developed earlier in WP2.

   - WP 2 YP 2014

3. D2.1 (Annotated Corpus of Floor Control Behaviors

   Based on the outcomes of the perception studies, that answer the questions what the most relevant features of the participants' behaviours are and what the perceived qualities of the interaction are, the recorded interactions will be annotated with the labels used by the observers as well as on layers for observable features (gestures, head and body movements, expressions in face, body and voice). The annotated corpus will then be used for improving the models of the relation between the labelled qualities of the interaction and the gestures in the given scenario. The annotated corpus can also be used for training and testing the machine models. The models are used for generating behaviours with the aim to produce interactions with the related qualities.

   - WP3 YP 20122

4. D4.1 (Integration of modules from other work packages into demonstrator (and Final version of demonstrator (Relion, UT)

   The use case scenarios developed within the project are expected to incorporate a virtual environment with advanced techniques for detection of social signals, user interaction, story telling and generation and animation of social signals by means of non-verbal behaviour. The demonstrator will be based on the use case scenario, developed by KLPD and T-Xchange in the

first year, and on the results of testing and evaluating the three prototypes of the demonstrator delivered in the first three years. It will incorporate specific software modules from other work packages developed with the aim to incorporate them in the "golden demo". The demonstrator will enable parts of the serious game for training scenarios, and will be used as an evaluation tool for various project deliverables.

- WP 5 YP 2014

5. D4.1 (Model of self-efficacy, social engagement and security awareness (Cinop)
   Following an iterative design method, every year an updated version of a model of self-efficacy, social engagement and security awareness will be delivered. This is the final model, describing how self-efficacy, social engagement and security awareness can be enhanced for the various target groups (elderly, children, people of low literacy and non-native citizens).
   - WP 6 YP 2014

6. D3.3 (Design concept mixed reality (TUD)
   Following an iterative design method, every year an updated version of the design concept of the support tool for social convention learning will be delivered. This final design entails a mixed reality application which allows the target group (people of low literacy and non-native citizens), based on what they have learned in the virtual reality environment, to engage in real interaction with other district members. It forms the basis for the final prototype (D3.4).
   - WP 8 YP 2013

Software

1. D2.4 (Software for automatic body motion detection (Vicar Vision and Noldus)
   In order to automatically detect body posture and movement related social signals it is of utmost important to have software for automatic body movement detection. The software will be built on basis of the (annotated) corpus and is the foundation for the automatic detection of body movement related social signals in the rest of the project. All body movement related social signal detectors can use this software as the first processing tool. Moreover it is an extension to the already available software human behaviour detection software of Noldus and Vicar Vision and hence will be integrated in their products.
   - WP 1 YP 2012

2. D3.5 (Improved method for measuring synchrony ((UT)
   Based on the method of Ramseyer et al. for measuring the amount of nonverbal synchrony cumulative over the duration of a whole interaction, we will develop a method focused on detecting local nonverbal synchrony at specific moments in the interaction. This method will be tuned to finding moments of high synchrony in interactions in the playground setting that forms the basis of WP2 – although the result will probably be also applicable in the more conversational setting underlying the other WPs.
   - WP 2 YP 2013

3. D3.1 (BML specification of social signals

   BML will be used to specify behaviors of artificial embodied agents that can show typical behaviours in a given interaction. The interaction is simulated between two or more artificial characters. The implementation will use existing BML realizer developed at HMI. The work will be performed in close cooperation with WP4 and WP5. Outcomes are used in the demonstrator (see WP5). We will investigate the idea to generate two party interactive behaviour virtually produced by two autonomous but interacting agents as if they are part of one "body". The question is if this is an effective approach is for simulating synchronic behaviour of interacting agents.

   - WP 3 YP 2013

4. D3.2 (Implementation BML multi-agent behaviours and integration in common demonstrator (WP5)

   The artificial agents are integrated as characters in a virtual environment and will act according to the roles they have as characters in the storyline in a serious game. This deliverable of WP3 is an outcome of co-operation with WP4 (story, serious game) and WP5 (demonstrator).

   - WP 3 YP 2013

5. D4.2 Final version of prototype of serious game. (T-Xchange, UT)

   This is the final prototype of a serious game in which storytelling techniques are applied to support training. The prototype will feature an 'emergent narrative' approach to storytelling, where the trainee (player) interacts with intelligent artificial agents ("non-player characters"). The prototype will implement a scene from the overall scenario established in WP5. Development of the prototype will be incremental. The final prototype will be the result of at least three rounds of development, evaluation and improvement / extension of subsequent prototypes. The final prototype is envisaged to include a 'lightweight' model for social behaviour interpretation and generation by artificial agents, enabling them to produce social signals and to draw inferences from social signals sent by other characters in the game. It will also include a model allow the agents to reason about meta-level educational goals of the training game, and to steer the interaction to achieve these goals. Selected parts of this prototype will be integrated with the overall demonstrator developed in WP5.

   - WP 4 YP 2014

6. D2.2/D3.2 Implementation and evaluation of the first/second use case (TXchange, UT, Re-lion, KLPD)

   The scenario and use case, specified in the first year, will be gradually implemented and evaluated in a number of iterations. (This includes the development of novel techniques for serious games, and the development of the serious games themselves. It also includes the

development of technology, including systems, sensors and software for interfacing, and the development of VR technology for interaction and the exchange of social signals. The results of these implementation efforts will be prototype demonstrators that will be used for experimentation, user studies and evaluation. (The implemented use cases will play an important role as showcases in dissemination activities. Moreover, the results are candidates for exchange of knowledge and synergy with other Commit projects, like P4 and P5.
- WP 5 YP 2013

7. D4.2 (Software tool box for inclusive design methods for various target groups, including best practices. (TNO)
   Following an iterative design method, every year an updated version of prototype for the software tool box for inclusive design methods will be delivered, to include various target groups (elderly, children, people of low literacy and non-native citizens) in developing support tools for enhancing self efficacy, social engagement and security awareness. This is the final prototype, including best practices of applying the methods to develop support tools to enhance (self-efficacy, social engagement and security awareness for the various target groups.
   - WP 6 YP 2014

8. D4.1 (Socio-Geographical Support Prototype 4
   Prototype 4 is the result of the last iteration cycle of the prototype in the work package. This prototype will focus on supporting district members to participate in social district events, such as Queen's day, carnaval, "intocht Sinterklaas", and football world cup. An important element therefore is planning and scheduling modelling for such an event. The software prototype will use the Almende sensor platform technology, and will be built upon previous prototype versions. Target user group of prototype version 4 are district members.
   - WP 7 YP 2014

9. D3.4 (Prototype mixed reality application (including Cybermind equipment and tools) (TUD)
   Following an iterative design method, every year an updated version of the implemented prototype for social convention learning will be delivered. This final prototype entails a mixed reality application which allows the target group (people of low literacy and non-native citizens), based on what they have learned in the virtual reality environment, to engage in real interaction with other district members.
   - WP 8 YP 2013

User studies

1. D3.3 (User study on the perception of ambiguous social signals (UT)
   The intrinsic ambiguity and context-dependency of social signals will be measured in a perception experiment with natural data. This user study will give insight in the user

perception of real social behaviour. It will address fundamental questions such as: which social signals are perceived as ambiguous and why?

- WP 1 YP 2013

2. D3.5 (User study on the perception of synthesized social behaviours (UT)

   This user study will give insight in the user perception of synthesized social behaviour, i.e. social signals generated by virtual humans. It will serve as a guideline for determining which social signals are ambiguous and, in combination with user study D3.3, will address fundamental questions such as: (1) Is there a difference in perception between real and synthesized social behaviour, and what are the causes? (2) What are the consequences for the synthesis of social behaviour in virtual embodied agents?

   - WP 1 YP 2013

3. D4.6 (User evaluation of prototype D4.4 in real-life setting (UT)

   Description We will evaluate the entertainment installation prototype with a user study. It will be deployed in a real-life setting, with real users. For all candidate settings (of which one will be selected in the first year), we have (through KITT Engineering) access to places where we can let real users interact with the system: a school, a seller of outdoor playground equipment, and a museum.

   - WP 2 YP 2014

4. D2.2 (Perception studies of human-human interaction

   How do human subjects perceive human social encounters and what are the main factors that determine the way they assess what they observe as outside observers or as participants in such a social encounter? The question is relevant to determine the important ingredients of a model for simulating social aspects of conversational interactions by means of embodied agents. The user study will try to answer this question and review findings from previous research.

   - WP 3 YP 2012

5. D4.1 (Perception of (conversational agent behaviour

   This perception study consists of two parts. The first one concerns the perception by human subjects of social behaviour shown by artificial social agents in a given scenario. The second part concerns the perception by human participants that are engaged in a social encounter with human and artificial agents in the same scenario. We measure by observation of social signals and by means of questionnaires how the subjects perceive the social behaviours related to floor control and turn taking and how this is related to the social qualities of the interaction. Finally we compare the results with the results of perception of human-human interaction. This will allow us to draw conclusions about the possibility of simulating a social encounter by artificial embodied agents.

- WP3 YP 2014

6. D3.3 User evaluation of third game prototype (UT)
   Description This user study evaluates the pre-final prototype of the serious game developed in WP4. The results of the study will inform development of the final version of the game. General evaluation goals include testing the usability of the interface, aspects of game play experience, and achievement of training goals. Evaluation goals specific to the evaluation of this version of the prototype are (1) to test the added value of the new agent model, allowing the agents to reason about training goals and to steer the interaction where necessary, and (2) to investigate if simply observing the way the story develops provides the trainee with sufficient feedback, or if more explicit forms of feedback are required. For the user evaluation we intend to build on and extend the methods that have been recently proposed in the European Network of Excellence IRIS (Integrating Research in Interactive Storytelling).
   - WP 4 YP 2014

7. D4.2 (Evaluation of demonstrator ((KLPD, TXchange, UT)
   The final product of WP5 is a "golden demo". The final product will be tested and evaluated with prospective users. (The focus will be on the social interaction concept as a whole. (In particular the serious game aspects will be addressed and evaluated, as well as the role of various techniques for detected, processing, generating, and representing social signals. A second goal is to investigate to what extent and how well the use case scenarios are addressed, what type of interaction, what modalities, and which serious game concepts would be worthwhile for future research.
   - WP 5 YP 2014

8. D1.4 (Use case P2.2: Part Best practice of applying methods to elderly target group and other stakeholders, focusing on perceived public security (BSS)
   In the course of the project three best practices of applying inclusive design methods to develop support tools for enhancing self-efficacy, social engagement and security awareness will be composed, for various target groups. This deliverable focuses on a best practice to enhance perceived public security for the elderly target group.
   - WP 6 YP 2011

9. D1.1 (Use Case P2.2: Part ("Field and focus group report" (in coordination with WP8)
   This part of the Use Case report will focus on establishing an understanding of the type of social concerns that are important for district members, and mental concepts essential to the culture of the district. This will be done in a field study setting, where district members will be interviewed in their own environment and with cultural probe study. Second element of the report will focus on the use of potential socio-geographical support technology. (Using a

scenario-based analysis approach, focus groups will see and discuss various future scenarios in which the technology is used.
- WP 7 YP 2011

10. D4.1 (Update report on user characteristics, use cases, scenarios, claims and requirements (TNO)
    Following an iterative design method, every year an updated version of a report on user characteristics, use cases, scenarios, claims and requirements will be delivered. This final report describes the target group (people of low literacy and non-native citizens) and their requirements for the virtual reality and mixed reality tools for social convention learning.
    - WP 8 YP 2014

Other results

1. D1.5 (Publicly available corpus.
   This corpus will serve as a starting point for our research into social signals in natural interaction. It determines which social signals are presented in the interaction, what is their social function, which signals are ambiguous, which can be detected automatically on the basis of body movement. Moreover it will be the basis for annotations, evaluations of social signal detectors and perception experiments.
   - WP 1 YP 2011

2. D4.5 (Ph.D. thesis on body movement and social signals (UT)
   This Ph.D. thesis will contain the accumulation of the research on body movement related social signals. It will serve as the reference in this field. It will contain a state of the art overview on body movement related social signals. It will discuss topics such as the role of social signals in human-human and human-agent-interaction, the difference in perception in the two interaction paradigms and will give an overview of state of art automatic detection of body posture and movement related social signals.
   - WP 1 YP 2014

3. D4.2/3/n (Inventory of possibilities for integrating WP1/2 recognition technology into product ranges of the industrial partners VicarVision, KITT, and Noldus BV (joint with WP1) (SMEs responsible)
   At the end of the project, we will deliver a report in which we make an inventory of project results that may be relevant to the product ranges of the SME partners involved in WP2, plus an indication of how we think these results can be integrated.
   - WP 2 YP 2014

4. D4.4 (PhD thesis on coordination in social and entertainment (human-human & human-computer) interaction (UT)

The thesis will bring together theoretical work on natural interaction, mutual coordination between people, and entertainment computing, with practical work in the context of the interactive playground installation that will be developed and evaluated in WP2.
- WP 2 YP 2014

5. D4.2 (PhD Thesis: (Fabricating Social Signals
   Being engaged in a conversation means being engaged in a social encounter and this not only requires linguistic knowledge and knowledge about the topic or activity but also being aware of what it means to act in a social encounter. What does this social awareness imply and how much of this awareness should be modelled explicitly when we build artificial agents for simulation of social agent behaviour as used in serious games designed for learners to become aware of the social implications of the decisions they make in for example the way a police officer has to do an intervention in a nervous situation. The results described in this thesis are based on perception studies and experiences about human subjects interacting with and observation artificial social agents in serious games scenarios.
   - WP 3 YP 2014

6. D4.3 (PhD thesis on socially intelligent characters for interactive storytelling in training games (UT)
   The PhD thesis will report on the scientific results obtained in WP4, focusing on the development and evaluation of the use of socially intelligent characters for interactive storytelling in training games. The thesis is expected to address at least some of the following research questions: How can believable social behaviour be generated by avatars in a serious game? How can social behaviour by artificial agents be used to support training in serious games? Do the social signals of the agents contribute to successful identification of the situation by the trainee? How should feedback on game play be presented to the trainee? The thesis will also present new techniques for keeping the game optimally adaptive to the user's actions while still incorporating specific training challenges. This will require the agents to have some meta-level understanding of the training goals and the possibility to steer the interaction with the trainee according to these goals.
   -WP 4 YP 2014

7. D1.2 (Use Case scenario (KLPD, T-Xchange, UT)
   An important goal is the creation of a scenario for the project as a whole. (The aim is to have a scenario that is relevant to all stakeholders. Therefore we expect an extended scenario where various elements must be realized:
   - It must provide a relevant training scenario for police teams.
   - It will be used as the basis for a serious game, developed by T-Xchange.
   - It must include a number of situations where the techniques developed in the various work packages can be employed. This includes situations where detection of social signals

- It is a basis for user evaluation of the final demonstrators.

- WP 5 YP 2011

8. D3.2 (Updated design document on inclusive design methods to enhance self-efficacy, social engagement and security awareness (requirements for the software tool box). (TNO)
   Description Following an iterative design method, every year an updated version of the design document for the software tool box for inclusive design methods will be delivered, to include various target groups (elderly, children, people of low literacy and non-native citizens) in developing support tools for enhancing self-efficacy, social engagement and security awareness. This is the final document, forming the basis for the final prototype (D4.2).
   - WP 6 YP 2013
9. D4.4 (PhD Thesis (TUD)
   Description The main result of WP7 is a PhD thesis, based on a number of academic publications.
   - WP 7 YP 2014

10. D4.3 (PhD Thesis (TUD)
    Description The main result of WP8 is a PhD thesis, based on a number of academic publications.
    - WP 8 YP 2014