COMMIT

PROJECTPLAN

WORKPACKAGES

DELIVERABLES

BUDGET

VIRTUAL WORLDS FOR WELL-BEING (P04-05)

PROJECTLEADERS: ALBERT VLUG, HANS STAP

Content

P04-05: Virtual World for Wellbeing

1. Background project

Virtual worlds play an increasingly important role in our lives as places where you meet and make friends, and they affect the way we live, learn, communicate, heal, and entertain. When designed and applied appropriately they will have a strong positive influence on our wellbeing. However, current virtual worlds exhibit poor affect and, therefore, do not offer a rich, emotional experience. New technology is required to cash in on the potential to increase physical and emotional well being in virtual worlds. In particular we need to increase the affect of virtual characters and provide enhanced interfaces between the real and virtual world with which users can steer their avatars and express their emotions. As demonstrators we will encourage and coach users to monitor, play, exercise and be in touch, targeting both on physical and mental well-being.

Wellbeing is a large and quickly expanding market, both for elderly and the young. Life's speed is ever increasing, disconnecting us from other people, ignoring our physical wellbeing and fitness and giving us too little time to experience and be amazed. Virtual worlds that help people to connect and exercise will play an important role in solving these social problems. For the Dutch creative industry there are ample opportunities to contribute to and profit from the increasing importance of virtual worlds, especially in the area of wellbeing. However, to achieve this they need to have access to the most modern technology in this domain and must be at the forefront of new developments. In close collaboration with the Dutch universities this project will enable them to achieve this position.

The project fits perfectly in the societal theme Wellbeing. From an ICT-science perspective the projects fits primarily in the topic User aspects since the experiences we wish to create are user-centered. Additionally, Analysis of user behavior, efficient Computation for real-time effects, and Sensors for measuring user conditions play an important role. The project is well embedded in the Dutch and European context. The project builds on standards for virtual worlds (e.g. MPEG-V standard from ITEA project Metaverse1). It also builds on work done in BRICKS, MultimediaN and the GATE project. It will use the expertise and resources developed in the FP6 NoE AIM@SHAPE and the FP7 Coordination Action FOCUS K3D (both focus on semantic 3D media).

The partners have been selected on their specific expertise in the various domains required for the successful execution of the project, and of experience of national and EU projects:

- Logica: one of Europe's largest system integrators (system integration, project management and innovation);
- University of Utrecht: a leader in the field of games, virtual worlds, animation and analysis of video and music;
- University of Twente: well known for its expertise in virtual reality environments, embodied agents, multimodal interaction and affective computing;
- Waag Society: experience in the development of new tactile interfaces and user engagement;
- University of Amsterdam: experience with emotion recognition in video;

- High school of Amsterdam: a well-known partner of Waag Society in executing user experiments in real-life settings;
- Serious Toys: a pioneering Philips spin-off from the MultimediaN project. Their cognitive stimulus toys are reaching the market, but the landscape of serious toys to improve wellbeing has hardly been explored;
- Motek: a leader in the use of innovative motion capture and simulation environments.

To increase the valorisation of the project results, the pilots will be enlarged with new partners during the 4 years duration of the projects. Healthcare organisation and suppliers of needed components will be introduced. Possible partner are:

- Homecare organizations
- Digifit
- St BOZ
- Xsens
- Cyclomedia
- Noldus

2. Problem description

The overarching question is how to create affective virtual worlds in which users can have rich and rewarding experiences. Nowadays virtual worlds often have very attractive and detailed graphics but the behavior of the virtual characters that represent the real people in these worlds do not have fine-grained control over body movement and emotional expressions. This considerably reduces the affective experience of the users and their interest in performing the activities that the worlds are supposed to stimulate is low.

In this project we investigate how to create such a rich experience, this 'hybrid'world. The scientific objectives are to research and develop new technology to measure the emotional state and intended behavior of users, mimic this in their avatars and develop algorithms to express emotion and social interaction in virtual characters. The techniques will be generically applicable. At the same time we will direct the results through demonstrators in wellbeing in encouraging and coaching people.

The research questions are: How do we create animations (body and face) for virtual characters to express emotions and physical states, how do we create animations to mimic social interaction, how do we extract semantic parameters from visual and musical performances to model avatar behavior, how can we create effective tangible interfaces for controlling avatars and how can we effectively use all this to stimulate and coach people to move.

3. Project outline

Project's goal

Virtual worlds play an increasingly important role in our lives as places where you meet and make friends, and they affect the way we live, learn, communicate, heal, and entertain. When designed and applied appropriately they will have a strong positive influence on our wellbeing. However, current virtual worlds exhibit poor affect and, therefore, do not offer a rich, emotional experience. New technology is required to cash in on the potential to increase physical and emotional well being in virtual worlds. In particular we need to increase the affect of virtual characters and provide enhanced interfaces between the real and virtual world with which users can steer their avatars and express their emotions. As demonstrators we will encourage and coach users to dance, play, and exercise targeting both on physical and mental wellbeing.

Planning of all dimensions

Since the COMMIT P5 project has been integrated in the COMMIT P4 project, a formal start of the combined project will be summer 2012. We have a balanced combination of academic partners and industry partners with Logica as project leader and Utrecht University as the biggest contributor. This leads to a good combination of research and pilots. The project will create four pilots: monitor, play, exercise and being in touch in virtual and hybrid worlds. The research questions are: How do we create animations (body and face) for virtual characters to express emotions and physical states, how do we create animations to mimic social interaction, how do we extract semantic parameters from visual and musical performances to model avatar behavior, how can we create effective tangible interfaces for controlling avatars and how can we effectively use all this to stimulate and coach people. The choice for these research objectives has a strong link to important societal challenges. Virtual worlds can play an important role in solving social problems, because they enlarge the world by connecting people in a meaningful and affective way. Ten important end goals:

- New algorithms to automatically compute synchronous facial and body motions that can express a variety emotions and physical states.
- New algorithms for navigation and collision avoidance among groups of close characters that mimic movement patterns observed in real people in similar situations.
- A computational model of music cognition to address the musical 'semantic gap' by focusing on the process of meaning generation.
- New methods to visually analyze video sequences of groups of people including their interactions, behavior, and expressions, in order to extract the emotional information.
- Technology for constructing socially aware systems for humans based on content-based video human analysis.
- New tangible interfaces, complex input and output devices combining various modalities.
- A generic software suite for building interactive worlds, based on affective avatars and emotion-based interaction.
- A pinnacle demonstrator for interactive virtual dance events.
- Demonstrator that enables the user to perform embodied playful activities in a virtual world with real-life effects.
- Demonstrator for a running exer-game *that provides a hybrid world with a treadmill and scenery video of a course, avatars of other runners.

Results

We make a difference between the 'research' work packages and the pilots as far as the results that we can expect in 2012. The first, academic work packages will offer first prototypes. The pilot work packages will build the platform on which to implement other work packages deliverables and to some extend plan to have a first version ready.

Deliverable Impact and Valorization

Valorization and impact are key topics for our project. We aim to use the pilot work packages to test the prototype platforms on real users / interested parties. To realize this we are already talking to companies and stakeholders that might be interested to use co or further develop our (interim) deliverables. We envision a number of possible deliverables that can be exploited in the valorization, such as the generic software suit that is constructed in the Integration work packages, and the three demonstrators that are developed in the pilot work packages Monitor, Play, Exercise and Touch.

Deliverable Dissemination

As part of the dissemination plan we already contect outlets like popular / general public websites like SYNC, Frankwatching, NU zakelijk and early contact with the VPRO. A more detailed plan dissemination plan will be drafted. We will organize scientific workshops and other scientific events. We will organize a dissemination-event specifically targeted at sharing the results of P4 with potential users (companies and other parties active in the field of interactive virtual worlds, relevant partners from P2 and P6, and other interested parties in our network). We will demonstrate our prototypes and demonstrators both at scientific events, and events for a broader public such as ICT-Delta.

International Imbedding

We will actively pursue the possibility to promote our project and look for completions and international cooperation. Visiting international seminars and conferences (also for dissemination purposes) is part of our project plan. The activities in P4 are firmly embedded in the international network of the academic partners. The research conducted in P4 is the continuation of the initial Work on virtual worlds in GATE and media technology in MultimediaN. There are ample collaborations with international partners via European projects and Networks of Excellences, such as GaLA – Game and Learning Alliance and others.

Deliverable Synergy

Already we are, pending the other COMMIT project descriptions, looking for synergy opportunities. The fact that one of the partners *(UT) is also managing a project (P2) means that we have a low hanging opportunity to work together and a good source of information as to the nature of deliverables and applicability. There are already contacts between P4-P6-P2 and P1.

- There is a natural synergy with P2. In particular we will cooperate to let persons use nonverbal communication skills to access content in an environment that acts in an analogous human-like way.
- We envision synergizing with P6. Specifically, we will cooperate towards solutions to enrich collections using Internet enabled content curation and to improve accessibility.
- Further, we will co-operate on building software components to participate in PASCAL VOC and TRECvid together with P1 and P6 on "classification", "person layout" and "action classification".

- There is a strong internal synergy within this project as a whole. By design, the work packages collaborate to provide input to the Integration and Pilot work packages.
- There is a natural synergy with the FES project GATE – Game Research for Training and Entertainment. There is an overlap in the partners between P4 and GATE, and P4 extends several of the GATE's research topics.

4. Economic and social relevance

Life's speed is ever increasing, disconnecting us from other people, ignoring our physical wellbeing and fitness and giving too little time to experience and be amazed. Virtual worlds will play an important role in solving these social problems because they connect people in a meaningful way at moments they have a little time to spare, without the need to travel or prepare.

Virtual worlds are also a viable and fast growing market. They find their use in many different domains, in wellbeing, entertainment, social networks, virtual tourism, remote training and remote care. A recent study of PWC shows that the market for entertainment video games in the Netherlands alone is over 500 million Euro and is growing at 8% per year (Entertainment and Media Outlook towards 2011, PriceWaterhouseCoopers, 2007). For the serious gaming market and the applications of virtual worlds in other sectors no precise numbers are available but this market is expected to be at least as large and grow even faster. The future market for this area in the Netherlands is clearly in the billions because almost everyone is a potential user.

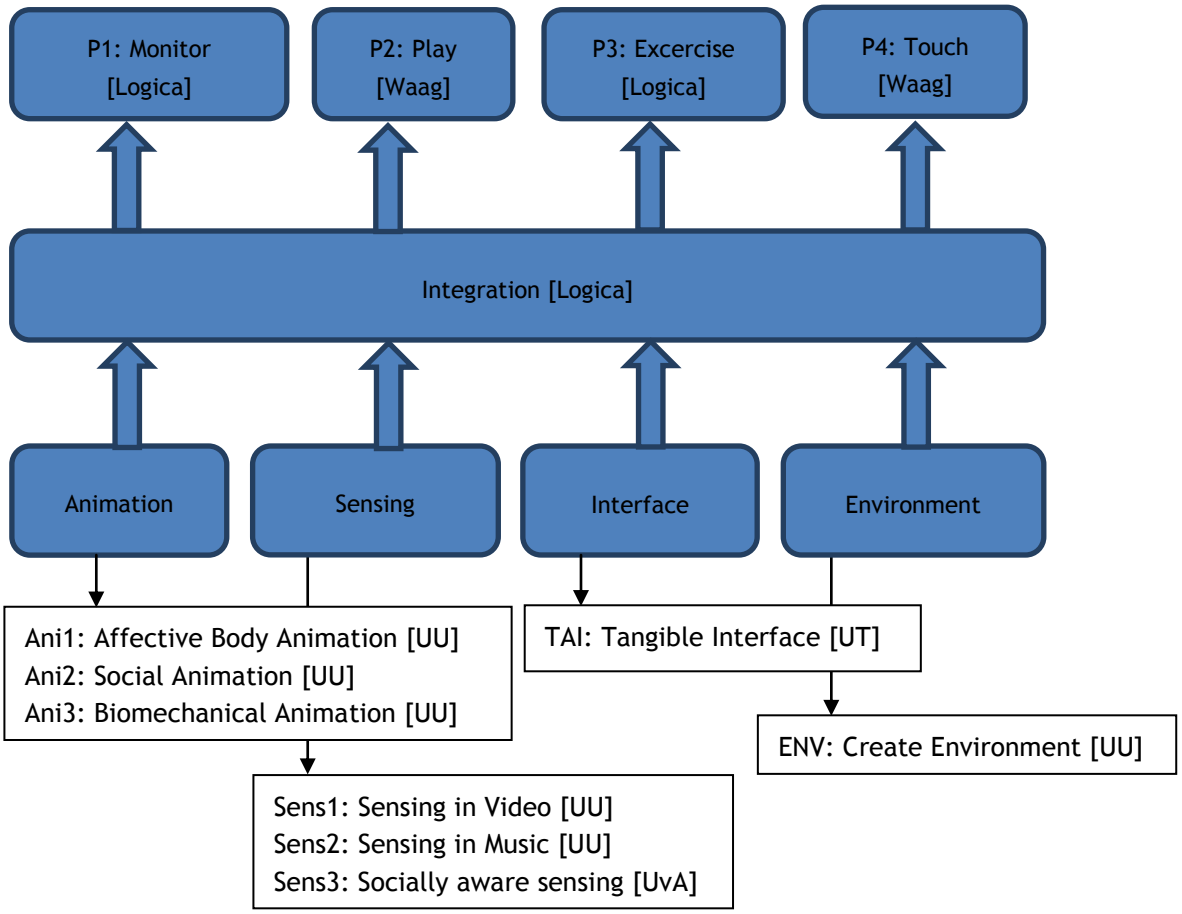
The Netherlands has a considerable number of companies that work in this domain. Also in many other sectors, like advertisement, health, and television, a growing number of companies use virtual worlds. The area is changing fast due to the development of new technologies and companies must stay at the forefront of this. However, many of the companies are SMEs and lack the funds and expertise to perform such research on their own. Hence government funding is essential. As is e.g. indicated by the recent "Verkenning Creatieve Industrie" (Verkenning Creatieve Industrie, Ministerie van Economische Zaken, juni 2009) a strong collaboration with academia is essential for the Netherlands to continue to play an important role in the domain of (serious) games.

The project will lead to new insights and technology that enables this industry to create more efficient and more effective solutions that bridge the virtual and real world. The results of this project will give the companies an international competitive advantage. It will provide them with knowledge, standards, best practices, and in particular software libraries that they can use to produce the next generation of affective virtual worlds in their application domain. By developing the technology in a collaborative and well-managed effort between universities and a large company with ample experience in software integration and innovation management, together with a strong network of the many SME's in this domain, it enables fast uptake of the results and will guarantee that the developed knowledge anchors in the companies.

5. Consortium

As described earlier, the consortium partners have been chosen based on their complementary expertise, the quality and availability of their personnel, the significance of the results they have obtained in the past, their track record of collaboration between academia and industry, and their experience with large national and international projects. They will supervise a number of PhD students in the various research work packages who will focus on the new technology. Software engineers will assist in producing demonstrators. In all work packages people from academia and industry work together in so-called "werktafels" to guarantee a combined focus on innovative technology and industrial needs. Structures are set up to guarantee the necessary governance, and to support collaboration.

6. Work Plan



The founding 8 work packages contain the scientific research in animation, sensing emotion, tangible interfaces, and creating environments, providing the new technology. The integration and communication layer will define requirements, standards for exchange between the animation, sensing, and interfacing components, develop generic software libraries out of this, and incorporate the research from project P2 on effective schemes for interaction. The research work packages will use these results to create their own technology demonstrators. The pilots in Monitor, Play, Exercise and Touch will be constructed as golden demos on top of the integration and communication layer. The experiences and results of the user studies and the demo's will

redefine the requirements in the integration layer which will redefine the requirements for the research work packages.

The project will run for 4 years. In the first year we will define the pilots in more detail and, based on further investigations, define the technology requirements. The 8 research work packages will create state-of the-art reports and statements of research objectives. The second year will develop a first collection of new technologies and a first version of the integration layer. First versions of the pilots will be used to verify the requirements and identify the technology gaps. In the third year we will primarily focus on developing the required new technology and the final year will focus more on the final integration layer and demonstrators.

Affective Animation: new technology for integrated body and face animation, steering avatar animation using few sensors, for automatically generating social animations, and for affective camera control to display such animations. Sensing Emotions: new technology for extracting semantic parameters from visual and musical performances and meaningful visualizations of such semantics. Tangible interfaces: new technology for interaction with multi-modal input devices. Environment: develop techniques to assist designers to semi-automatically create virtual places with particular desired affective qualities. Integration layer: standards for exchange of information between the interaction devices, the sensing algorithm, and the affective animations; general purpose software libraries. Pilots: golden demo’s to demonstrate the effect of creating affective and emotional virtual environments for dance and play, including user studies of their effectiveness and business plans to facilitate their take-up after the project.

A project manager from Logica will manage the project. A project board will be formed with one representative of each of the partners. This will decide on major deviations of the plan. Each work package has a responsible leader who is responsible for the progress and connections to other WPs The work package leaders report regularly to the project manager and the project board.

7. ANI 1 Affective Body Animation

Project number P4-5	**Project financing** (Subsidy / total) k€ 360 / k€ 801			
WP title & acronym	ANI 1 Affective Body Animation			
WP leader	Arjan Egges (UU)			
	1	2	3	
Participant (abbreviated)	UU	Motek	Logica	
Person-months per part.	64	10	6	
Type of job (AIO, SE, etc)	AIO	SE	SE	

Objectives, background and description of work in WP

Background:

Users of virtual worlds are normally represented by their avatars. In 3D virtual environments. These avatars are mostly animated virtual characters. Also other computer-controlled entities are represented through animated characters. In many current systems, these characters can only be controlled through very basic means such as a small set of pre-recorded motions or a few different facial expressions. To create more involved experiences in virtual worlds it is essential that virtual characters can express their emotions (such as happiness) and physical state (such as tiredness) much more convincingly. In order to achieve this, not only the visualization of these aspects should be realistic, also the user should be able to steer these aspects of their avatar in an easy and natural way.

In this work package we will develop an integrated framework in which motion and emotional expressions are combined into a generic approach for affective character animation. To this end we will develop new algorithms to automatically compute synchronous facial and body motions that can express a variety emotions and physical states, where we will focus on stronger expressions like laughing, crying, shouting, heavy breathing, etc. We will also develop a mechanism in which users can steer the animation of their avatars through a simple interface such as a few sensors placed on the user's arms and legs, which drives an animation engine that translates these signals into similar avatar motions.

Deliverables (4 yr)

Deliverables

A. scientific
A1 (M9): State of the art report on affective avatars and steering mechanisms (paper)
A2 (M24): Basic framework for integrating body motion and facial expressions (paper plus implementation)
A2 (M24): New techniques for steering animations through simple devices (paper plus implementation)
A3 (M36): New algorithms for reconstructing and animating body motion and gestures (two papers)
A4 (M48): Final implementation of the integrated system plus user study results (paper plus implementation)

B. socio-economic
B1(M12): Requirement analysis by the industrial partner (paper)
B2 (M24): Initial demonstrator to show the potential of strong facial emotional expressions (demonstrator)

Initial system for affective body and facial animation (Y2)

This software will contain the initial algorithms and techniques developed for affective animated characters. High-level emotional parameters will be defined that can be mapped to different character motions. These high-level parameters will be controlled by the user in a later stage in the project (see deliverables in years 3 and 4).

System for user control of body and facial animation (Y3)

This software will allow for the interpretation of a variety of user inputs, such as high-level emotional parameters as well as user motions such as gestures, which will be obtained using a motion capture system consisting of a limited set of markers and/or the recently developed vision-based motion capture systems such as Kinect.

B3 (M48): Extended demonstrator to show complete body and facial animation and steering (demonstrator)

Final system for affective body and facial animation (Y4)

In the final software, the user input parameters will be integrated with the affective body and facial animation system developed earlier. This will lead to a full simulation library that allows users to control an emotional avatar through high-level parameters.

Deliverables (1st yr)

A. scientific
A1 (M9): State of the art report on affective avatars and steering mechanisms (paper)

B. socio-economic
B1(M12): Requirement analysis by the industrial partner (paper)

C. dissemination of science
C0 (throughout the project): Demonstrations and lectures at conferences, papers, etc.

D. dissemination to profit/non-profit/customers/general public
D0 (throughout the project): Demonstrations and lectures at trade shows, press releases, etc.

8. ANI 2 Social Animation

Project number P4-5	**Project financing** (Subsidy / total) k€ 314 / k€ 698			
WP title & acronym	ANI 2 Social Animation			
WP leader	Mark Overmars (UU)			
	1	2	3	
Participant (abbreviated)	UU	?	Logica	
Person-months per part.	64	10	6	
Type of job (AIO, SE, etc)	AIO	SE	SE	

Objectives, background and description of work in WP

Background:

In many virtual worlds multiple characters are present in the same scene and interact with each other. Many social activities involve multiple parties that adapt their behaviour to each other. Examples are dancing, talking, or walking in a group. Since one of the main goals of virtual environments is to create a social experience, it is crucial that characters and avatars in these environments move according to the social rules.

In this work package we investigate new techniques for computing realistic movements and animations for such socially-driven multi-character animation. This will involve new algorithms for navigation and collision avoidance among groups of close characters, models and algorithms for mirroring behaviour and for emotional interplay, and techniques to adapt animations of other characters to match the avatar movements.

The social interplay between characters is observed by the user through a virtual camera. The location and movement of the camera strongly influence the affective experience that the user had as well as the effectiveness of his/her actions. In this work package we will develop new techniques to automatically control the camera based only on global characteristics of the particular activity of the group of characters (e.g. dancing, talking, walking together), thus enhancing the user experience.

Objectives:
- Provide scenarios on the basis of user studies and focus groups;
- User tests and evaluation using Living Lab environments
- Build a demo.

Target group: ??
Elderly (65+) in care homes/institutions

Description of the work:
- Use Case development
- Co-creation workshops to determine user requirements and needs
- Develop & test two use-cases that will be implemented
- Develop final demonstrator based on findings of use-cases
- Rapid prototyping
- Small scale user tests
- Final prototype
- Large scale field testing
- Golden demo; reporting, dissemination, engaging prospective users & customers
- Business cases (partners & finance) & (service) blueprints
- Build a demo.

Deliverables (4 yr)

a. Results (number + deliverable + time):
   - See chapter Results

b. Impact and Valorisation (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact):
   - 5 workshops for health care specialists (Y3 & Y4)
   - 5 workshops for elderly (Y1-Y4)
   - Data sets on activities (Y4)

c. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination):
   - 2 use cases (Y3 & Y4)
   - 3 meetings for care and ICT professionals (Y2, Y3, Y4)
   - Print media: ICT & Zorg, etc (Y3, Y4)
   - On-line media: ICT & Zorg, etc (Y2, Y3, Y4)
   - 3 eHealth conferences (Y2, Y3, Y4)

d. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding):
   - International Summer Schools
   - International conferences

e. Synergy:
   Input for the design and development comes from:
   - P4 Virtual Worlds for Wellbeing: WP xyz

   Connection with running projects:
   - Smart systems for smart services – for relation with SME's

Deliverables (1st yr)

a. Results (number + deliverable + time):
   - Important journal paper: -
   - Important conference contributions (nr only): -
   - Products: -
   - Software: -
   - User studies: -
   - Other results: -

b. Impact and Valorization (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact): -

c. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination): -

d. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding): -

e. Synergy: see above

9. ANI 3 Biomechanical Animation

Project number P4	**Project financing** k€ 360 / k€ 801			
WP title & acronym	ANI 3 – Biomechanical Animation			
WP leader	Nicolas Pronost (UU)			
	1	2	3	
Participant (abbreviated)	UU	Motek	Logica	
Person-months per part.	64	10	6	
Type of job (AIO, SE, etc)	AIO, HL, UD	SE	SE	

Objectives, background and description of work in WP

Background:

One of the main achievements in virtual character animation is the production of motions that are natural to the human viewer. This can be achieved by techniques based on the kinematics of an inner skeleton representation. The feedback of the character animation to the viewer usually uses visually appealing models to enforce the perception of a virtual human. When it comes to producing physically or anatomically plausible motions, additional information and calculation is required, based on anatomical models of the human musculoskeletal system. The animation of a plausible avatar in a wellbeing-oriented virtual scenario could greatly benefit from the assessment of the physical activity of the user. Usually this kind of motion analysis is carried on in highly controlled and restrictive environment. To enable the possibility of physical wellbeing assessment in other environments (*e.g.* at home), methods inspired from biomechanics, motion analysis and virtual character animation have to be developed, along with the investigation of accommodated low-cost capture devices. In order to achieve this, the anatomy and the physical properties of the human body should be considered during the real-time animation. Examples of parameters used for this task are muscle geometries and their Hill-type model, metabolic energy expenditure and overall balance of the virtual character.

Objectives:

In this work package, we will study and adapt computational methods to estimate the physical wellbeing based upon existing musculoskeletal models. Because of our focus on a low level of restriction, we will study the use of low-cost devices (such as Microsoft's Kinect camera or a set of accelerometers). These methods will produce estimated measures of muscular activity of the user and drive the characters in the virtual world. Physical fatigue and local soft-tissue deformations will be derived from simulating the human motion. As these methods are typically computationally intensive, research is required to determine the proper amount of optimization and offline computation. Finally the translation of the model outputs to the user through avatars will be investigated.

Description of work:

Task 1: Biomechanical animation of virtual characters from physical activity measurements.
Task 2: Improved method for motion editing based on physical fatigue.
Task 3: Investigation of anatomical animation and physical activity.
Task 4: Final implementation, validation and user studies.

Deliverables (4 yr)

a. Results (number + deliverable + time):

- Important journal papers: 3
    - A2 (M18): Biomechanical animation of virtual characters from physical activity measurements
    - A3 (M28): Improved method for motion editing based on physical fatigue
    - A4 (M39): Investigation of anatomical animation and physical activity
- Important conference contributions (nr only): 3
- Products: -
- Software:
    - B1 (M24): Initial demonstrator to show the potential of muscular activity assessment to be used in biomechanical animation of virtual characters
    - B2 (M48): Extended demonstrator to show the complete physical wellbeing assessment and character animation
- User studies:
    - A5 (M48): Final implementation, validation and user studies
- Other results: -

b. Impact and Valorisation (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact): -

c. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination):

- C1: dissemination to profit/non-profit/customers/general public
- C2 (M48): Demonstration at fairs, educational activities, trade shows
- C3 (M48): Press release

d. Synergy: -

Deliverables (1st yr)

e. Results (number + deliverable + time):

- Important journal paper: -
- Important conference contributions (nr only): 1
- Products: -
- User studies: -
- Other results: -

f. Impact and Valorisation (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact): -

g. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination): -

h. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding): -

i. Synergy: -

10. SEN 1 Sensing emotion in video

Project number P4-5	**Project financing** (Subsidy / total) k€ 314 / k€ 698			
WP title & acronym	SEN 1 Sensing emotion in video			
WP leader	Robby Tan (UU)			
	1	2	3	
Participant (abbreviated)	UU	Logica		
Person-months per part.	64	6		
Type of job (AIO, SE, etc)	AIO	SE		

Objectives, background and description of work in WP

Background:

The way that people move together, for example when dancing or sporting, carries semantic and emotional information. In this work package in Virtual Worlds for Wellbeing, we will visually analyze video sequences of groups of people in motion, in order to extract such information.

The objectives of this work package is to perform research on aspects of the extraction of distinguishing features to describe and categorize motion styles, arousal, happiness, etc. The methods to be developed must be generic, in the sense that they are applicable under various conditions such as lighting, angle of view, number of people, etc.

Video analysis of people has been done in many areas, for example security, sports, and traffic. More specifically, the analysis of motion of people has been analyzed for training purposes in sports and dance, and for making synthetic animations more realistic. These research results apply usually to individual people, not the groups of people. In this work package we perform research on the video analysis of motion of groups of people. We will generalize earlier work, including our work at UU, about motion and gesture recognition, to the emotional interpretation of movements. This will be done primarily on the basis of video, but we will use our motion capture lab to obtain referential data, as we have done earlier in other domains.

Objectives:
- Provide scenarios on the basis of user studies and focus groups;
- User tests and evaluation using Living Lab environments
- Build a demo.

Target group: ??
Elderly (65+) in care homes/institutions

Description of the work:
- Use Case development
- Co-creation workshops to determine user requirements and needs
- Develop & test two use-cases that will be implemented
- Develop final demonstrator based on findings of use-cases
- Rapid prototyping
- Small scale user tests
- Final prototype
- Large scale field testing
- Golden demo; reporting, dissemination, engaging prospective users & customers
- Business cases (partners & finance) & (service) blueprints
- Build a demo.

Deliverables (4 yr)

f. Results (number + deliverable + time):
- See chapter Results

g. Impact and Valorisation (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact):
- 5 workshops for health care specialists (Y3 & Y4)
- 5 workshops for elderly (Y1-Y4)
- Data sets on activities (Y4)

h. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination):
- 2 use cases (Y3 & Y4)
- 3 meetings for care and ICT professionals (Y2, Y3, Y4)
- Print media: ICT & Zorg, etc (Y3, Y4)
- On-line media: ICT & Zorg, etc (Y2, Y3, Y4)
- 3 eHealth conferences (Y2, Y3, Y4)

i. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding):
- International Summer Schools
- International conferences

j. Synergy:
Input for the design and development comes from:
- P4 Virtual Worlds for Wellbeing: WP xyz

Connection with running projects:
- Smart systems for smart services – for relation with SME's

Deliverables (1st yr)

f. Results (number + deliverable + time):
- Important journal paper: -
- Important conference contributions (nr only): -
- Products: -
- Software: -
- User studies: -
- Other results: -

g. Impact and Valorization (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact): -

h. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination): -

i. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding): -

j. Synergy: see above

11. SEN 2 Sensing emotion in music

Project number P4-5	**Project financing** (Subsidy / total) k€ 314 / k€ 698			
WP title & acronym	SEN 2 Sensing emotion in Music			
WP leader	Frans Wiering (UU)			
	1	2	3	
Participant (abbreviated)	UU	Logica		
Person-months per part.	64	6		
Type of job (AIO, SE, etc)	AIO	SE		

Objectives, background and description of work in WP

Background:

Music has a big emotional impact on people. In this work package in Virtual Worlds for Wellbeing we cope with the musical aspects of semantic and emotional information in personal communication.

The objective of this work package is to solve the musical 'semantic gap' by focusing on the process of meaning generation. We will make a computational model of music cognition research results. These show that musical meaning emerges from the confrontation between complex patterns we perceive in acoustical input and a repository of such patterns that we have previously acquired through listening and training. For example, rhythmic, harmonic, and formal patterns are important sources of meaning in music. By researching these aspects from both a music cognition and a computer science viewpoint, this work package will provide essential knowledge for the creation of advanced musical semantics analysis.

Music has been analyzed statistically in many ways on the basis of low level features, counting pitch classes, beats per minutes, etc. This gives a broad categorization, but still provides little semantic or emotional information, which is much more personal, and less statistical. We will identify the relevant parameters, and create computational models, implementations, and prototype systems.

Objectives:
- Provide scenarios on the basis of user studies and focus groups;
- User tests and evaluation using Living Lab environments
- Build a demo.

Target group: ??
Elderly (65+) in care homes/institutions

Description of the work:
- Use Case development
- Co-creation workshops to determine user requirements and needs
- Develop & test two use-cases that will be implemented
- Develop final demonstrator based on findings of use-cases
- Rapid prototyping
- Small scale user tests
- Final prototype
- Large scale field testing
- Golden demo; reporting, dissemination, engaging prospective users & customers
- Business cases (partners & finance) & (service) blueprints
- Build a demo.

Deliverables (4 yr)

k. Results (number + deliverable + time):
   - See chapter Results

l. Impact and Valorisation (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact):
   - 5 workshops for health care specialists (Y3 & Y4)
   - 5 workshops for elderly (Y1-Y4)
   - Data sets on activities (Y4)

m. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination):
   - 2 use cases (Y3 & Y4)
   - 3 meetings for care and ICT professionals (Y2, Y3, Y4)
   - Print media: ICT & Zorg, etc (Y3, Y4)
   - On-line media: ICT & Zorg, etc (Y2, Y3, Y4)
   - 3 eHealth conferences (Y2, Y3, Y4)

n. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding):
   - International Summer Schools
   - International conferences

o. Synergy:
   Input for the design and development comes from:
   - P4 Virtual Worlds for Wellbeing: WP xyz

   Connection with running projects:
   - Smart systems for smart services – for relation with SME's

Deliverables (1st yr)

k. Results (number + deliverable + time):
   - Important journal paper: -
   - Important conference contributions (nr only): -
   - Products: -
   - Software: -
   - User studies: -
   - Other results: -

l. Impact and Valorization (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact): -

m. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination): -

n. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding): -

o. Synergy: see above

12. SEN 3 Socially aware sensing from video's

Project number P4-5	**Project financing** (Subsidy / total) 315 k€ / 699 k€			
WP title & acronym	SEN 3 Socially aware sensing from video's			
WP leader	Theo Gevers (UvA)			
	1	2	3	
Participant (abbreviated)	UvA	Logica	?	
Person-months per part.	48	6		
Type of job (AIO, SE, etc)	AIO	SE	SE	

Objectives, background and description of work in WP

Background:

This WP will focus on human behavior analysis and interaction. The group contributes to new products in line with the "sense & simplicity" brand promise, by making them adaptive and responsive to the people using them. Sensory signals include body gestures and posture, facial expressions, and eye gaze, among others. The concrete objective of this project is the investigation of principled models and algorithms to construct socially aware systems to support human behavior analysis. So far, human behavior analysis has only one of the above information sources. This WP fuses the different modalities to go beyond standard, single modality human analysis enabling multi-modal semantic (human behavior) analysis in video. The potential use of the results are to recognize the emotional aspects of dance such as the tension, hope, and joy (PIL 1), to enable humans to perform selective sports or playful activities in a virtual world with real-life effects (PIL 2), and to measure gait and motion under possible various stimuli (PIL 3).

Objectives:
The aim is to research on and to develop new technology to measure the emotional state and behavior of humans. Further, to address the challenge of constructing socially aware systems for humans. To achieve this, we develop semantic identification technology and services to support human behavior analysis and interaction. Content-based (video) human analysis will be applied for the understanding of human behavior in different scenarios particularly for physical wellbeing and fitness.

Target group: ??
Elderly (65+) in care homes/institutions

Description of the work:
Task 1: emotion, eye tracking, gaze and head pose estimation and classification.
Task 2: Action and body expression recognition.
Task 3: information fusion of different signals.
Task 4: field trial for PIL 1, PIL 2 and PIL 3.

Deliverables (4 yr)

p. Results (number + deliverable + time):
- See chapter Results

q. Impact and Valorisation (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact):
- 5 workshops for health care specialists (Y3 & Y4)
- 5 workshops for elderly (Y1-Y4)
- Data sets on activities (Y4)

r. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination):
- 2 use cases (Y3 & Y4)
- 3 meetings for care and ICT professionals (Y2, Y3, Y4)
- Print media: ICT & Zorg, etc (Y3, Y4)
- On-line media: ICT & Zorg, etc (Y2, Y3, Y4)
- 3 eHealth conferences (Y2, Y3, Y4)

s. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding):
- International Summer Schools
- International conferences

t. Synergy:
Input for the design and development comes from:
- P4 Virtual Worlds for Wellbeing: WP xyz

Connection with running projects:
- Smart systems for smart services – for relation with SME's

Deliverables (1st yr)

p. Results (number + deliverable + time):
- Important journal paper: -
- Important conference contributions (nr only): -
- Products: -
- Software: -
- User studies: -
- Other results: -

q. Impact and Valorization (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact): -

r. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination): -

s. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding): -

t. Synergy: see above

13. TAI Tangible User Interfaces

Project number P4-5	**Project financing** (Subsidy / total) 475 k€ / 1055 k€			
WP title & acronym	TAI Tangible User Interfaces			
WP leader	Dirk Heylen (UT)			
	1	2	3	4
Participant (abbreviated)	UT	SeriousToys	Waag	Logica
Person-months per part.	64	19	14	6
Type of job (AIO, SE, etc)	AIO, HL, UD	SE	SE	SE

Background:
This WP description is a combination of one work package in the original P4 project and 2 work packages from the original P5 proposal.

- P4. TAI1 Tangible Interfaces. De Waag (28PM), Logical (39PM), UT (41PM)
- P5. III: Interaction and Communication – Tangible Objects. De Waag (15PM), Philips (34PM), UT (36PM)
- P5. IV: Interaction and Communication – Lifelike Communication. De Waag (15PM), Philips (34PM), UT (36PM)
- P5. VII: Sensor and Data Fusion – Language Technology for Serious Gaming. Serious Toys (49PM).

Objectives:

Everyday objects and wearable's become equipped with sensors registering contact, pressure, heat, motion and so on. They become sensitive to the user's touch. At the same time, they incorporate actuators that can produce the same tangible experiences.

In this work package we are concerned with studying, creating, programming and evaluating human media interactions with smart (tactile) interfaces. In particular we want to create natural feedback loops in the interaction between users and objects combining different forms of control: both explicit command and control style interaction and implicit sensing of the user experience and the user action.

One central theme in this work package will be to investigate new input devices that are sensitive to the way they are being "touched" by the users. It will research hardware, algorithms and programming language primitives that translate raw data captured by the interface into useful interaction parameters and intelligent feedback.

The other side of the interaction coin concerns output. Systems (commercial or otherwise) that produce tangible output are not as widespread. Only a few of the tactile sensations are stimulated. There exists some haptic devices for training (but these are expensive and difficult to customize) and several prototypes of systems that make use of vibration but sound and vision remain the dominant modes for output systems. This workpackage will also study the effects of the use of several modes of tactile stimulation.
Besides questions of the interpretation of the input (sensing and interpreting touch) and the effects of output (understanding tactile stimulation), this also requires the study of the intelligence (artificial emotional, social and rational intelligence) that is needed to decide on the appropriate timing and type of feedback. Making the objects and the environment smart should cater for adaptive and intuitive interfaces.
The work will proceed by a number of focused user studies in collaboration with the workpackages on scenarios and demos, the design and implementation of smart prototypes and field studies of use. The resulting knowledge will be used in various gaming and interaction systems, in particular in the pilot workpackages, and to extend the programming language for tangible interfaces.
We start with a scan of state of the art examples of interaction and user observations while performing various tasks related to the demonstrators in their work packages. Then, we investigate prototypes of hard- and software that get refined over the course of a few iterations. Meaningful ranges of parameter values will be determined and software will be written that enables applications to make use of the new interfaces.

Scientific challenges:

- Modelling and interpreting tactile manipulation in an environment that goes beyond control-based interfaces and with a focus on experiential and affective dimensions.
- Modelling and measuring the experiential dimensions of interactions between users and the ambient interfaces with a focus on tactile stimulation.
- Adaptive and intelligent decision making regarding the production of playful feedback that can deal with unpredictability.
- Language and compiler technology for end user programming of tangible interfaces.

Description of work in WP

Tasks:

- Requirements engineering
- Prototype building (in collaboration with the pilot workpackages) and Testing
- Psychological experiments
- Modelling and implementation
- User evaluation studies
- Extension of multiplatform programming language and compiler for tangible interfaces

Deliverables (4 yr)

j. Results (number + deliverable + time):

- Important journal paper: 3 papers. (1) When: Year 2. In: Transactions on Systems, Man and Cybernetics. On: the engineering of tangible interfaces. (2) When: Year 2. In: Journal of Multimodal User Interaction. On: the applications developed using tangible input and output. (3) When: Year 4. In: Transactions on Affective Computing. On: the user studies testing the affective dimensions of the tangible output.
- Important conference contributions (nr only): 4
- Products: Multiplatform Software Development Kit (SDK) for tangible interaction consoles.
- Software: Contributions to the applications developed in the pilots year 3 and year 4.
- User studies: 4. A first study focussed on requirements elicitation (year 1), a second data study (year 2) and two evaluation study (year 3 and year 4).
- Other results: 2 workshops – for instance at CHI (year 2 and year 4).

k. Impact and Valorisation (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact): -

l. Dissemination(number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination): demos at 2 international conferences and 2 national events like ICT Delta.

m. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding): The best known research group on Tangible User Interfaces is the Tangible Media Group at the MIT Media Lab. This fact testifies to the particular place the research on tangibile interfaces takes: experimental with research, engineering, prototyping and user testing closely interconnected. This will also be the model followed in this WP. As for international embedding the WP will try to establish collaboration with the MIT Media Lab and aims to organize joint workshops and special sessions at CHI and Human Computer Interaction International, respectively.

n. Synergy: the user studies will be carried out in the context of the Pilot workpackages. Results of this WP are also relevant for one of the workpackages in P2 (the WP on interactive playgrounds, sensing and ambient intelligence which will also make use of tangible interaction) and one workpackage in P5 in which the affective user experience involved in tactile interation will be investigated. The results of these studies will guide the development of the prototypes in P4 and the prototypes will be used in experiments in P5.

Deliverables (1st yr)

o. Results (number + deliverable + time):

- Important journal paper: 0
- Important conference contributions (nr only): 1. Where: International Conference on Entertainment Computing. On: the design of tactile interfaces.
- Products: -
- Software: First generation SDK for (tablet) PCs.
- User studies: 1 to understand the needs of the users and outline some requirements on systems. This will take the form of focus groups and of some interactive workshops.
- Other results: definition of use case scenarios and a literature review.

p. Impact and Valorisation (patents, downloads, product transfers, licenses, other forms of impact): -

q. Dissemination (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination): 4 + demonstrators + year 3 and year 4

r. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding): -

Synergy: the user studies will be carried out in collaboration with the Pilot studies.

14. ENV Creating Environments

Project number P4	**Project financing**: k€ 314 / k€ 698				
WP title & acronym	Affective Environments, P4-ENV				
WP leader	UU				
Participant (abbreviated)	UU	Logica	Cyclomedia	BOZ	
Person-months per partner	68	6	8	2	
Type of job (AIO, SE, etc)	Aio, Hgl	SE	SE	Advis	

Objectives, background and description of work in WP

Objectives:

The creation of affectively engaging virtual places is currently primarily manual labor by skilled designers, and is very expensive and inflexible. In AAA huge budgets are spent on designing such worlds. In other applications of virtual worlds like for training, virtual tourism, or engaging elderly, such budgets are normally not available. The lack of the required affective quality leads to a decreased level of immersion. In other virtual worlds, like Second Life, the users themselves create the world. However, the tools for this are limited, again leading to poor worlds.

Background:

Extensive research has already been devoted to the automatic creation of virtual worlds. However, up to now the focus was largely on creating the geometry of the world and not on capturing a desired affective experience, which includes more than just geometry. We will build on studies carried out at Utrecht University over the past five years that have determined the cues that are important for creating a desired affective quality. Based on this we will design efficient algorithms to semi-automatically create such worlds. We will look both at outdoor environments and indoor scenes. A test environment will be constructed to test the effectiveness of these algorithms. The results of this work package will be used in the pilot projects P4-PIL1-Monitor and P4-PIL3-Exercise

Description of work:

This work package will develop techniques to assist designers to semi-automatically create virtual places with particular desired affective qualities. This includes the geometry, textures, lighting, and sound in these worlds. It should become possible for designers to adapt the affective quality of a world, and to personalize worlds by adding individually chosen music and visual material. This is useful for both professional designers and for user created content.

Task 1: Automatic reconstruction of worlds. Task 2: Adding personalized visual data. Task 3: Adding personalized musical data. Task 4: Pilot tests.

Deliverables (4 yr)

s. Results (number + deliverable + time):

- Important journal papers: 1
    - A1 (M36): Paper on affective virtual environments with personalized visuals
    - A2 (M48): Paper on affective virtual environments with personalized music
- Important conference contributions (nr only): 4
- Products: Software suite for building affective, personalized, virtual environments
- Software:
    - A3 (M12): First prototypes / simulation showing tangible first year results
    - A4 (M24, 36): Extended prototypes with personalized data
    - A5 (M48): Final demonstrator
- User studies:
    - A6 (M36) User study on monitoring people in personalized virtual worlds
- Other results:

t. Impact and Valorisation (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact):

- B1 Software for personalizing virtual worlds made publicly available (Y4)

u. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination):

- C1: dissemination to profit/non-profit/customers/general public
- C2 (M48): Demonstration at fairs, educational activities,
- C3 (M48): Press release

v. Synergy:

Deliverables (1st yr)

w. Results (number + deliverable + time):

- Important journal paper: -
- Important conference contributions (nr only): 1
- Products: -
    - Software: A3 (M12): First prototypes / animation showing tangible first year results
- User studies: -
- Other results: -

x. Impact and Valorisation (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact): -

y. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination): -

z. International Embedding -

aa. Synergy: -

15. INT Integration and Commnication layer

Project number P4-5	**Project financing** (Subsidy / total) 309 k€ / 686 k€			
WP title & acronym	INT Integration and Communication layer			
WP leader	Hans Stap (Logica)			
	1	2	3	
Participant (abbreviated)	Logica	UU	Waag	Motek + ?
Person-months per part.	48	10	4	4 + 18
Type of job (AIO, SE, etc)	SE	SE	SE	SE

Objectives, background and description of work in WP

Background:

In the research work packages, techniques and algorithms are developed that are the building blocks for this integration work package. Rather than a single demonstrator, a platform and software library will be developed that allows easy construction of affective virtual worlds. The Logica eHealthbox platform will be transformed to enable application and data integration between the sensoring devices, the shaping virtual environment software for wellbeing and the monitoring of wellbeing. To achieve this we first need to make requirements analysis of the properties of the technologies that are required. Also standards must be developed for the exchange of information between the different components. Next, a close analysis of genericity and functionality of the individual software components must be made, and interface patterns must be recognized. This is followed by the design of a suitable generic API, such that data structures and algorithms are templated and can be instantiated by specific ones. In this process, advanced and modern software design and construction methodologies are used. This way, the developed software suite can be easily re-used. This platform will be used to develop the Monitor Pilot and Exercise Pilot. For the valorisation of the project results, healthcare settings will be simulated and healthcare organisations will participate. Linking the data of the virtual worlds of the pilot with relevant data from the EHR and/or PHR will be part of this workpackage. The integration platform will also be used to create the technology demonstrators in the research work packages and in the Play and Touch pilots.

Objectives:

- Integrate the sensoring output to the animation input components to create demonstrators and virtual worlds
- Provide a platform for data exchange between virtual worlds and the real health status of the person (wellbeing in medical, physical and mental terms)
- Facilitate environments for user tests and evaluation

Description of the work:

- Analyse input and output parameters of software and hardware components used or developed in research workpackages
- Design standard interfaces
- Provide screens to make data and data flow visible
- Facilitate the integration with medical data out of healthcare processes (e.g. standard medical devices to measure hartrate and lung capacity and standard medical datafiles with the actual health status)
- Provide a platform to integrate the developed modules for building pilot environments

Deliverables (4 yr)

u. Results (number + deliverable + time):
See chapter Results

v. Impact and Valorisation (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact):
- 4 workshops on integration standardisation(each year)
- Factsheets (each year) and technical whitepaper (Y4) on integration platform
- Publication of data interfaces

w. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination):
- On-line media: ICT & Zorg (Y3, Y4)
- 4 eHealth conferences on integration platform functionality (each year)

x. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding):
- International tuning on interfacing standards, e.g. Continua, HL7, XDS, Microsoft
- International alignment with European Medical Device Regulation
- International cooperation with similar projects in the Nordics, especially Denmark

y. Synergy:
Input for the design and development comes from:
- P4 Virtual Worlds for Wellbeing: all research workpackages

Synergy is likely with:
- P1 smart reasoning systems for wellbeing at home (patient centric monitoring at home, wellbeing applications for lifestyle changes)
- P7 sensor networks for wellbeing (data processing)
- P11 embedded systems for healthcare (component verification and testing)
- P13 trusted healthcare services (trust management for home healthcare services)

Connection with running projects:
- Smart systems for smart services – for relation with SME's
- Domotica in healthcare

Deliverables (1st yr)

u. Results (number + deliverable + time):
- Important conference contributions (nr only): World of health IT (Wohit) 2012 Copenhagen
- Products: First version of data interface definition
- Software: specification of data on health status (patient perception of well-being and health goals)

v. Impact and Valorization (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact):
* 1 workshop on integration standardisation
* factsheet on integration platform

w. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination):
* First basic demonstrator of virtual fitness environment
* 1 eHealth conference on integration platform functionality

x. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding): start international cooperation

y. Synergy: see above

16. PIL 1 Monitor Pilot

Project number P4	**Project financing:** k€ 276 / k€ 614				
WP title & acronym	PIL-1 Monitor				
WP leader	Logica				
Participant (abbreviated)	Logica	HvA	UU	?	?
Person-months per partner	23	10	8	10	10
Type of job (AIO, SE, etc)	SE	SE	AIO	SE	Advis

Objectives, background and description of work in WP

Objectives: The aim is to develop a system and virtual environment to monitor activity of groups of people, and analyze the effect of various stimuli such as crowdedness and atmospheric music. The activity analysis will be based on wearable sensors and video analysis. To allow further experimentation, a virtual world will be built that is inhabited with virtual characters, some of which may be steered by observed people. The effects we are interested in are those related to well-being, such as feeling safe, comfortable, enjoyed, etc.

This work package will be implemented as a living lab project. We will consider two types of locations: recreation and activity rooms of a house for elderly, and NS railway stations. We expect that the findings in this pilot project will lead to up-take by societal and commercial parties such as houses for elderly and public environments.

Background: The concept of atmospherics refers to the design of an environment through the use of colors, lighting, sounds, and furnishings to stimulate perceptual and emotional response, and ultimately to affect their behavior. Atmospheric music, crowdedness, and other factors can expand and contract perceived duration, such as waiting time or playing time, as well as influence the perception of quality of service, and feelings of arousal, pleasure, stress, etc. Studies so far have been targeted mostly towards individuals and commercial applications (customers for goods and services). In this work package the work is directed towards monitoring, and possibly stimulating well-being of groups of people.

Description of work:
Task 1: People tracking, data sensing.
Task 2: Adaptive music selection.
Task 3: Group simulation in virtual world.
Task 4: Measuring behavior.
This system is built using the integration platform designed and constructed in work package Integration (INT1), and uses research results from work packages Sensing-1, Sensing-2, Animation-1, Animation-2, and Interface.

Deliverables (4 yr)

bb. Results (number + deliverable + time):

- Important journal papers: 1
    - A1 (M36): Paper on the system design aspects of the demonstrator
    - A2 (M48): User study
- Important conference contributions (nr only): 1
- Products:
- Software:
    - A3 (M12): First prototypes / simulation showing tangible first year results
    - A4 (M24, 36): Extended Prototypes
    - A5 (M48): Final demonstrator
- User studies:
    - A6 (M36) User study on monitoring group of people.
- Other results:

cc. Impact and Valorisation (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact):

- B1 System for monitoring group of people made publicly available (Y4)

dd. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination):

- C1: dissemination to profit/non-profit/customers/general public
- C2 (M48): Demonstration at fairs, educational activities, dance events
- C3 (M48): Press release

ee. Synergy:

There will be collaboration with P7 Swell: to develop software for automatic detection of the physical and mental state of a computer user at home or at work, and for automatic feedback to the user, in order to increase wellbeing.

Deliverables (1st yr)

ff. Results (number + deliverable + time):

- Important journal paper: -
- Important conference contributions (nr only): 1
- Products: -
    - Software: A3 (M12): First prototypes / animation showing tangible first year results
- User studies: -
- Other results: -

gg. Impact and Valorisation (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact): -

hh. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination): -

ii. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding):

jj. Synergy:

There will be collaboration with P7 Swell: to develop software for automatic detection of the physical and mental state of a computer user at home or at work, and for automatic feedback to the user, in order to increase wellbeing.

17. PIL 2 Play Pilot

Project number P4-5	**Project financing** (Subsidy / total) 499 k€ / 1109 k€			
WP title & acronym	PIL 2 Play Pilot			
WP leader	Isjah Koppejan (Waag)			
	1	2	3	
Participant (abbreviated)	Waag	UT	Logica	?
Person-months per part.	33	25	24	20
Type of job (AIO, SE, etc)	SE	AIO	SE	SE

Objectives, background and description of work in WP

Background:

Users of virtual worlds are normally represented by their avatars. In 3D virtual environments. These avatars are mostly animated virtual characters. Also other computer-controlled entities are represented through animated characters. In many current systems, these characters can only be controlled through very basic means such as a small set of pre-recorded motions or a few different facial expressions. To create more involved experiences in virtual worlds it is essential that virtual characters can express their emotions (such as happiness) and physical state (such as tiredness) much more convincingly. In order to achieve this, not only the visualization of these aspects should be realistic, also the user should be able to steer these aspects of their avatar in an easy and natural way.

In this work package we will develop an integrated framework in which motion and emotional expressions are combined into a generic approach for affective character animation. To this end we will develop new algorithms to automatically compute synchronous facial and body motions that can express a variety emotions and physical states, where we will focus on stronger expressions like laughing, crying, shouting, heavy breathing, etc. We will also develop a mechanism in which users can steer the animation of their avatars through a simple interface such as a few sensors placed on the user's arms and legs, which drives an animation engine that translates these signals into similar avatar motions.

Objectives:
- Provide scenarios on the basis of user studies and focus groups;
- User tests and evaluation using Living Lab environments
- Build a demo.

Target group:
Elderly (65+) in care homes/institutions

Description of the work:
- Use Case development
- Co-creation workshops to determine user requirements and needs
- Develop & test two use-cases that will be implemented
- Develop final demonstrator based on findings of use-cases
- Rapid prototyping
- Small scale user tests
- Final prototype
- Large scale field testing
- Golden demo; reporting, dissemination, engaging prospective users & customers
- Business cases (partners & finance) & (service) blueprints
- Build a demo.

Deliverables (4 yr)

z. Results (number + deliverable + time):
- See chapter Results

aa. Impact and Valorisation (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact):
- 5 workshops for health care specialists (Y3 & Y4)
- 5 workshops for elderly (Y1-Y4)
- Data sets on activities (Y4)

bb. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination):
- 2 use cases (Y3 & Y4)
- 3 meetings for care and ICT professionals (Y2, Y3, Y4)
- Print media: ICT & Zorg, etc (Y3, Y4)
- On-line media: ICT & Zorg, etc (Y2, Y3, Y4)
- 3 eHealth conferences (Y2, Y3, Y4)

cc. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding):
- International Summer Schools
- International conferences

dd. Synergy:

Input for the design and development comes from:
- P4 Virtual Worlds for Wellbeing: WP xyz

Connection with running projects:
- Smart systems for smart services – for relation with SME's

Deliverables (1st yr)

z. Results (number + deliverable + time):
- Important journal paper: -
- Important conference contributions (nr only): -
- Products: -
- Software: -
- User studies: -
- Other results: -

aa. Impact and Valorization (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact): -

bb. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination): -

cc. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding): -

dd. Synergy: see above

18. PIL 3 Exercise Pilot

Project number P4	**Project financing** k€ 579 / k€ 1286					
WP title & acronym	PIL 3 – Exercise					
WP leader	Hans Stap (Logica)					
	1	2	3	4	5	6
Participant (abbreviated)	Waag	Logica	UU	Motek	HvA	Ntb
Person-months per part.	37	35	6	2	17	25
Type of job (AIO, SE, etc)	SE	SE	AIO, HL, UD	SE	ADV	SE

Background

With the merging of WP4 Virtual Worlds for Wellbeing and WP5 Sensor Content for Wellbeing, the old demo-tasks 'Exercise' and 'iBuddy' (P5-WP VIII) are merged into a new task 'Exercise' that demonstrates both the aspects of virtual worlds and sensing applied to stimulating exercises among elderly people and thereby increase their physical, mental and social wellbeing.

The focus of this new WP is to maintain and possibly improve the health state of elderly persons, and contribute to ambient assisted living. An affective system will be developed and tested, which persuades elderly persons to adapt to healthy aging and support and stimulate them to increase their exercise level.

Objectives

Within the pilot Exercise we will develop an insight in the relation between the needs of the population and the technology in their everyday use. For this we need a human-centric approach where we develop affective interactions and study their use in real-life situations.

Currently, sensor systems are developed for monitoring the activities of elderly persons, both at home and in care organizations. These systems focus on the detection of alarming situations such as fall detection or more generally for the assessment of the ability to live independently. The sensor systems can also be used for measuring the activity level of the elderly. The sensor systems consist of the (ambient) sensors in the home, camera or other imaging sensors (Kinect) in the home plus the sensors that are wearable such as accelerometers on smartphones or GPS.

Virtual worlds play an increasingly important role in our lives as places where you meet and make friends, and they affect the way we live, learn, communicate, heal, and entertain through 'immersion'. When designed and applied appropriately they can have a strong positive influence on our wellbeing. In the field of exercise for elderly, such (multi-sensory) environments have shown to be effective in keeping elderly involved in physical exercises such as home trainer exercises, balance training to prevent fall incidents or walking exercises.

In this task we will develop a pilot system that combines both the virtual world as well as the sensor data, based on user requirements and needs. The results of the research WPs (affective animation, sensing emotions, environment modeling, and –to a lesser extent- tangible interfaces) will be demonstrated in the demo. Prototypes and the final system will be developed in cooperation with prospective users to ensure the results will fit their needs and possibilities. During the last year of the project, we will develop a business case in collaboration with commercial partners to investigate the uptake of the results.

Description of work

PIL 3 Exercise will start by building a demo in which to integrate the results of the other work packages. The demo (in the first stage consisting of sensor system such as Kinect, accelerometer sensors, ambient sensors and virtual environment) will be created in a user-driven way and based upon the needs of the users. Different technologies will be integrated; the demo will show one selected use case of the application.

The partners are currently Logica, Utrecht University, Motek, Waag Society and Hogeschool van Amsterdam. They will bring in the expertise on virtual environments and sensing. There are currently two SMEs interested in joining, namely Digifit and BOZ Foundation (Stichting BOZ).

Stichting BOZ is already exploiting virtual environments in an application where elderly do exercises on a bicycle, and are presented with virtual environments. Digifit develops new wellness applications in the field of fitness and lifestyle, applying smart technology to motivate people to live healthier and more active lifestyles in an easy and fun way. They plan to build the 'virtual fitness school' and also focus on elderly. Their platform enables players to share their data and compete.

Deliverables

A. scientific
A1 (M36): Paper on the effects of interacting with the demonstrator

B. socio-economic
B1 (M12): First prototypes showing tangible first year results
B2 (M24, 36): Extended Prototypes
B3 (M48): Final prototype
B4 (M48): Business case in cooperation with business partners

C. dissemination of science
C1 (M36): Demonstration at multimedia conference

D. dissemination to profit/non-profit/customers/general public
D1 (M48): Demonstration at fairs, educational activities, sports events
D2 (M48): Press release

19. PIL 4 Touch Pilot

Project number P4-5	**Project financing** (Subsidy / total) 659 k€ / k€ 1465					
WP title & acronym	PIL 4 Touch					
WP leader	Isjah (Waag Society)					
	1	2	3	4	5	6
Participant (abbreviated)	Waag	HvA	UT	Logica	SeriousToys	ntb
Person-months per part.	43	16	25	3	29	20
Type of job (AIO, SE, etc)	SE	SE	AIO	SE		

Objectives, background and description of work in WP

Background:

Population ageing is a current trend everywhere in the world. Finding solutions that allow elderly people to stay socially connected is one of the keys to keeping care affordable and address the overall European challenge of preventing loneliness and isolation amongst elderly people.

With the generation of baby-boomers retiring in the next decade there is a huge opportunity for keeping them active and living independently as long as possible. Further, this demographic has a huge economic potential. Our population is gradually aging and the traditional health care system cannot cope. In 2007 there were 2.4 million people over 65 years of age and this number will rise quickly. The 80+ populations in EU will be double in 2050. The 60+ percentages of total population will rise from 20 % in 1995 to 25 % in 2020. Especially the oldest part of the population holds a risk of becoming isolated and lonely, as they grow old and their work related networks erode. Independent and happy people are active, aware of their own capacities and connecting and exchanging with others. At the same time, the modern elderly are less prepared to be "taken care of" but want to stay in their own homes and stay in control. However, they face the inevitable fate of becoming less physically able and less connected over time, which brings the risk of falling ill and severe loneliness. Growing old in many cases makes individuals loose control of their everyday life and daily activities, especially when they move to care homes. This can have severe consequences such as depression and an increased risk of dementia. Living inactively and socially isolated therefore has a direct impact on the rising costs associated with health care in society. The paradigm shift occurring in the care industry (ICT as an enabler for elderly people – not only helping people but also encouraging self-reliance) offers substantial opportunities for improving the health care system. To help the elderly to stay in control, to stay connected and to increase their wellbeing, *(tangible) interfaces* could be of help.

This WP explores ways to assist elderly with ICT-solutions to stay in touch with their peers and the caring community. The fundamental insights developed in the other WP's serve as a basis for the development of an ICT-solution for 'Touch'. This concerns, In particular insights into how objects are manipulated and affective information from this can be gathered, and insights into how tangibles can communicate social emotions. Goal is to develop a solution, which increases the quantity or/and quality of interactions and thereby increase the sense of wellbeing of the elderly and prevent them from becoming socially isolated. Studies show that not so much the number but especially the quality of the contacts is crucial. The connectedness involves both intentional and directed communication. We research and model which signals contribute to the feeling of "social connectedness" and develop tangible interfaces that contribute to convey it, and it that way contribute to wellbeing. Based on the outcomes of research in other WP's a demo will be developed, which stimulates social interaction, for example through serious gaming.

Serious gaming can both combat cognitive decline with the elderly and enhance the quality of contact with others, as gaming offers a playful interaction. The information about the gamer acquired during play can be used in the broader application: having grandchildren and elderly play together remotely can **strengthen cognitive abilities** on both sides and create a strong **sense of connectedness**. The demo will be developed in co-creation workshops with the users and tested in settings such as the Living Lab Health Lab.
Overall objective:
Within the Pilot (Being in) Touch a demo will be build, which could support elderly in being in touch, taking into account their physical and cognitive capabilities. Since technologies such as mobile devices and social communities such as Facebook are not designed for all, elderly do experience problems with the interfaces as a result of their limitations. This project will come up with design guidelines for building a demo for the purpose of being in touch, develop inspiring and effective examples, and demonstrate their use in real-life settings that the partners in this project have access to.
Objectives:

- Provide scenarios on the basis of user studies and focus groups;
- Provide a blueprint of a Healthy Ageing Environment targeted at connectedness,
- Toolbox of reasoning and evaluation methods that can be used by the AIO's from the other WP's for their basic technologies;
- User tests and evaluation using Living Lab environments
- Develop a demo.

Target group:
Elderly (65+), their relatives and caring community

Description of the work:

- Use Case development
- Co-creation workshops to determine user requirements and needs
- Create Healthy Ageing Environment
- Extend Healthy Ageing Environment by findings in WP 1, 3, 4 & 5
- Develop & test two use-cases that will be implemented
- Develop final demonstrator based on findings of use-cases
- Rapid prototyping
- Small scale user tests
- Final prototype
- Large scale field testing
- Golden demo; reporting, dissemination, engaging prospective users & customers
- Business cases (partners & finance) & (service) blueprints

Build a demo.

Deliverables (4 yr)

ee. Results (number + deliverable + time):
- Important journal paper: 1 scientific paper on the design of Healthy Ageing Environments (HAE) for Elderly care (Y4)
- Important conference contributions (nr only): 3
- Products: 1 blueprint for social and communicative environment (Y4)
- Software: API for HAE (Y2)
- Research report about the user needs regarding "connectedness" (Y1)
- Research report on the acceptance and use of the prototypes (Y2)
- Scientific report on real-world field test (Y3)
- Service Blue Print (Y4)
- User studies: 2 (for 2 use cases) (Y3, Y4)
- Other results: workshop programme (Y3); Instructables for HAE's (Y3); HAE Manual (Y4)

ff. Impact and Valorisation (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact):
- 5 workshops for health care specialists (Y3 & Y4)
- 5 workshops for elderly (Y-Y4)
- 1 license for HAE (Y4)
- Data sets on activities (Y4)

gg. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination):
- 2 use cases (Y3 & Y4)
- 3 meetings for care and ICT professionals (Y2, Y3, Y4)
- Print media: ICT & Zorg, etc (Y3, Y4)
- On-line media: ICT & Zorg, etc (Y2, Y3, Y4)
- 3 eHealth conferences (Y2, Y3, Y4)

hh. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding):
- International Summer Schools
- Express to Connect / http://express2connect.org/
- Euro Living Lab / http://www.openlivinglabs.eu/
- Ambient Assisted Living / http://www.aal-europe.eu/
- International conferences

ii. Synergy:

Input for the design and development of the Healthy Ageing Environment comes from:
- P4 Virtual Worlds for Wellbeing: WP Tangible Interfaces
- P15 Trusted Healthcare Services: WP1

Connection with running projects:
- Express to Connect – for user studies
- Health Lab – for testing
- Smart systems for smart services – for relation with SME's

Deliverables (1st yr)

ee. Results (number + deliverable + time):
- Important journal paper: -
- Important conference contributions (nr only): Conference paper on new ways to improve social connectedness amongst elderly (Design & Emotion conference) (Q3)
- Products: -
- Software: -
- User studies: Research report about the user needs regarding "connectedness" (Q4)
- Other results: -

ff. Impact and Valorization (number + deliverable + time) (patents, downloads, product transfers, licenses, other forms of impact): -

gg. Dissemination (number + deliverable + time) (press media, popular papers, brokerage and consultancies, demonstrators, other dissemination): -

hh. International Embedding (international competitions, international licenses, international cooperation, other proofs of international embedding): -

ii. Synergy: see above

Consortia and collaboration

The partners in this workpackage are: **Waag Society**, **Hogeschool van Amsterdam** (Digital Life Centre), the **University of Twente** (Human Media Interaction Group) and **Serious Toys**.

The HMI group of Twente University has a strong reputation in media interaction technologies with a background in computer sciences. Waag Society has run many projects working in the heart of the creative industry, a.o. with applications to the elderly. In the Digital Life Centre of the HvA students from ICT and Health professions jointly work on short research projects for SME and care institutes. SeriousToys is a pioneering Philips spin-off from the MultimediaN project. Their cognitive stimulus toys are reaching the market, but the landscape of serious toys to improve wellbeing has hardly been explored.

Possible other partners are: care organizations, a telco company, ConnectCare.

20. Deliverables

Number of important journal paper: 28
Number of important conference contributions: 37

Products

1. SEN1
Prototype system for matching implication-realization patterns (M36)
- WP 1 YP 2014

2. SEN2
Prototype system for emotion based recognition (M40)
- WP 2 YP 2015

3. PIL2
Embodied Playful Learning Theatre (Y2)
- WP 8 YP 2013

4. PIL3
M6-D1 First iteration of the basic platform
M9-D2 First demonstration during a live event
M18-D3 2nd version of the platform
M30-D4 3rd version of the platform
M42-D5 4th version of the platform
M48-D6 Final version of the platform
- WP 9 YP 2012

5. Description INT
Prototype system for emotion based recognition (M40)
- WP 10 YP 2015

Software

1. SEN1
Algorithm for extracting semantic musical parameters from performances (M12)
Algorithm for inferring implication-realization patterns from features (M25)
Algorithm for matching music to user queries specifying emotion (M30)
Algorithm for locating most salient segments in music (M42)
Algorithm for extracting semantic musical parameters from performances (M12)

This algorithm will extract various semantically relevant parameters from musical audio recordings, including rhythmic, harmonic and formal parameters. Such parameters typically develop over time: therefore they will be determined at a suitable level of granularity. Feature extraction methods will be able to deal with different musical instruments and varying acoustical properties of the recordings. Algorithm for inferring implication-realization patterns from features (M25) This algorithm will employ the output of the semantic parameter extraction algorithm to infer patterns of implication and realization within pieces of music. Such patterns will be determined for the individual parameters; subsequently these patterns will be integrated to create an

overall development of implication and realization within each piece within the database. Algorithm for matching music to user queries specifying emotion (M30) This algorithm will relate patterns of implication and realization to emotion along the dimensions of valence and arousal. This mapping will have a temporal dimension, so that emotional change is accounted for. Users will be able to use Query By Example, where the task is to retrieve music with a similar emotion to the given query. This will be done by means of a retrieval method that matches the valence/arousal profiles. As a second option, users will be able to specify the emotions they feel to the music they know, based on this, a direct mapping between valence/arousal profiles and emotions will be created which allows personalized emotion-based retrieval based on textual queries. *Algorithm for locating most salient segments in music (M42) This algorithm includes components for determining boundaries between musical segments based on implication-realization patterns; for determining repetition, variation and hierarchical musical structure, and for selecting patterns that are most characteristic for the piece. The salience of a pattern is determined by its degree of cognitive closure, its frequency in the piece and its scarceness in the genre to which it belongs. Thumbnails will be created by determining which high-level segment contains the largest number of different salient segments.
- WP 1 YP 2012

2. SEN2
Face based emotion feature localization and emotion recognition in groups of people (M12) Body-part based emotion feature localization and identification in groups of people (M25) Entire-body based emotion recognition of groups of people (M37) Image or image-sequence retrieval based on emotion content (M48) Face based emotion feature localization and emotion recognition in groups of people (M12) Human face is the most important part of human body in expressing emotions. Particularly when people interact with other people. *The software will first localize the facial features of emotions in a scene where there are two or more people interacting to each other. Second, these features will be used to categorize the individual's expressions *into a few emotion candidates. Third, these candidates will be verified *by including them in the analysis of the possible interactions of the people involved. All the mentioned steps will assume an image sequence, where the information is more reliable. Body-part based emotion feature localization and identification in groups of people (M25) While human face is arguably the most important part, other parts of human body also play crucial roles in expressing emotion. From the hand gestures, foot gestures, body language, etc, alone (without face) we can infer the approximated emotion of the person. Hence, the software should include this information. First, the software will detect and track the targeted body part. Second, it infers the pose and then the gesture of the body part. Third, from the estimated gesture, it categorizes the possible emotions of that gesture (by generating a few candidate emotions). Fourth, it combines the candidates of all body parts in order to calculate the rank of the emotions. The highest the rank, the more likely the emotion will be. Fifth, the software applies the same algorithm for all possible people in the scene. Sixth, combining all the information from the individual's body parts and the possible interactions of the targeted people, the software should be able to predict the emotions of the people involved and the scene. All the mentioned steps will assume an image sequence, where the information is more reliable. Entire-body based emotion recognition of groups of people (M37) *In the previous deliverable (M12 and M25), the software does the tasks separately. In this software deliverable, it must combine the two strong modalities (face and body parts) into one integrated framework. Image or image-sequence retrieval based on emotion content (M48) The goal of previous deliverables focuses on predicting emotions given an image sequence. In this software deliverable, the goal focuses on retrieving image or image-sequence based on a user query, where the query can be a name of one emotion or a few strongly related emotions. This software is useful for searching emotions (it can be called "emotion-google").
- WP 2 YP 2012

3. SEN3
M24-D4 Software: software methods combining emotion recognition and headpose estimation.
M38-D7 Software: head pose module.

M42-D8 Software: age and gender module.
M42-D9 Software: eye tracking and gaze estimation module.
M42-D10 Software: body movement recognition module.
(M12) Live demonstration of emotion recognition.

Emotion recognition software is demonstrated that automatically tracks facial features over time and classify the corresponding facial configurations into different emotional classes. The software includes face detection and facial land marking to correctly indentify facial characteristics. A classifier is trained on spontaneous and non-spontaneous facial expressions. (M24) Data collection at Nemo. Our data collection admits people for a brief duration (10-15 minutes) into a relatively isolated space. There is a very nice room reserved for this purpose at the NEMO Museum. The participants tell us their age, and then we show them some images and videos. The videos are typically short and funny, selected to make the subject laugh. We also ask our subjects to mimic some expressions they see on the screen (which will be one of six random basic emotional expressions: happiness, anger, sadness, disgust, surprise, fear). We record our subject's face during the experiment. We use these recordings to train the computer to estimate the age of a person under different conditions. (M42) Head pose, age and gender modules. We explore the relation between age estimation and facial expressions. Estimating the age of a person from the facial image is difficult for computers. Wrinkles on the face indicate older people, but expressions also cause wrinkles on the face. Emotional expressions (expressions of happiness, fear, anger, etc.) induce systematic wrinkles and morphological changes on the face. Given a neutral and an expressive face of the same person, we can factor out the changes due to expression, and create a system that estimates the age of the person with greater accuracy, when compared to a system that only works on a single neutral face image. Software is developed to automatically estimate the head pose, age and gender. (M8) Participation in PASCAL VOC Challenge We will participate in PASCAL VOC Challenge in "classification", "person layout" and "action classification". Collaboration is done with the Computer Vision Centre in Spain (Barcelona). Both UvA and CVC have high reputation in these challenges. More international collaboration will be issued with Trento Italy. Close synergy will be with P2. Further, we will co-operate on building software components to participate in PASCAL VOC and TRECvid together with P1 and P6 on "classification", "person layout" and "action classification".
- WP 3 YP 2014

4. ANI1
Initial system for affective body and facial animation (Y2)
System for user control of body and facial animation (Y3)
Final system for affective body and facial animation (Y4)
Initial system for affective body and facial animation (Y2)

This software will contain the initial algorithms and techniques developed for affective animated characters. High-level emotional parameters will be defined that can be mapped to different character motions. These high-level parameters will be controlled by the user in a later stage in the project (see deliverables in years 3 and 4). System for user control of body and facial animation (Y3). This software will allow for the interpretation of a variety of user inputs, such as high-level emotional parameters as well as user motions such as gestures, which will be obtained using a motion capture system consisting of a limited set of markers and/or the recently developed vision-based motion capture systems such as Kinect. B3 (M48): Extended demonstrator to show complete body and facial animation and steering (demonstrator) Final system for affective body and facial animation (Y4) In the final software, the user input parameters will be integrated with the affective body and facial animation system developed earlier. This will lead to a full simulation library that allows users to control an emotional avatar through high-level parameters. C. dissemination of science C0 (throughout the project): Demonstrations and lectures at conferences, papers, etc. D. dissemination to profit/non-profit/customers/general public D0 (throughout the project): Demonstrations and lectures at trade shows, press releases, etc.

- WP 4 YP 2012

5. ANI2 Initial system for social animation (Y2)
Final system for social animation (Y4)
Initial system for social animation (Y2)

This software will allow for the simulation of groups of people that exhibit a social cohesion amongst them and in a limited fashion with the users' avatars. An interface will be developed that allows defining the way that the crowds behave through a number of high-level parameters. Final system for social animation (Y4) The final version of the software will have a complete integration of the user avatar behavior in the social crowd simulation system developed in Y2, including models and algorithms for mirroring behaviour and for emotional interplay. Furthermore, this software will also contain features that allow for an easy setup and execution of user experiments in crowd interaction.
- WP 5 YP 2013

ANI3
Biomechanical animation of virtual characters from physical activity measurements (M18)
The developed method will estimate, in real-time, the muscular activity of a subject. Techniques such as musculoskeletal simulations give accurate insights of the algorithms involved but they usually rely on very accurate tracking and intensive calculations. Our method will use low cost capturing devices (such as Microsoft's Kinect or a set of accelerometers) and partly off-line optimization and online estimation. The model outputs will then be translated to the user through virtual characters: the avatar of the user and the other animated characters in the virtual world.

Improved method for motion editing based on physical fatigue (M28)
Next to the muscular activity estimation method we will have physical models of virtual characters on which the motion can be edited according to its activity over time and thus physical fatigue. It will be based on the usage-dependent maximal capacity of muscles to produce actuation forces and its effect on the measurement criteria, so that long lasting scenarios will produce different motions from different fatigue effects. The decision of changing the scenario online will also be investigated to reach the user's particular objectives. Motion edition might for example take the form of extending existing motion editing techniques with physical activity parameters.

Investigation on anatomical animation and physical activity (M39)
Actuation is produced by muscle contraction, which changes the shape of the soft tissues, including the muscle itself. Therefore the physical activity of a human being is closely related to the muscle geometries and their evolution over time. A specialized field in computer animation is dedicated to the real-time deformation of such geometries. We will investigate the correlation between geometry-based deformations and muscular activity. The goal will be to determine these plausible correlations in order to develop a technique to assess online, from (computer animation oriented) soft-tissue deformations, the physical activity of a virtual human (avatar of the user or animated character).

Final implementation, validation and user studies (M48)
The final implementation of the physical wellbeing assessment will combine the methods previously described into one common framework, enabling the complete, online animation of physically and anatomically plausible characters. To evaluate the framework, user studies will be conducted in order to determine its impact on the community. In addition, the framework will be validated using biomechanical experiments.

6. TA1
Contributions to the applications developed in WP VII and WPVIII, year 3 and year 4. The software deliverables consist of software modules for multi-modal input and output processing of variable datasets. The data variables depend on the input sensors of the hardware interaction devices and processing algorithms of real world variables. The multi modal input and output processing software consist of audio visual processing modules or motion capture software modules. These software modules are interconnected through a software framework which is developed on top of an API. As a result the software modules and –framework bind together algorithms and toolkits for the interpretation and combination of datasets. This results in the development of audiovisual- and biofeedback mechanisms for user interaction with tangible interfaces.
- WP 6 YP 2014

7. PIL 1
B1 (M12): First prototypes / storyboards /animation showing tangible first year results
B2 (M24, 36): Extended Prototypes
B3 (M48): Final demonstrator
B1 (M12): First prototypes / storyboards /animation showing tangible first year results
Depending on the progress the first deliverable will show as much as possible a working proof of concept of the general idea of the pilot.
B2 (M24, 36): Extended Prototypes Extended prototypes connecting several locations and inputs and outputs to dancers and changes the atmosphere depending on the recognized emotions.
B3 (M48): Final demonstrator
Final version showing as much as many of the additional ideas and the work from other work packages.
- WP 7 YP 2012

8. PIL2
API for EPLT (Y2). The software deliverables consist of software packages and a framework for: 1) Input processing of data variables. This consist of the analysis, interpretation and combination of sensor data through a single unified API. This allows detection of the state of the user by combining the sensory input like heart rate, gestures, movement/direction and facial expressions. 2) Output processing of interpretations of sensor data through real-time visual feedback by means of projection. The software modules developed in Y4 operate audio video processing, motion capture and bio sensoring hardware technology and provide automated real time feedback for user interaction in the EPLT.
- WP 8 YP 2012

9. INT
B1 (M12): API design specification
B2 (M24): Tools implementing existing techniques and solutions leading to a first release
B3 (M36): Tools implementing novel techniques from the other work packages
B4 (M48): Release 2 of the toolkit
B2 (M24): Tools implementing existing techniques and solutions leading to a first release Collection of tools that for instance convert content / video to the required format for use in the pilots. Other tools consist of algorithms for streaming video, integration of other video streams / animations and so on. B3 (M36): Tools implementing novel techniques from the other work packages.
Depending on the work packages this deliverable with offer tools and techniques to integrate the animations/ emotion recognition or other deliverables.
- WP 9 YP 2012

10. PIL 3
B1 (M12): First prototypes / storyboards /animation showing tangible first year results

B2 (M24, 36): Extended Prototypes
B3 (M48): Final demonstrator
B1 (M12): First prototypes / storyboards /animation showing tangible first year results. First platform consisting of treadmill, control unit and tv synchronized.
B2 (M24, 36): Extended Prototypes Extension of the prototype from year one with support for more devices and sensors. Introduction of the first additional features on the platform (for examples see the Use Case Exercise).
B3 (M48): Final prototype. Final prototype with as much features developed by the project and *3rd party contributors
B4 (M48): Business case in cooperation with business partners

User studies

1. SEN1
Experimental evaluation of semantic parameter extraction algorithm (M18)
- WP 1 YP 2013

2. Experimental evaluation of emotion-based matching (M37)
- WP 1 YP 2014

3. ANI1
Effectiveness of animation control system (Y4)
- WP 4 YP 2015

4. ANI2
Effectiveness of social animation (Y3)
- WP 5 YP 2014

5. ANI3
Effectiveness of the physical wellbeing assessment (Y4)

6. TA1
A first study focussed on requirements elicitation (year 1), a second data study (year 2) and two evaluation study (year 3 and year 4).
- WP 6 YP 2012

7. PIL1
Effectiveness of social animation (Y3)
- WP 7 YP

8. PIL2
2 (for 2 use cases) (8-9) (Y3, Y4)
- WP 8 YP 2014