ANSWER Annual Report

ANSWER is a new approach to the creative process of film and game production. ANSWER produces a notation system for describing the creation of multimedia content, offering a bridge between digital media production and animation for game design. ANSWER will develop the DirectorNotation to symbolically describe creative intention, and tools for automatic generation of animated pre-visualizations for film and game pre-production. An interface will be created to allow the Director to work imaginatively with the notation as it is authored, and an iterative scheme is introduced to ensure that developments of ideas and the realities of the actual production are reflected in the final notation description. Professional users from the film and games production industry are integral partners in the project, which ensure that we work together towards a common goal and are not dominated by technological considerations, before artistic needs.

Summary of Activities

Activities of the final year of the project are presented in the following subsections:

- Implementation finalization of the ANSWER tools and architecture core modules

- Integration of all ANSWER tools

- ANSWER Demos preparation

- Testing & evaluation

  - Test use cases

  - Real evaluation from end-users

  - Evaluation of results from STEFI movie production

- Dissemination at international workshops and scientific papers

User Interface

2010 saw substantial development of the Notation Editor – the front-end GUI through which Director Notation scores are created and reviewed, and through which the director accesses the automatically generated pre-vis movies. Building on the core notation support of 2009, this year we implemented support for two substantial additional aspects of Director Notation: Actor Notation and Editing Notation. With the addition of Actor Notation support, the user is now able to specify in detail not only the movements and positioning of the actor as a whole, but also posture and actions of individual body parts. Editing Notation allows the user to

specify camera orientation and movements, but also provides the option to specify camera cuts and fades, as an alternative to the shot ('setup') definition mechanism already provided as a pre-notation step in the Editor. We also implemented a history/undo feature, error reporting, and support for post-production synchronisation, and significant improvements were made to reliability of loading and saving Notation Scores. The following sequence of images illustrates the current position of the Notation Editor.
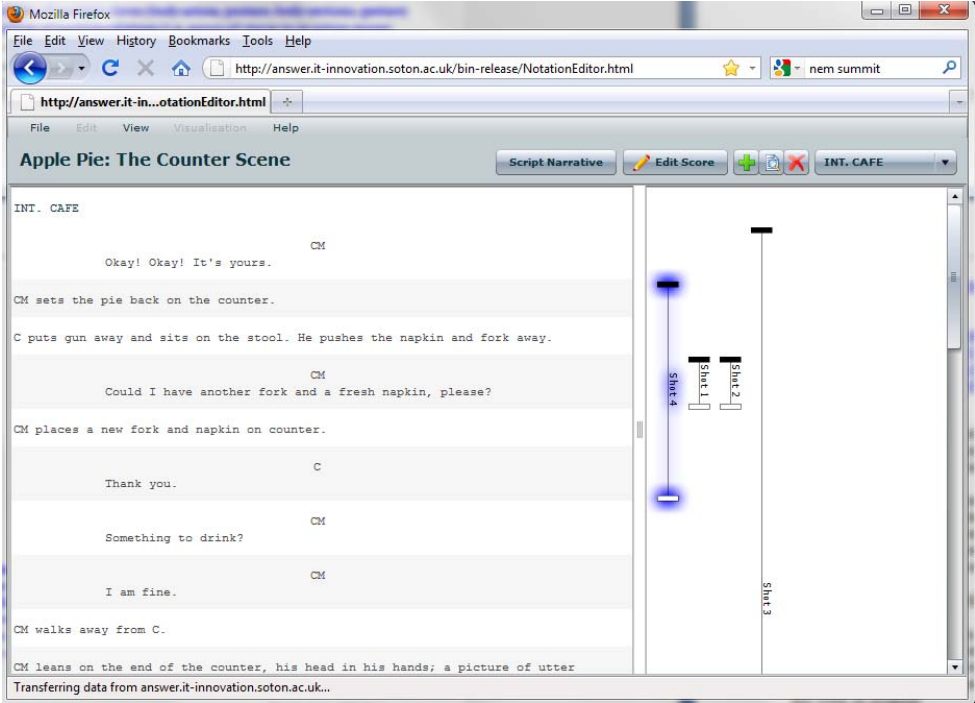

Figure 1 Notation Editor - Script Review and Shot Definition view
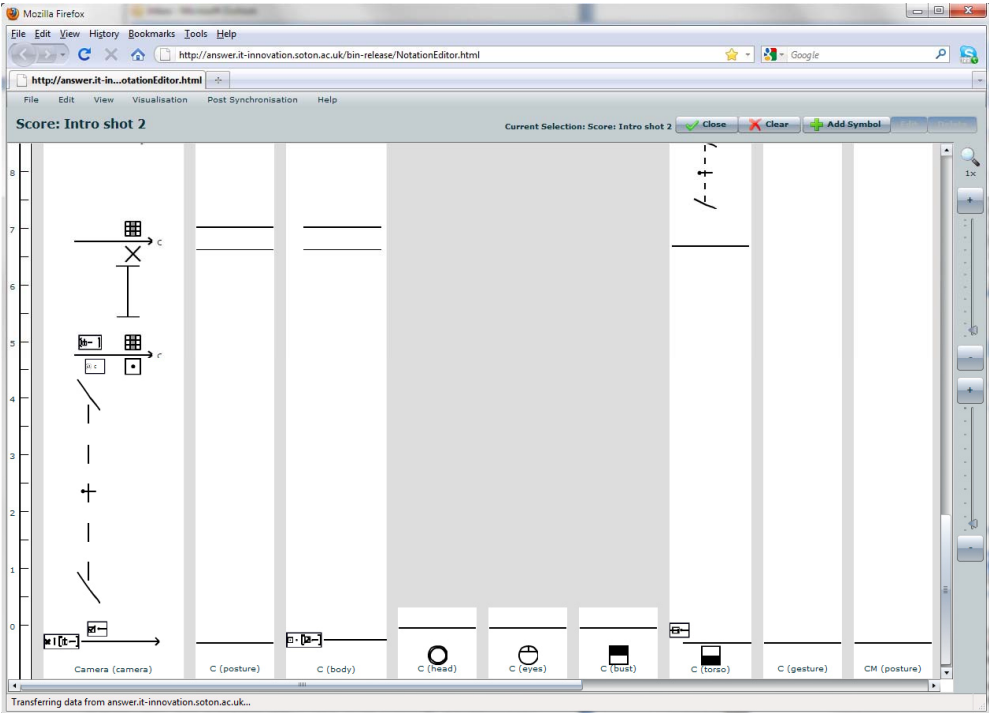

Figure 2 Notation Editor - A complex score featuring Editing and Acting Notation
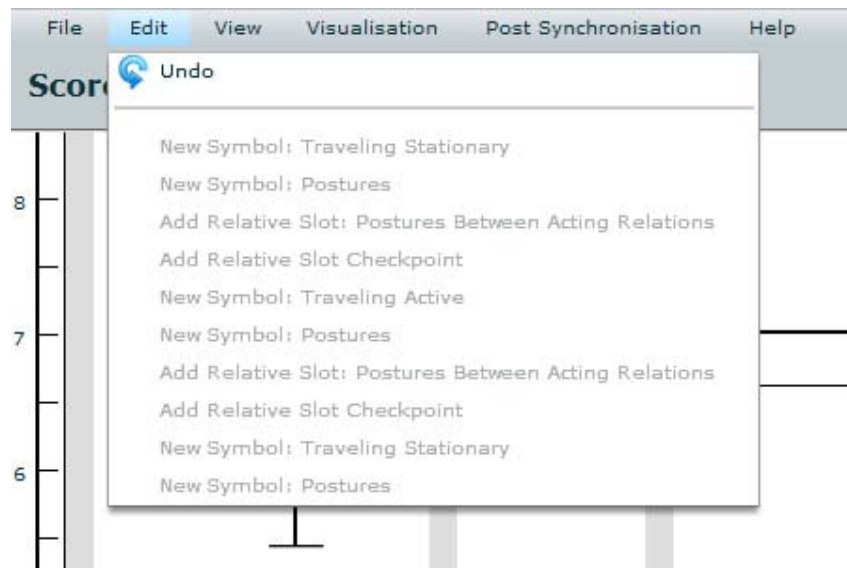
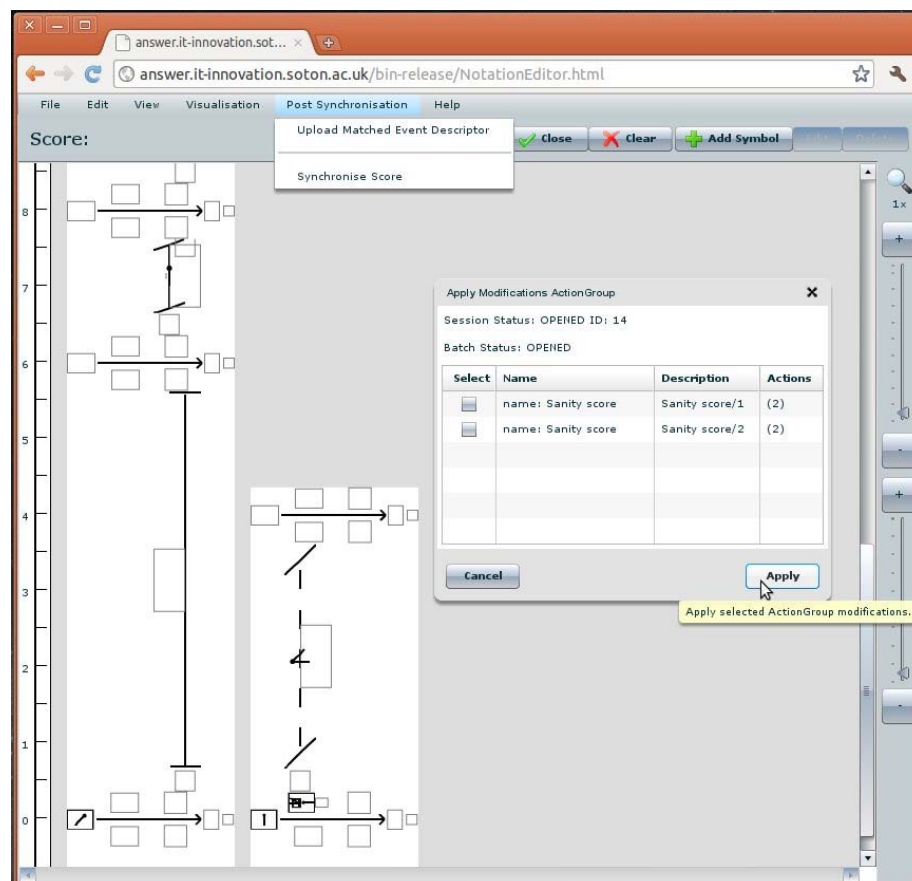Figure 3 Notation Editor - The Undo function allows the user to reverse edits made to their score

Figure 4 Notation Editor - Application of notation modifications generated by the Rule Engine to synchronise the score to actual footage

Emotion Visualization

Concerning the visualization of strong emotions we continued our work by starting to include the animation of appropriate wrinkles as shown in Figure 5. As can be seen in the image showing the latest ANSWER character Janet, for many emotions wrinkles can occur due to muscle movements, e.g. for joy, there are small wrinkles around the eyes, and when being angry, there are also often wrinkles between the brows. Analogous to skin tone changes expressive wrinkles can be animated by interpolating between bump maps. In general, besides skin changes it is also necessary to synchronously handle corresponding changes around mouth and eyes, as people mostly focus on these regions. Therefore, we are additionally integrating the possibility to control wrinkle animations synchronously to tears, skin tone

changes and morph target animations via PML into our X3D-based behaviour control framework.

Figure 5: Neutral face expression (left) compared to angry expression with wrinkle between the eyes.

Demo Preparation

The screenshots in Figure 6 show the room model, which was overhauled according to the new demo script, and both our newly modeled character models, Joe and Janet, for which new animations were created. First of all these animations include a full set of expressive morph targets (see Figure 5 for an example) as well as visemes (the visual pendant for phonemes) for doing speech animation. Furthermore, a comprehensive set of body animations was created.

Figure 6: Screenshots showing the overhauled room model with the new characters Joe and Janet.

Therefore, we have also extended our 3ds Max Exporter (called InstantExport, cp. Figure 7) to be able to directly export animations as *TimedAnimationContainer* nodes, which are used to encapsulate all data that is specific to a single animation, as well as PML scripts that allow direct testing of the exported asset. This greatly simplifies the process of setting up a new scene, including asset management.
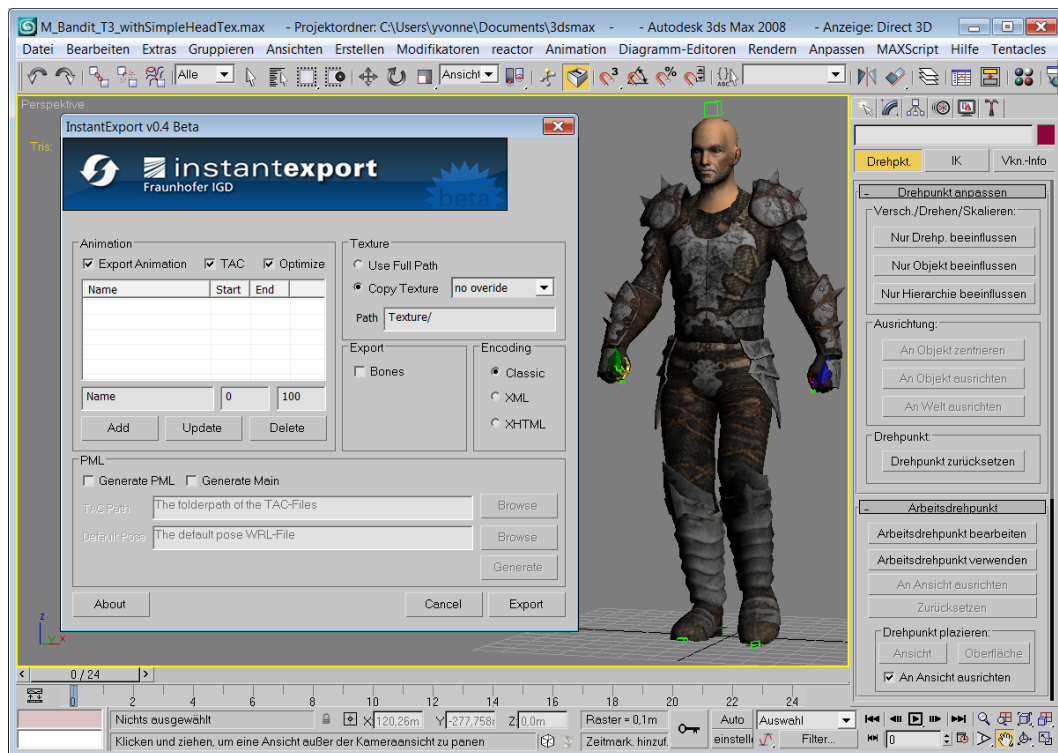
Figure 7: The X3D exporter for 3ds Max now can also export TimedAnimationContainer and PML.

Camera and Effects

Camera and effects manipulation have been implemented for further assisting the object tracking, camera movements, and post-processing. As can be seen in Figure 8, both effects can easily be combined to achieve an old-fashioned look.

Figure 8: From top left to bottom right: standard rendering, black-and-white rendering, blur with grain, all effects (black-and-white, blur with kernel size 3, grain) combined, for old-fashioned look.

Furthermore, we've also implemented a new kind of effect for simulating special lens types that can distort the camera image, like e.g. the wide-angle lens shown in Figure 9.

Figure 9: Normal view onto the living room scene (left) compared to a distorted view (right).

Declarative Movements

To support director commands like "look at X" or "point at X" we realised control of parts of the avatar using real-time inverse kinematics instead of artist-created animations. During this year early prototype development has been advanced and transferred to a generic, open technology based on X3D inside of Instant Reality. The development is still work in progress. Specifically, during this reporting period work has advanced the prototypical implementations using a robust, numeric method called Cyclic Coordinate Descent. This will allow any chain of limbs to be pointed at any spot and support angular restrictions on bones. Specific solutions, for example addressing arms and heads, allow more natural movements beyond the numerical solution (Figure 10).
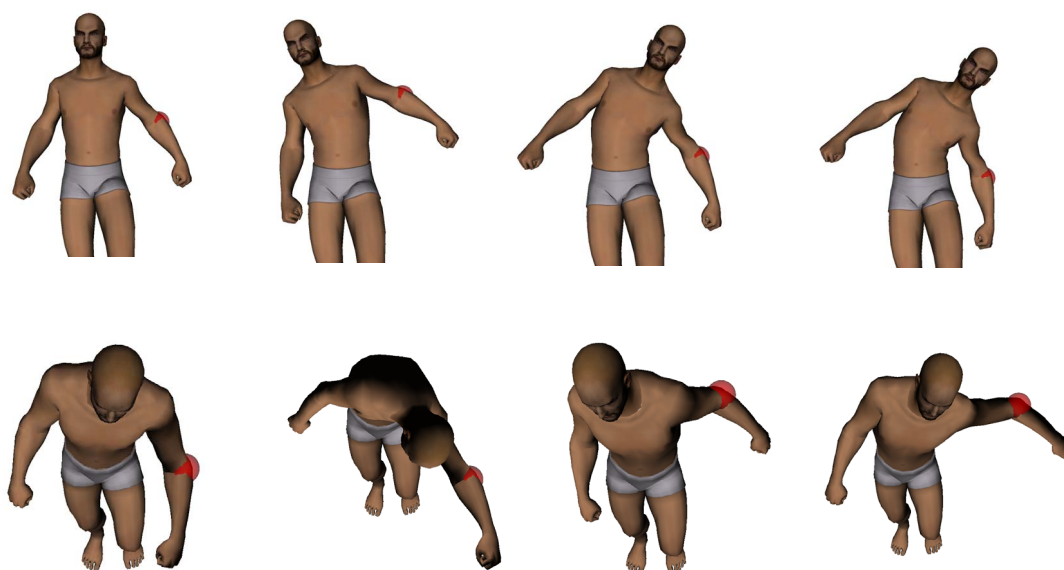

Figure 10: Advancing the inverse kinematic simulation of a skin-bones avatar based on H-Anim

Production Synchronization

This task comprises the implementation of all content-based video analysis sub modules and their integration into the ANSWER Postproduction Synchronization Tool (PST) application. The PST acts as a support worker component for the BONES application. It is a stand-alone application, being connected via network to a BONES PC. The PST performs content-based analysis on video data that is sent by BONES, in order to extract visual events from video, using its video analysis modules (like face detection, film slate detection & analysis, object tracking, camera motion classification, and event matching).

ANSWER Postproduction workflows: IGD has now specified (in collaboration with DFT) a refined workflow for post production in ANSWER. This workflow will reflect all user requirements and some extended and refined features like event matching and automatic

creation of rough cuts. Event matching will allow association of DirectorNotation (DN) events with recognized events from pre-vis/footage. This is necessary to allow the Notation editor to adjust events and re-render a synchronous version of the Pre-Vis.

Postproduction Synchronization Tool (PST) Application: the PST now offers a graphical user interface to the user (see Figure 11), which makes it easier to control the PST manually, as a stand-alone application.
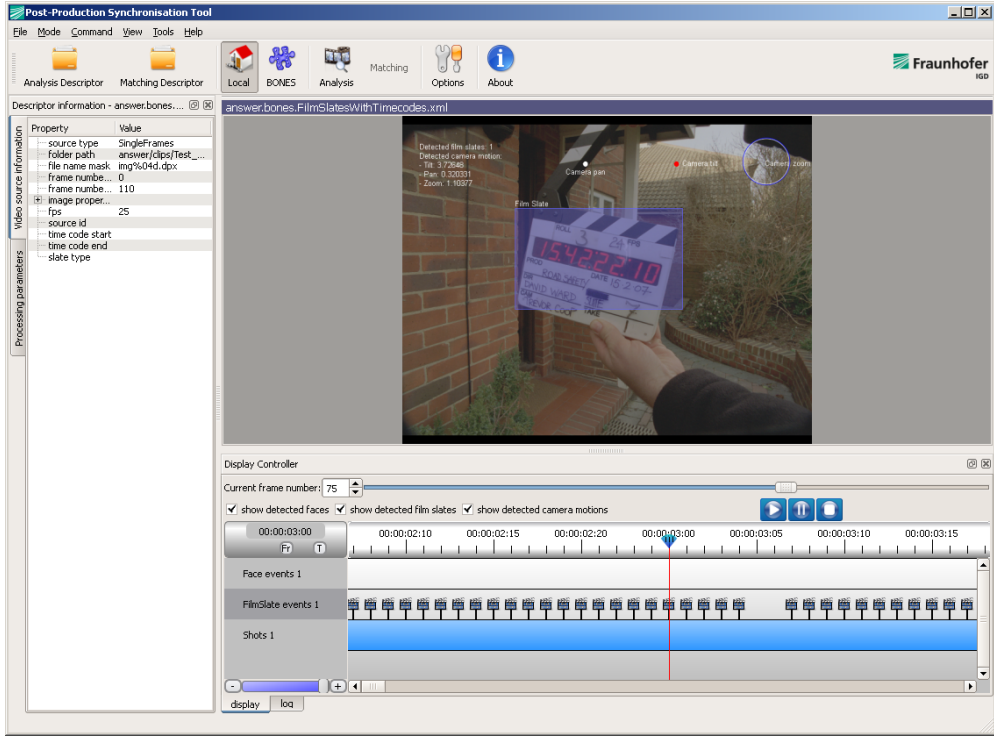

Figure 11: Screenshot PST (latest version): Improved visualization of sequences and events in timeline

Content-Based Post-Production Implementation

Integration of the Postproduction Synchronization Tool (PST) into the BONES postproduction tool has been improved and, following discussion with the partners, the workflow was refined. The integration has been tested successfully. The basic interaction between the PST module, which runs on a Windows computer, and the BONES system, which is based on LINUX is shown in the picture below (Figure 12).
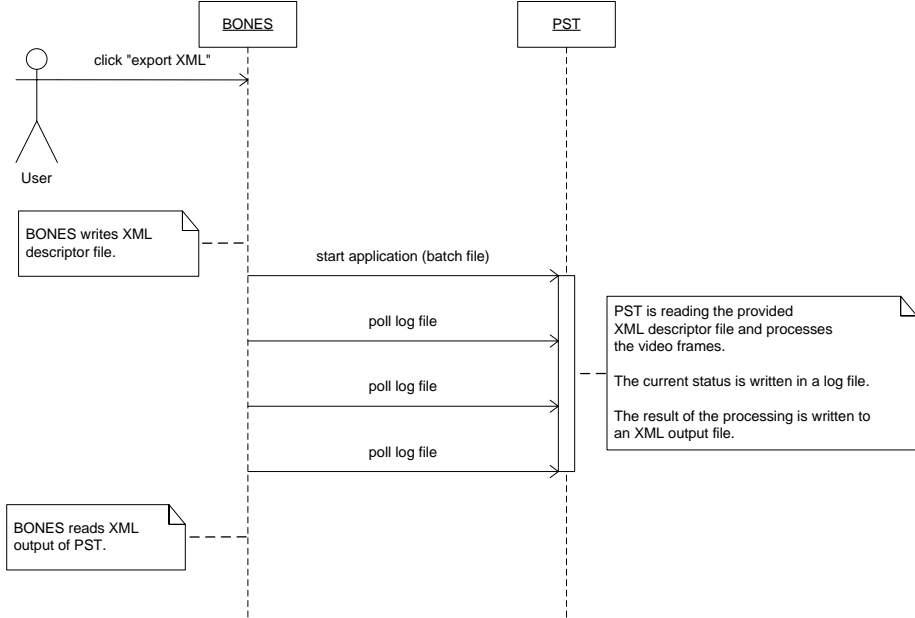

Figure 12: workflow Bones and PST

ANSWER components integration

This task comprises all activities related to external integration between two or more ANSWER components. The workflow of the Postproduction application has been specified in the following main steps:

a) Prerequisites:

A DirectorNotation Script has been modeled for a certain amount of scenes (or whole movie), being referred to as the *DN script.*

b) Ingest

In this workflow step the footage and pre-vis video data are ingested to the BONES system.

Notation Editor	InstantReality	BONES	PST

PreVis, Footage

c)
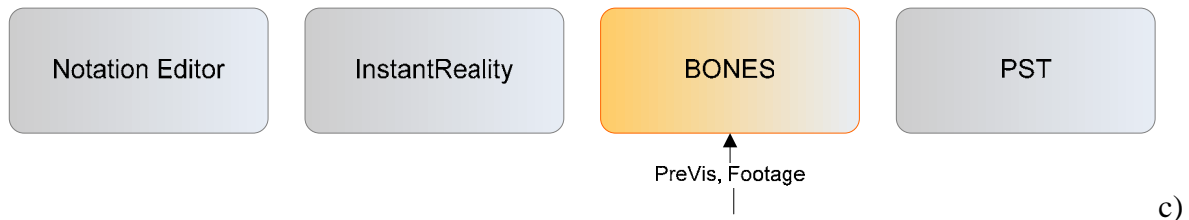
Analysis

The basic goal of this step is to automatically extract content-based events from the video data, which is the basis for later synchronization.
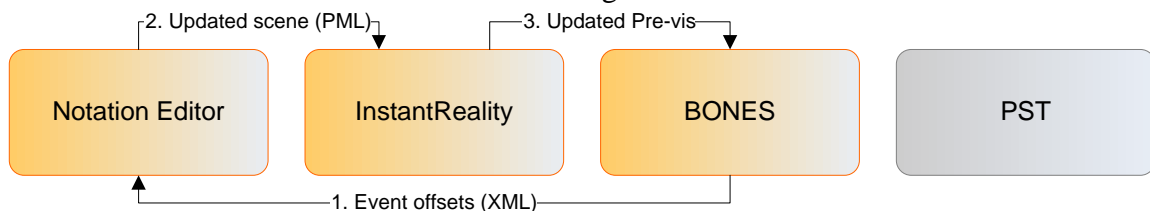
1. Clip source info (XML)

Notation Editor	InstantReality	BONES	PST

2. Extracted Events (XML)
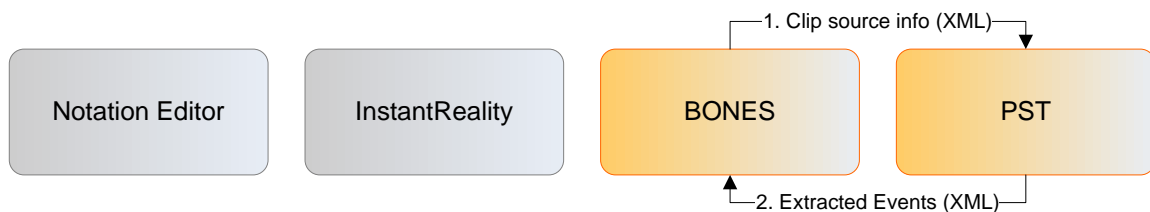
d) Matching

The basic goal of this step is to match events that have been defined in the DN script (during the scene/film modeling process) with the events that can be extracted from the video data (both pre-vis and footage).

1. Events (XML)

Notation Editor	InstantReality	BONES	PST

2. Matched events (XML)

e) Synchronization

Goal of this step is to create a synchronized version of the pre-vis which is perfectly aligned with the events extracted from a selected footage take.

2. Updated scene (PML)   3. Updated Pre-vis

Notation Editor	InstantReality	BONES	PST

1. Event offsets (XML)

f) Automatic Rough Cut

The goal of this step is to create an automatic rough cut from a set of previously analyzed footage/pre-vis clips. This means that BONES will be able to automatically visualize selected footage clips (incl. Pre-Vis) in its timeline corresponding to the DN script.

Scenes + events (XML)

Notation Editor	InstantReality	BONES	PST

2. Cut List (EDL)
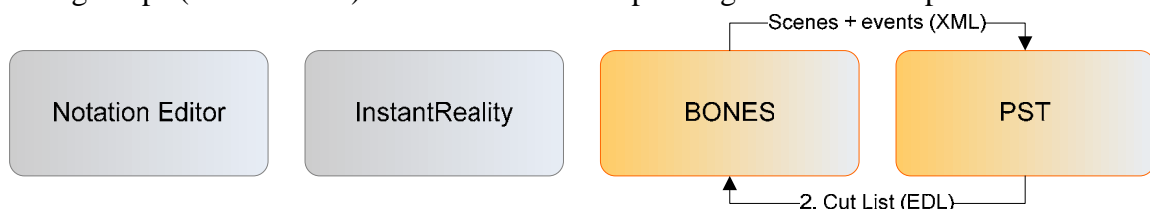
Below some recent screenshots of the above integration steps into the PST application are shown:
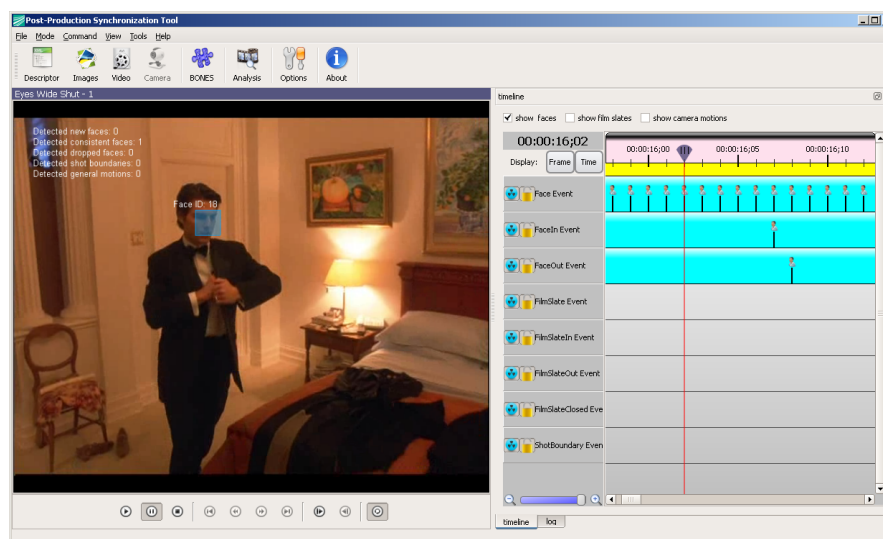

Figure 13: Screenshot PST application with updated graphical user interface – A detected and tracked human face (video pane on the left side) is also shown as an event in the timeline (right side).
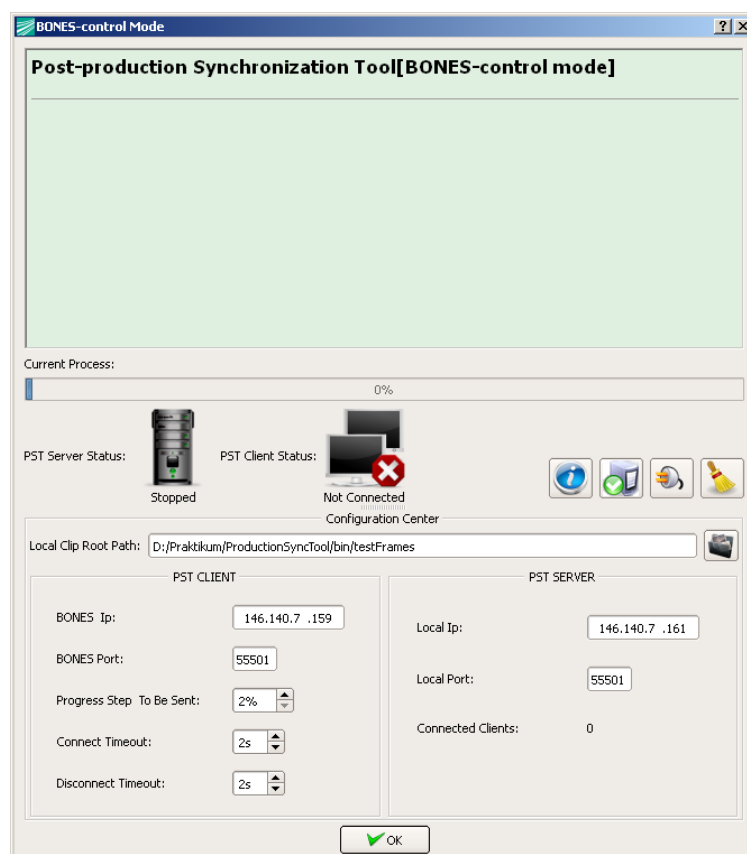

Figure 14: Updated Dialog Screen for maintenance of BONES-PST connection.

Movie Creation for Demonstration

The ANSWER project outputs are being tested in the actual professional work of one of the film directors representing STEFI in the ANSWER project. This work in fact consists of two relevant activities, and during the last year both options were examined and continued until now.

1. One is a full feature film for which actual pre-production has not yet begun - the film will be produced in 2011, and preliminary work on it can be performed as ANSWER tests, but actual work on the film will begin after these tests are completed.

2. The other is a sitcom for which a pilot episode is already scheduled for production in 2010, so ANSWER can be tested as a pre-production tool for it, and then comparison to the actual, industrial-level production will be possible. Early pre-production work for both of these options was begun by STEFI early in 2010, and continued until the middle of the year, and one of the options will be chosen and carried out to completion in following project work.

User Involvement, Promotion and Awareness

Activities

- In late March of 2010, IT Innovation's ANSWER team travelled to Toronto, Canada to develop academic links and exploitation opportunities for the project. ANSWER was very well received - in particular there was interest in using the platform for Low-Mid Budget Productions (where it was felt that greater use is currently made of virtual production techniques) and for games cut scenes. Good contacts were made from York University, Waterloo University, Ryerson University and Sheridan Institute. ANSWER was also demonstrated to a gathering of industrial and academic representatives at Pinewood Studios Toronto.
- Also IT Innovation has begun to explore how ANSWER results might be used beyond the core film and television production domain. They held meetings with a medical video communications company, and an ophthalmologist to explore possible future applications of ANSWER technology in the planning and documentation of precision medical procedures, or creation of training videos of those procedures.
- Continued membership of the X3D consortium, and participation in the H-Anim Working Group.
- The ANSWER Notation Editor was demonstrated at NAB 2010 in Las Vegas, as part of IT Innovation's stand in the NAB International Research Park.

Publications

- In May 2010 a paper with the title "Automatische 3D Visualisierung für die Film- und Fernsehproduktion" was given at the German FKTG conference in Hamburg (17-20.05.2010). This is the most important event for the film and television engineers in Germany. In the discussion after the speech there was a great interest in the ANSWER project, so we were asked to publish a detailed technical article in the FKT, the monthly journal of the FKTG. The article appeared in the December 2010 issue.

Figure 15 ANSWER technical article in FKT Magazine

- Rolf Hedtke, Rolf Schiffmann, Christoph Jung, Yvonne Jung, Ajay Chakravarthy, Richard Beales, Stefanos Koutsoutos, and Angelos Yannopoulos. *Automatische 3D Visualisierung f˙ur die Film- und Fernsehproduktion*. In *FKTG Journal* and presented at FKTG annual conference Hamburg May 2010 and published in FKT 12/2010 pp.639 – 652.

- Ajay Chakravarthy, Richard Beales, Yvonne Jung, Sebastian Wagner, Christoph Jung, Angelos Yannopoulos, Stefanos Koutsoutos, Rolf Schiffmann, Rolf Hedtke, and Ignace Saenen. *A notation based approach to film pre-vis*. In 7th European Conference on Visual Media Production (CVMP 2010), London, UK, 2010. IEEE. 6 p.

- Jung, Yvonne; Wagner, Sebastian. *Emotional Factors in Face Rendering*.In: International Association for Development of the Information Society (IADIS): IADIS Multi Conference on Computer Science and Information Systems 2010. Proceedings [CD-ROM] : MCCSIS 2010.IADIS Press, 2010, pp. 354-358.

- Jung, Yvonne; Wagner, Sebastian; Jung, Christoph; Behr, Johannes; Fellner, Dieter W.:*Storyboarding and Pre-Visualization with X3D*. In ACM SIGGRAPH u.a.:Proceedings Web3D 2010 : 15th International Conference on 3D Web Technology.New York : ACM Press, 2010, pp. 73-81.

- Nikoletta Mavrogeorgi, Stefanos Koutsoutos, Angelos Yannopoulos, Theodora Varvarigou. *Language Reasoner System*. In IEEE ICISCI 2011: 2011 IEEE International Conference on Information Systems and Computational Intelligence. (*accepted for publication paper*)

Workshops

An industry feedback workshop was held at Pinewood Studios in December, to gauge industry reaction to our work as the project draws to a close, and identify aspects of the ANSWER system that might usefully be developed further in future R&D projects. Led by Simon Phillips (Tools of Directing Ltd.) and coordinated by IT Innovation with South East Media Network, the event saw a frank exchange of views as industry representatives and project partners discussed the strengths and weaknesses of the ANSWER approach.

Figure 16 ANSWER industry feedback workshop at Pinewood Studios

We were proud to be selected as one of the EC-supported R&D projects showcased at the Networked Electronic Media (NEM) summit in Barcelona in October (Figure 17). ICCS, IGD and IT Innovation took turns to man the ANSWER exhibition booth, where we gave interactive demonstrations of the ANSWER Notation Editor and Pre-Vis generator. IT Innovation and ICCS also presented ANSWER at one of the co-located conference sessions.

Figure 17 ANSWER in NEM SUMMIT Conference

Future Work or Exploitation Prospects, as appropriate

ICCS and STEFI are currently organizing an ANSWER conference, which will address two important goals with one activity - "two birds with one stone". In order to disseminate ANSWER results in a high-profile way, a high-profile audience must be reached. In order to validate the ANSWER approach, and questions raised by the reviewers in past review meetings, the basic assumptions of the project should be discussed at a deep level. The ANSWER conference thus addresses the basic assumptions of the project, inviting leading academics to present papers and participate in open discussion.

A workshop is being organised that will present ANSWER in depth to film directing students. The students will be given detailed presentations. They will also be involved in practical exercises, trying out the ANSWER project outputs for use in their own projects and according to their own needs.

Finally all partners will continue their dissemination and exploitation activities based on our achievements of ANSWER project during all these three years. Research on this scientific field does not stop!

Further Information

[Adobe Flex](#)
[Protégé Server Wiki](#)
[Larian – Divine Divinity 2](#)
[Instant Reality](#)
[X3D](#)
[Gamasutra.com](#)
[AIGameDev.com](#)
[ANSWER project](#)