Interdisciplinary Teaching of Computer Animation for Master's students

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Abstract

This position paper presents an interdisciplinary way of teaching Computer Animation for graduate students enrolled in a Master's degree of Computer Graphics, Video Games and Virtual Reality. The ideas proposed in the paper are being used for two lectures: Computer Animation and Character Animation. The content of each lecture fits the recommendations made respectively for the topics of Animation I *and* Animation II *at the Computer Graphics Education Workshop [BCFH06] that was held in Vienna in* 2006*. While those lectures are intended for a Computer Science degree, they also aim at teaching some artistic and software use aspects. In the advanced animation class, students learn how to create a character animation from scratch, thus dealing with the entire graphics pipeline like in a real work environment.*

Categories and Subject Descriptors (according to ACM CCS): I.3.7 [Computer Graphics]: Three-Dimensional Graphics and Realism: Animation; K.3.2 [Computers and Education]: Computer and Information Science Education: Curriculum, Computer Science Education.

1. Introduction

Computer Graphics is a field that keeps evolving fast. As a consequence, the content of graduate Computer Graphics lectures needs to be regularly adapted. Nowadays, to be successful as a researcher or an engineer, one must have skills in different areas. In addition to standard scientific skills, it is highly desirable to possess knowledge on artistic aspects. However, teaching of Computer Graphics in general and Computer Animation in particular is still strongly separated between those two types of skills. On one hand, we find the Computer Science degrees that involve programming, math and physics. On the other hand, we find the Art degrees more focused on how to create meaningful animation movies by using modeling and animation software such as Maya [May09].

This hard separation is however not beneficial to the students. For example, a student in a Computer Science degree might be frustrated if he/she knows how to deform an object using equations but is unable to first create a 3*D* object to which to apply the deformation algorithm. It is also common that an artist needs to write or use a script for the software he/she is working with and the task is more difficult if that person doesn't know anything to programming. Furthermore, it is important for team work that engineers and artists understand the work of one another. They need to collaborate and communication among them can be greatly improved if they know more about the work of the other. We thus believe it is important to teach students in an interdisciplinary way.

2. Context

We teach Computer Animation for students enrolled in a Computer Science Master's degree. While some of them will pursue a career in academic research, most of them will go work into companies of 3*D* animation, special effects or video games. We have thus decided to teach the use of modeling and animation tools in the basic animation class, and the entire graphics pipeline of character animation in the advanced class.

The teaching is divided into two equal parts: a theory part where the students learn algorithms and techniques; and a practical part where they learn how to create a short animation movie using existing software. We have chosen Autodesk Maya [May09] as it is widely used in industry for both, games and movies as well as by many researchers. During class we show how to use the software to apply a specific technique onto an object. Students are expected to

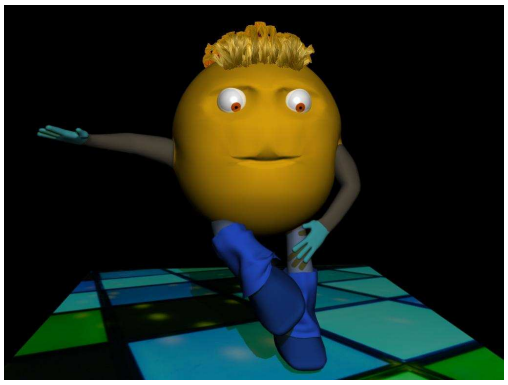

Figure 1: *The* Orange Dancer, *created by Pablo Quesada Barriuso for the Fall08 Character Animation lecture, contains all of the layers seen in class: a skeleton with IK handles, a skin binded with a smooth skinning technique and weights painted by hand, muscles in the arms and legs, dynamic nCloth for the leg warmers, static hair and facial animation using blendshapes.*

practice at home. Small exercises are proposed as homework assignments to manipulate the tools and they are given the possibility to work on a complete short movie, alone or in a team, as a semester project. It is however not imposed as some of them are more interested in research and implementation.

To be able to achieve good results, it is necessary to give the students freedom regarding the semester project. They are responsible for choosing the topic they are more interested in. In case they decide to work on a movie, they are required to create a meaningful animation that tells a story. Because there are as many different projects as there are students, they need individual support from the teacher. Thankfully, most problems can be addressed through email. However, last semester, we also organized an optional class towards the project deadline where the students came with their laptops and shared individual problems. This proved very successful.

3. Interdisciplinary Teaching

In the first class, Computer Animation, we teach modeling and basic animation techniques [Lar09]. For each standard modeling and basic deformation technique, we explain, in the theory part of the class, how it is computed with math and physics, and how it could be programmed. Most of these techniques are tools in Maya. We thus use the software to illustrate the concepts and show how to use it at the same time. This way, the students learn how to apply various tools to create or animate objects without needing to re-implement all basic techniques. Examples are loft / extrude for modeling, and bend / twist / taper or Free Form Deformations for animation.

In the second lecture, Character Animation, we present the whole pipeline of the creation and animation of a character. We see how to model the shape, the skeleton and animation techniques for skeleton, skin, muscles, hair, cloth and face. While in the theory part of the class we see how to solve, for example, an Inverse Kinematics chain, we see, using Maya, how to put such a chain on a skeleton. Because the students have learned how the IKs are solved, they can then easily understand why it is necessary to adjust the *pole vectors* to successfully solve IK chains in Maya. Not only do they learn how to use the software, but by understanding it better, they can achieve better results when using it to animate their character. Another example is the smooth skinning technique. While the technique is mathematically simple, it is however tedious to use in the real-world on a given character. Skinning weights need to be painted by hand as there is no satisfactory automatic technique to date. In addition, almost any modification to any layer of the character model implies the total re-painting of those weights: adding blendshapes for facial animation, a bone to the skeleton or some muscles. In production environments, this is a task that is repeated six times on average. This is also what did the students who seriously worked on their characters. Figure 1 shows the character produced by Pablo Quesada Barriuso during the Character Animation class of Fall08.

4. Conclusion

By using commercial tools widely used in industry, we are able to illustrate better sometimes abstract concepts presented in class. In addition, the students learn how to manipulate tools they will be in touch with during their career: either because they will need to develop code for the tools directly, or because they will have to work together with artists.

While the first class teaches basic independent techniques, the second class teaches the entire pipeline of character animation. Students are thus confronted to real life problems as they need to address all stages of the production from modeling to animation to rendering to post-production. While each part is worked on by different artists in industry, it is good, for a programmer, to have an overview of the entire process. In addition to being better prepared to the industry they also get to achieve meaningful results by producing short, but complete, animation movies, which is very self-satisfying.

References

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