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Character Animation at the Grupo de Modelado y Realidad Virtual

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1. Presentation of the Research Group

The GMRV (Grupo de Modelado y Realidad Virtual [GMR]) was founded 4 years ago at the Rey Juan Carlos University (URJC), in Madrid, Spain. The university is itself recent as it was founded in 1997 only. The group is composed of 8 instructors or assistant professors, 4 associate professors, and Prof. Luis Pastor, head of both the department and the group. In addition, 8 people are employed as full-time researchers or PhD students, 4 people teach part-time, and the administration is taken care of by 3 research managers and administrative staff.

Even though both the GMRV and the URJC have been very recently opened, it has been possible to gather a noteworthy infrastructure, including a CAVE in our VR lab. This equipment has been obtained through competitive grants and projects and applied R&D for private companies. One of such programs is INSIGHT-MIST that involves the development of an arthroscopy surgical simulator. Additionally, GMRV coordinates Madrid's working group in Virtual Reality within the GATARVISA research network.

Regarding teaching, the GMRV group is involved in basic Computer Science and Computer Graphics courses at both undergraduate and graduate levels. Last year a Master on Computer Graphics, Games and Virtual Reality was launched within the new European framework for graduate studies.

Over the last 4 years, the research of the group has mainly focused on surgical simulators, haptics, physically based simulations and search by content in video. This year, Caroline Larboulette joined the group and started research on character animation together with Juan Ramos, PhD student.

2. Lines of Research involving Character Animation

Modeling of characters for animation

The idea behind this project is to create a usable 3*D* model of a character from traditional character's sheet for movie production. A typical character's sheet shows the silhouette of the character in more or less 3 different views: front, side and back. The aim of the project is to first inflate a polygonal model from the drawings. The second step concerns the skeletonization of the polygonal model to obtain a suitable animation skeleton (and skinning weights) (see figure 1). The final step will be to derive 3*D* poses of the character to match the key poses provided in the character's sheet. The model automatically created can then be modified/refined/textured by artists to create the final character and/or directly be used to sketch a scenario.

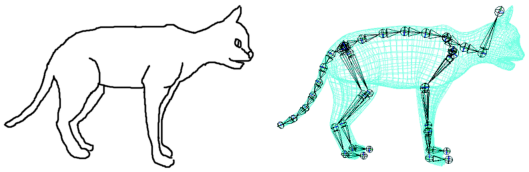

Figure 1: *An example of a 2D drawing and the corresponding 3D mesh and animation skeleton. Note that we could not provide actual images of the real drawings we are working on because of non-disclosure agreements.*

Real-time animation for video games and VEs

Previous work has been published by the authors on real-time character animation (see figures 2 and 3). The key idea was to provide tools to enhance real-time animations, in order the animation to be more believable. To further improve the quality and speed of the previously developed algorithms, we are currently integrating the dynamic skinning [LCA05] and automatic dynamic wrinkles generation [LC04] algorithms to the Interactive 3*D* and Virtual Reality Software from EON Reality Inc. [EON] that we use in our CAVE.

Animation of anatomically based characters on GPU

Anatomically based modeling has been widely investigated

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Figure 2: *A few examples of the results obtained through the use of the wrinkling algorithm presented in [LC04].*

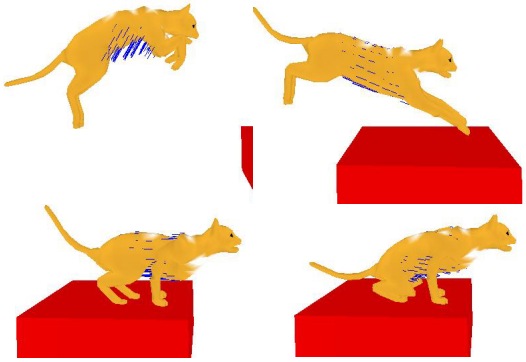

Figure 3: *An example of a cat where dynamic skinning [LC04] is used to animate the belly in a jumping movement.*

about 15 years ago, but the models proposed at that time were hardly usable. The reason for this is that those techniques suffer two problems: the modeling is quite tedious and the computation times during animation are too long to make it a practical solution for video games. While some techniques have proposed ways to create more or less accurate anatomic models of characters, we on the other hand decided to tackle the problem of the animation of such models in real-time by using a GPU-based pipeline. In our approach, the characters are first modeled and skinned offline in the traditional way. Then, we add a layer of parametric muscles, each of them having different parameters. The character is animated in real-time, taking into account the deformation of the skin that results from the deformation of the underlying muscles. Dynamic effects due to inertia or gravity are also considered in our implementation. An example of an arm and a few muscles can be seen on figure 4.

3. Projects

Mozart virtual

In addition to pure research, we also participate to the European project *Mozart Virtual*. The aim of the project is to recreate the past world of Mozart and Martin y Soler (see figure 5), two opera composers whose lives crossed across cities all over Europe. By collaborating with artists, musicians and historians, we are recreating various cities including Vienna, Madrid and London for our CAVE. In addition, we are integrating virtual characters (Mozart, Martin y Soler and opera actors) to create a more life-like environment, plus a few modern and ancient opera representations featuring an animated scenography and virtual actors.

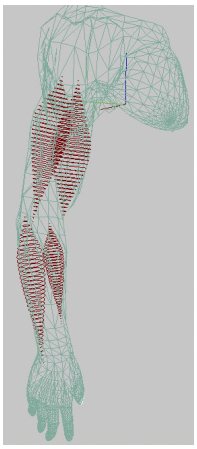

Figure 4: *An example of an arm of a character and a few muscles modeled by parametric surfaces.*

Figure 5: *On the left a representation of Martin y Soler; On the right, a portrait of Mozart.*

References

[EON] Eon reality inc. http://www.eonreality.com.

[GMR] Grupo de modelado y realidad virtual. http://www.gmrv.es/.

[LC04] LARBOULETTE C., CANI M.-P.: Real-time dynamic wrinkles. In *Proceedings of Computer Graphics International'04* (June 2004), IEEE Computer Society Press, pp. 522–525.

[LCA05] LARBOULETTE C., CANI M.-P., ARNALDI B.: Dynamic skinning: Adding real-time dynamic effects to an existing character animation. In *Spring Conference on Computer Graphics (SCCG)* (Budmerice Castle - Slovak Republic, May 2005), Juttler B., (Ed.), In cooperation with ACM SIGGRAPH and Eurographics, ACM Press.