D6.5 AGENT BEHAVIOURAL SYNTHESIS DEMONSTRATION

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1 EXECUTIVE SUMMARY

The work demonstrated in this deliverable covers the generation of body animation for the digital agent. An intermediate agent asset was built, which was used during the development process whilst Framestore built the high resolution agent. This also provides an alternative, less computationally expensive agent for use within the wider project. A body animation pipeline was developed to process training data captured for animation generation research. Systems were then built to create animation for the agent's gaze, gestures and locomotion from higher level input cues from other modules in the reference implementation. These are presented as video demonstrations in the Unreal Engine project reference implementation and UE5 using MetaHuman characters.

You can find the video demonstration here:

https://epicgames.box.com/s/ts9nkp6bo7j70gl7g38s08t2aum9lc3s

2 BACKGROUND

This deliverable is a demonstration of the work described mainly in D3.6 Body animation Visual Synthesis, focusing on the interaction with the wider system in Unreal Engine. The methods described here will be refined and applied in WP8T4 Prototype Evaluations and WP9T3 Agent Demonstration.

3 BODY ANIMATION DEMONSTRATION

The main objective of this deliverable is to show the body animation system operating in context and show how the motion generation component interacts with the rest of the system. The demonstrations here are shown in the Unreal Engine 4.27 project reference implementation as well as Unreal Engine 5. Since UE5 is likely to become the industry standard, we decided to develop for both platforms.

In order to ensure that we are able to support a diverse range of characters, the animation systems were built around the Unreal Engine MetaHuman control rig. This means that the animation produced is natively compatible with all MetaHumans, as shown in some of the UE5 examples.

The demonstrations are presented in the attached video and are described below.

3.1. Intermediate Agent

This clip shows the intermediate agent in the UE4.27 reference implementation for the project. The animation here is from the broadcast use case.

The intermediate agent has been developed as a lightweight alternative to the high resolution agent produced by Framestore. The lightweight body rig was produced using the newly released in-house tools of the UE MetaHuman technology. MetaHuman is a tool created by Epic Games that will empower the user to create a bespoke photorealistic digital human, fully rigged and complete with hair and clothing. The switch to using MetaHuman technology enables the creation

of a generic skeleton and a corresponding mesh using auto rigging methods which empower PRESENT with several advantages. The benefits of MetaHuman include greater character diversity, cross-platform adaptability, wider applications and use cases and the possibility of continuous expansion as the tool advances.

3.2. Body Solve

This clip shows the body solve for a ROM sequence of the actor. This is solved by first fitting the MetaHuman skeleton to the input sequence to match the dimensions of the actor. This model is then optimised to fit the input motion capture data and create an animated body result on the MetaHuman control rig.

3.3. BML Interface

This clip shows the implementation of the BML (behaviour markup language) interface to pass instructions to the agent, with head nodding and shaking as example gestures being triggered using this mechanism.

A separate BML Realiser Component was created in the reference implementation to handle BML parsing. This avoids having to implement a parser in the Motion Generation Component and separates the logic required to deal with arbitrary multiple cues coming from the wider system from the motion generation itself. The BML Realiser Component is then able to directly call input methods of the Motion Generation Component.

3.4. Gestures - Head

This clip shows the head nodding and shaking gestures activated in the reference implementation. This is mainly intended to show the mechanism for activating gestures via the BML interface. An expanded set of gesture animations from the body motion capture sessions will be added to the project.

3.5. Gestures - Aiming

This clip shows the mechanism for generating different aiming gestures. New gestures are created using a simple algorithm to blend in joint offsets over an animated sequence. Using a small training set, a new gesture is synthesised to aim at a different target point in space specified by preceding components within the system. This target point is the input to the motion generation component, which then generates the appropriate animation. The gold spheres in the clip represent the targets of the pointing gestures captured during the motion capture sessions. The blue spheres represent examples of new target points with corresponding gesture animations generated using this method.

3.6. Dance Cards

This clip shows some examples of the training data set captured to provide training data for the locomotion system. There are 49 dance cards in total, covering a range of body movements including walking, running and turning.

3.7. Locomotion

This clip shows the locomotion system driving the agent's movement. Given a target position and orientation for the actor, the locomotion system generates a suitable motion trajectory and corresponding body control rig animation data to carry out the required movement.

This system is based on motion matching, where a set of training body animation sequences is used as a sample set of plausible motion segments. These segments are assembled by the algorithm to form the animation moving the agent to the target position and orientation.

3.8. UE Reference Implementation Gaze

This clip shows the system driving the gaze of the agent to look at a specified target, represented as a sphere for demonstration purposes. The gaze management has been implemented using a procedural framework similar to the Advanced Locomotion System (ALS). This is implemented as a Blueprint in Unreal Engine, which is computationally efficient and blends well with other animation sources.

The system is based around a set of poses of the character at various gaze positions. These poses consist of eyes, head, neck and body movement to simulate realistic behaviour, where the further the gaze is from the orientation of the character, the more the neck and body are twisted to look at the target.

3.9. UE5 Gaze

This clip shows the gaze system working in UE5 and driving a MetaHuman character. The system has been developed to be compatible with MetaHumans, which allows a much more diverse set of agents to be used. It is also desirable to support compatibility with UE5, as this will replace UE4 as time goes on.

4 CONCLUSION

This deliverable shows that we have successfully implemented all of the components required to animate the body of the digital agent. A lightweight agent asset has been created and a training set of animation data processed using the body animation pipeline we have developed for the project. The body animation pipeline shows improved results compared to the previous Vicon Shogun-based approach and has been used to produce an extensive body animation data set.

Generative methods for locomotion, gaze management and gestures have been implemented. The locomotion system is based on the data set captured for the project and focuses on improving subtle movements suitable for the project use cases. The gaze system has been designed to allow targeting at a specific point in space, which is important for eye contact with users and camera

positions. There is scope to improve this by combining with motion capture data. The gesture system will also be expanded to include a wider set of gestures to support different use cases.

The integration work with the UE reference implementation led to the creation of a flexible BML realiser component, which handles the passing of high level cues from other parts of the system to the motion generation component. Each of the main animation systems has been integrated with the motion generation component. Work will continue on these components to support project use cases.

Further work has been done to integrate the body animation systems with UE5. This will be beneficial to the exploitation of the project as UE5 becomes more widely used and will allow the system to use some of the improved capabilities in the engine itself. The decision to base the whole animation system on the MetaHuman control rig significantly expands the scope to use the project for anyone who has access to those characters and allows us to drive a much more diverse range of characters.

5 ACRONYMS AND ABBREVIATIONS

Mo-Cap	Motion Capture
UE	Unreal Engine
BML	Behaviour Markup Language
FK	Forward Kinematics
IK	Inverse Kinematics