



## IMMERSIVE PRODUCTION AND DELIVERY OF INTERACTIVE 3D CONTENT

### DELIVERABLE D6.2:

#### FIRST DEMONSTRATOR, BASED ON HYBRID CAPTURE TECHNIQUE

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## Classification and Approval

Classification: Public

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### Acknowledgements

All partners of the RE@CT project contributed to this report during the last months.

## RE@CT Consortium Overview

Participant no. *	Participant organisation name	Short name	Country
1 (Coordinator)	British Broadcasting Corporation	BBC	UK
2	Fraunhofer HHI	HHI	Germany
3	INRIA	INRIA	France
4	University of Surrey	Surrey	UK
5	Artefacto	ART	France
6	OMG	OMG	UK

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# 1 Introduction

This report describes the preparation and first public viewing of the RE@CT first demonstrator, which was delivered just a few days into Month 19 of the project.

First, we describe the augmented reality game that has been developed as the benchmark for future comparison, based on virtual characters created with traditional modelling and animation techniques. We then show the preliminary outcomes from the integration of the re-animation tool using content captured during the test shoot in February 2013 on a mobile platform before giving a short overview of the first demonstration held at the Mirage 2013 conference in Berlin on 6-7 June.

## 2 Scenario implementation

### The Serious Game

The serious game demonstrator has been built around an historical theme, which is briefly described below.

*"The story begins in 1198 in Montfort, near Rennes. Lord William of Montfort wants to recover his castle, which is occupied by Richard the Lionheart, king of England.*

*Lord Montfort has set up his camp near the castle, from which the colours of his banner are clearly visible. His ally Alan of Dinan is also there, with troops of infantrymen and several knights.*

*The aim of the game is for you to help them regain control of the castle and free the local population from King Richard's dominion.*

*In order to do so, you will need to move from square to square and answer riddles, which will take you to the last square of the game and allow you to regain control of the castle."*

The complete scenario is currently available in French on the project wiki. A full English translation will be made available at a later stage in the project, once the original scenario is finalised.

The scenario for the demonstrator was developed following a close collaboration with historians from the Museum of Montfort, near Rennes in France. The initial demonstrator was therefore made available for free to the museum for one of their exhibitions. Local television channel TV-Rennes broadcast a report on the exhibition and in particular on visitors' experience with the game. This report is available to view or download from the project's website: [http://react-project.eu/videos/REPORTAGE\\_JEU\\_CHEVALIER\\_WEB.mp4](http://react-project.eu/videos/REPORTAGE_JEU_CHEVALIER_WEB.mp4).

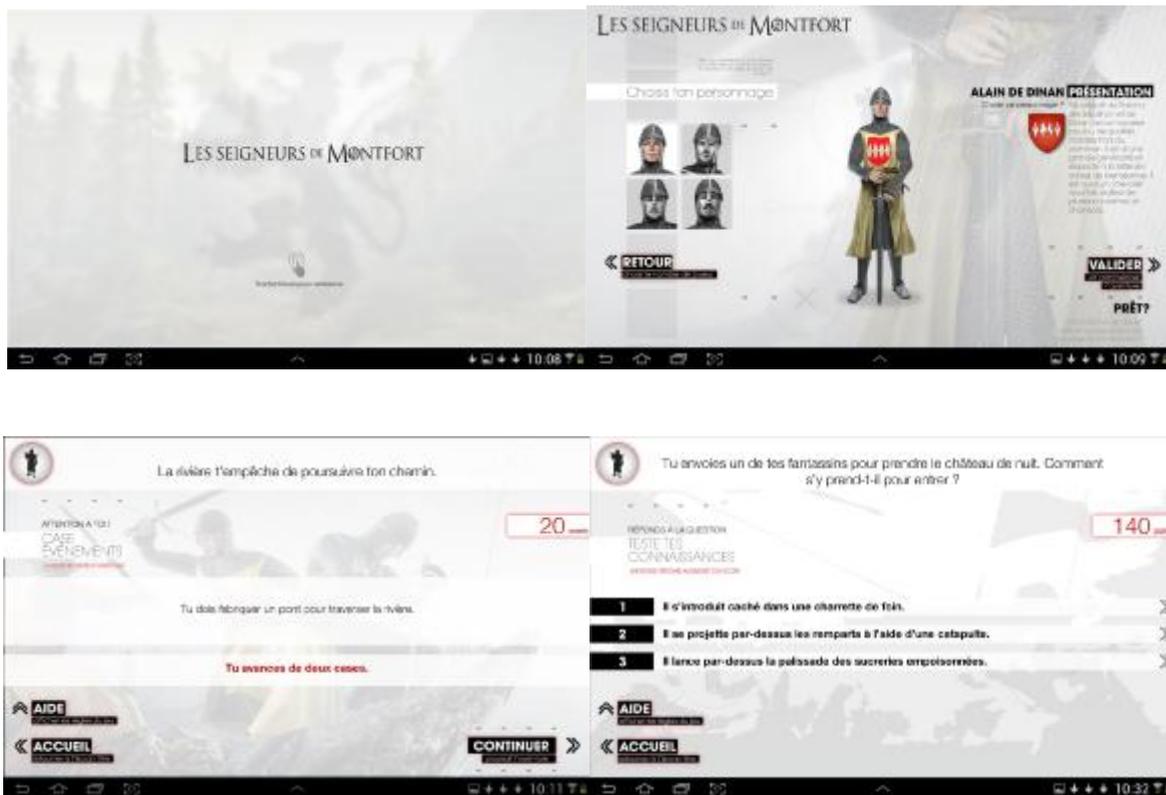


Figure 1: Example of 2D screens of the Lords of Montfort demo app.

## Dedicated hybrid data acquisition

An initial test shoot for data acquisition was performed in June 2012, followed by a full capture session in February 2013. These took place in a BBC TV studio in London, equipped with 14 HD video cameras for video-based 3D model and animation capture, plus a 17-camera Vicon marker-based motion capture system from OMG to provide animation data for ground truth testing and for props such as swords. The capture system was described in Deliverable D2.1 (project internal). Some photos of the system in use are shown in Figure 2 below. The cyclorama background appears grey, but is actually covered in a retro-reflective material. The HD video capture cameras can be seen with blue LED rings around them, so that they see the background as bright blue. This method of producing a chroma-key background avoids the problem of blue spill reflecting from the cloth when the actors are close to it, which can happen with traditional blue cloth. The motion capture cameras are smaller than the HD video cameras and are mounted above them. They are fitted with infrared LED rings. Retro-reflective markers are fitted to the sword and to the actor; these are much more reflective than the cyclorama cloth and can easily be detected by the motion capture cameras.



Figure 2: The capture system being used for acquiring images and motion capture data

The sequences of actor motion captured by OMG were used as guides by animators when animating the digital characters modelled by Artefacto. Artefacto also performed some additional motion capture to complete the dataset built during the first test shoot. These animated characters, produced using conventional techniques, were for use both in the initial version of the game, and also for use in future work in the project when comparing the quality of new video-based animated characters with those produced using a conventional approach to modelling and animation.



Figure 3: The main character animated based on MoCap data.

### 3D Modelling

Artefacto collaborated with historians to design the game's scenario and also to ensure that the modelling of the accessories (weapons, tools, tents etc.) used by the players remained as faithful as possible to reality. One of the complexities was to translate the idea of what something would have looked like based on historical drawings or documents into a 3D model. Drawings and (unexpectedly) movies, such as Ridley Scott's *Robin Hood* (2010) were a real source of inspiration for accurate modelling.

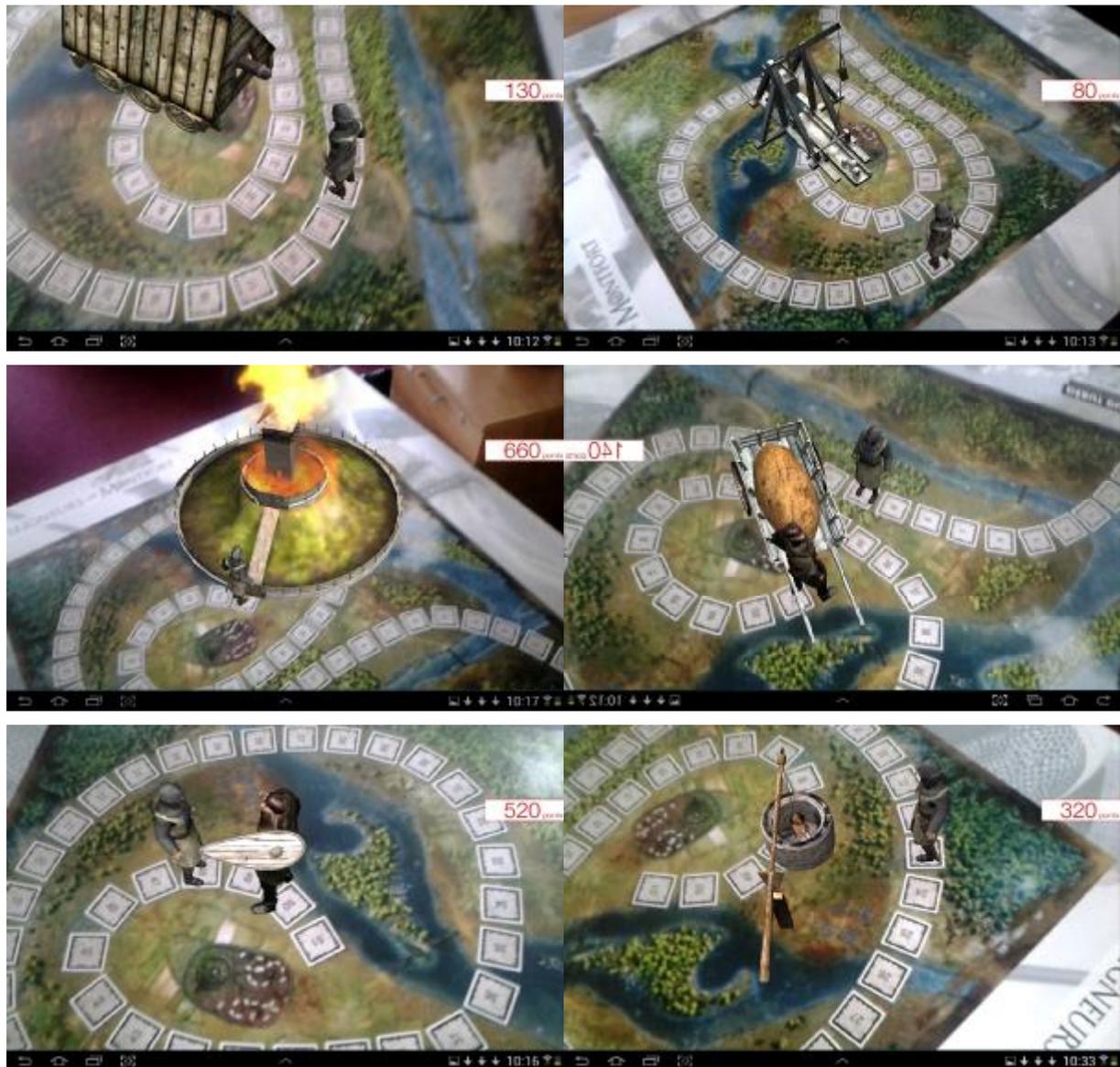


Figure 4: Models created from drawings and inspired by movies.

## Embedded technologies

In this first demonstrator, we have simplified the global graph of the game. In fact, we have built upon a rather linear story, where something happens depending on the status of the game and on the position of the character on the squares. Hence, depending on the progression of the characters, and depending on the score of the player, the story moves in one or other direction. This stops the game becoming repetitive. A die is also used to integrate more randomness in the game.

This first demonstrator raised a real issue regarding the ease of play using augmented reality. There is a compromise to be found between allowing players to zoom on a particular character or action and being able to have a full overview of the board when playing. Therefore two tracking approaches have been integrated into the game to allow for a smooth transition between the full board view and a zoom onto a particular square for a closer view of the action.

### 3 First 3D reconstruction on mobile platform

In the weeks running up to the demonstration, BBC, INRIA and University of Surrey provided the first temporally coherent 3D reconstructions from the second test shoot held in February 2013 at BBC.

Artefacto has started exploring ways to play those sequences on a mobile platform. One of the major complexities is that it is not possible to pre-load the data. This is because the amount of data to be preloaded is extremely high and the number of cameras used to perform the 3D reconstruction multiplies the number of textures per mesh when using Free View Point rendering. Therefore as a compromise the texture for each mesh for each time frame is pre-calculated. The generated texture is a 512x512 image for each time frame. The technique used to create those textures is a blending of all the textures coming from the different cameras with weights applied according to the best camera for a given vertex on the mesh. This approach has been provided by University of Surrey.

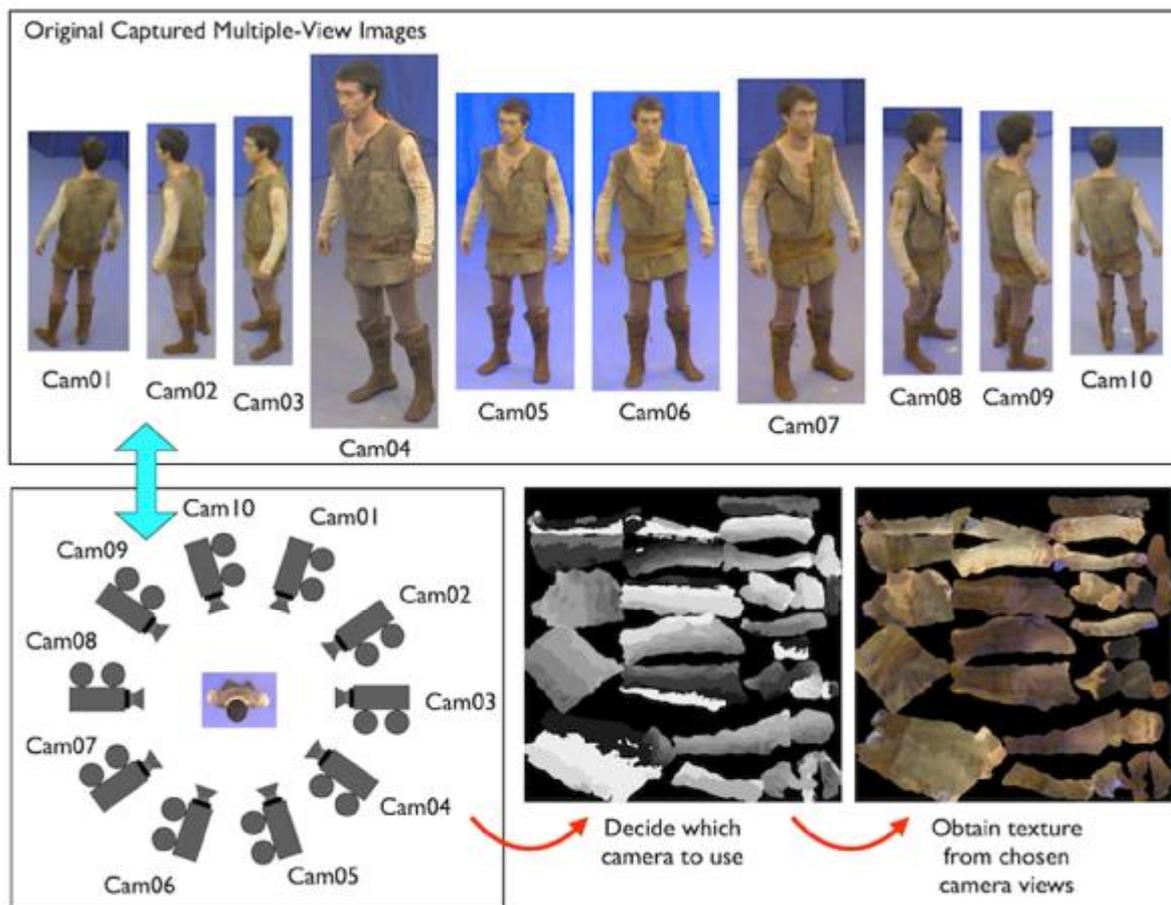


Figure 5: Overview of the process to create a single texture from multiple camera views.

All data can be preloaded on the hard drive of the mobile platform and then loaded in real-time into video memory.



Figure 6: 3D-reconstructed infantryman on the Broceliande board.



Figure 7: 3D reconstructed infantryman jumping.

## 4 First dissemination event

The demonstrator was shown at Mirage 2013 held in Berlin on June 6-7, 2013. Mirage is an international conference with focus on Computer Vision / Computer Graphics collaboration techniques. It was the 6th in a series of successful events having the objective of bringing together scientists and other people interested in the interdisciplinary fields of vision and graphics, with special emphasis on the link between the converging disciplines. With recent developments in 3D sensor and camera technologies, mobile computing, and GPU processing, many novel applications emerge in areas like multimedia, augmented reality, media production, gaming, and medicine.

The event was a real success with approximately 40 people attending the conference and even more attending the demonstration sessions. There were 6 demos providing experiences in different fields such 3D stereoscopic displays and cameras, audio immersion, Augmented Reality, 3D acquisition with a set of Kinects, etc.

The RE@CT demonstrations consisted of animated characters created with RE@CT technologies, and the augmented reality game demonstrating RE@CT-created content alongside traditional computer graphics content. Key researchers from the RE@CT consortium were available for Q&A.

The demonstrations went very well, with just about all attendees at the event viewing the demonstrator. The board game demonstrator drew a lot of interest; in addition to the version with traditionally-modelled characters, we showed a preliminary version with an infantryman captured during the second test shoot in February 2013. The interactive animation blending software was also demonstrated, and a video was played showing facial animation and some 'behind the scenes' background information from the second test shoot. Two posters gave a summary of the aims and achievements of the project.



Figure 8: RE@CT demonstrations at Mirage2013.

## 5 Conclusion

The first demonstrator from the RE@CT project, in the form of an augmented reality game incorporating a character modelled using technology developed within the project, was successfully shown in public at the Mirage conference. Other demos and videos explaining the underlying technology and showing the test shoot were also shown. The augmented reality game itself has also been shown to members of the general public at the Museum of Montfort, near Rennes in France.

Further improvements to the demonstrator are currently being made, and will be shown at BBC R&D's stand at IBC2013, Amsterdam, in September.