Capstone Design Class in Animation

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ABSTRACT — The objective of this paper is to describe an experimental upper-level 3D animation course that was designed to expose a student team to the creative, technical, and problem-solving processes involved in integrating animated 3D graphics, audio and video into a 60-second commercial for an outside client. The paper will present the rationale for the class, the class plan, and what actually transpired during the semester. It will also present the lessons learned and give some insight into the positive and negative aspects of offering such a class.

I. INTRODUCTION

The class was presented to the students as their first job out of college where deadlines had to be met and where students would want to work at the peak of their abilities. The main goal of the class was to work on a real-world project with real-world complications and problems. Since the project had not been sanitized, tutorialized, or otherwise cleaned up to provide a clear-cut learning experience, the students would have to work their way through problems that had fuzzy solutions at best. The class would make its own decisions on style, workload, and, to some extext, quality levels. The class made use of many of the skills covered in the curriculum, and quite a few that were not.

II. REASONS FOR THE CLASS

There are two larger reasons for proposing this class. The first was that instead of students exclusively learning processes and technique, they needed the opportunity to put their skills into action. We cover techniques for the different specialties in modeling and animation in various classes, and try to reinforce them with projects. But we didn't have any curricular opportunity for a student group to put it all together to produce a product.

The second was a matter of appearances. Competing against larger, better funded, programs the faculty felt that this would add stronger material for the departmental portfolio than what could be added through class projects.

III. PLAN FOR THE CLASS

As students advance through the curriculum, they gain skills and knowledge through the carefully planned experiences in the classroom. And as animation technologies advance and diversify, it's important that students have experience in integrating the many technical niche specialties required in a project under real-world conditions. While students may be adept at the work in a controlled environment, actual design and animation projects frequently pose problems that aren't easily solved. Students need to gain experience:

- in an environment that simulates the pressures of the student's first job;
- working as a self-motivated and self-policing team;
- encountering and working through problems, some with no real technology-based solution;
- working with real, not teacher-mandated, deadlines;
- working with a client that is not in the business, and doesn't understand the technical nature of what they are trying to produce;
- producing a professional grade product on their own.

The goal was to have the class act as the students' first job out of college. I wanted to have the students work at their best level so that they would impress their first employer (in this case: me). In other words, don't put off really doing a good job until you're getting paid; try it out now and see how it goes.

Another goal for the class was to have them work as a self-motivated and self-policing team. Rather than placing pressure on the students to perform for me, I wanted them to be pressured by their peers to not let the team down.

The work burden was not intended to be distributed evenly in the class. Depending on what particular skills were required, students were responsible for greater or lesser amounts of work based upon their skills and interests. For the most part, people were able to choose their areas in which to work so they were at least in familiar territory when the work hit. I did put some of the students on particular aspects of the work based upon what I knew to be their interests, and on their past work in

different classes. In some cases students worked in areas where they had little previous experience, but a desire to gain some.

The grading policy was designed to mimic real life as much as possible. Students were allowed one missed deadline out of the understanding that life gets busy with competing priorities and school doesn't always come first. But when they miss a second deadline, they are thanked for their help, given and F, and are off the project for the remainder of the semester. Meeting a deadline did not mean that perfection was required. Their best effort was required. Bringing in D or C level work was considered missing a deadline, whereas B and A level work was considered meeting the deadline.

My role in the class was to be as a production manager. I wouldn't be lecturing or preparing lessons or presenting material, but would be managing the production to ensure that we met deadlines. I would also be the quality control officer and would ultimately decide when something was "good enough." Having had a fair amount of experience as a production manager, I envisioned that this would be a fairly light load on my semester.

Naturally, the reality of the class was only coincidentally related to the plan.

IV. CLASS AS IT ACTUALLY HAPPENED

First off, this class was, far and away, the most stressful and time draining class I've ever had. While there wasn't the obligation to prepare class materials, there was a lot of work in managing the production. There was also the stress of wanting the semester be a success with a completed project we could all be proud of.

I did find an excellent client in our college sports media relations group (Buc Sports Media Relations, ETSU being the Buccaneers). They have a weekly

coach's show that is broadcast locally and several sports related groups that they advertise for. They were excellent for several reasons:

- they needed the work done;
- they had some experience in audio/video but weren't digital media savvy;
- they were part of the campus and were used to dealing with students;
- the class project would actually get air time on their show;
- there was no money involved;
- and, probably most importantly, the client was excellent to work with on a personal level with both me and the students.

I brought the client to one of the first classes where he explained his needs and requirements. We went over his target audience, his message, what source material he had, and the specific items that needed to be included. Since some of the idea behind the class was for it to simulate the student's first job, meeting basics such as taking notes, remembering names, etc. were part of the curriculum.

After the initial meeting the class went through several weeks of brainstorming. I think this was one of the more successful parts of the class since the students were trying to sell each other on their ideas. It was challenging for them to put creative, half thought out ideas into words to convey the idea and why the felt it was a strong idea. I think they were also good brainstorming sessions in that no ideas were considered bad ideas, everyone definitely fed off of other's concepts, and it was fun all around. At the end of each class I'd try and summarize what we as a group were thinking, eliminate some of the ideas that had clearly gained no traction in the class, and gradually focus on the remaining concepts for refinement.

At the end of several weeks I had the client return and we pitched the four ideas that we felt were our best. I believe one was thrown out for political/regulation reasons, but the client was happy with the rest, and clearly preferred one of them.

The Concept. The commercial was for the Buc Sports group whose tag line was "Join the Team That Builds the Future." In general terms the concept for the commercial was that a freshman comes to campus and sees a poster for a runner from the 1958 running championship team. The student turns around to discover that the runner is suddenly standing behind her (now no longer in the poster) and beckoning her to follow. They start off on a cross-campus chase encountering different things from the future 'till the end when they see the vision for the future with the tag line. The overall idea being that the people from the past help people from the present find the future.

Pre-production. We spend the remainder of the first half of the semester on preproduction. This included sketches of the different 3d objects from the future and a set of storyboards for the actual shots in the commercial. The concept sketches were very straightforward and we could move from there into modeling quickly since that was something the students had worked at in several other classes.

We also scouted out sites on campus to use for shots in the video. The students took still photos of different spots from different angles that were potential locations to shoot from. This was extremely helpful when we worked on the storyboards in class.

Most of the skills present in the class were computer-based and technical in nature (modeling, tracking, animation, scripting) with some art and design skills (2D design, color theory, composition). Planning out different shots and angles for the video

was challenging for the class since it wasn't something they had done before, especially as a group. Over a period of several classes we worked up storyboards for all the proposed shots knowing that many of them would be cut and not used in the final result.

During one class we shot test footage for each shot in our storyboards with two students standing in as the actors. We broke into two groups in order to cover the different shots along with some others that presented themselves. We covered all of our storyboards and also learned that most digital media majors are not suited for repeatedly running across campus on cue.

We edited these together to form a rough animatic of the final commercial. This was the most helpful planning device since a number of issues presented themselves at this point. The biggest issue was that we were aiming for a 30-second spot but we couldn't edit the footage down to a 30 and still tell the story we needed to tell. I believe that this was because (1) telling a complicated story in 30 seconds is a difficult thing to do, and (2) none of us were editors by training. We could use the software and press the correct buttons easily enough, but we didn't have the editing experience to make knowledgeable choices that would get us where we wanted to go. I wanted a 30 just based on the total number of finished frames we would have to deliver, but we ended up with a 60. The class didn't realize the impact of this until the very end of the semester when we were crunching to get the thing finished.

Making the rough version of the commercial was also the best planning, organizational, creative decision-making tool of the semester. It allowed us to number every shot, assign people for each shot, ignore all the likely distractions of "what if" and "maybe we should," and to focus on only what was actually needed. It allowed us to make informed creative decisions with consent of the whole class. It was the structure around which we built our file-naming convention, and our task assignments.

It also helped us later during the actual video shoot. As it turned out, we only had the two actors for one day. Normally this would be almost impossible to shoot given that we had over 30 shots all over campus, but we were so prepared from doing the animatic and so knowledgeable about each shot that we were able to accommodate this requirement. The shoot happened at the mid point of the semester.

From that point we entered post-production, where most of the classes' talents lie.

Post Production. There were several points to the post production that went very well. One shot required a 3d motorcycle to pull up next to the runners and park with a real person riding it. We made approximately a half a dozen complete passes at just the motorcycle and integrating it into the scene, and two complete passes at adding the real rider. We had taken photographs of the location to use as reflection maps on the motorcycle, but it took a number of tries to get this to work out correctly. This shot was the most successful just because we were able to continuously work with it and refine it to make it better. It was what I was hoping for all the shots: that we would be able to make many passes at each one to correct mistakes and improve the overall final shot.

The deadlines in this class were quite firm. We had by the end of the semester to create a finished product. There was no way to take advantage of an administrative route to get more time, such as an incomplete, or retaking the class next semester. This was more of a project than a class with no chance to

do it over. My goal was to have a finished product by Thanksgiving, and be able to spend the remaining weeks making corrections and improvements to an already finished piece, but that didn't happen. The remaining weeks involved huge amounts of hours on the students' part and on my part with work being done around the clock. We had one all day session (6:30am –midnight) on a weekend to get everyone together and try and finalize everything. In this regard, the project followed the typical computer graphic work flow — a relaxed beginning and a crazy ending — that I was trying to avoid.

Most of the students were working with a client that wasn't in the business for the first time. In my experience these clients seem to be somewhere in the continuum between (1) those who think that since you are working on a computer everything is as simple as pushing the right button, and (2) those who think that anyone who can do anything on a computer is just a miracle worker. Fortunately, our client was slightly more towards the latter and this provided a positive first experience. While this worked out well and there were personal contacts made, I feel that the wrong client would have made this a miserable, let's never do this again, project.

There was a shared workload on some of the tedious tasks. One of the main characters in the commercial had an effect applied to him to show that he was from the past. This involved tracing him in every frame of the commercial. This completely tedious misery was shared equally among everyone in the class. This part, in particular, brought out the peer pressure. When a few students were dragging their feet, the rest of the students that had already paid their dues really got on them to live up to their end of the production. This was much more effective than anything I could do.

Naturally, as we worked through the post-production we encountered problems with no real technology-based solution.

V.   SPECIFIC PROBLEMS

Lens Distortion. One of our major hurdles was dealing with lens distortion. This is a common problem with common solutions when ever you are doing a camera match.

In a camera match, we are trying to create a computer-based camera that exactly matches the real-world camera used to video tape a particular scene. Cameras frequently have some amount of lens distortion giving the image a small amount of bulge (or a depression) in the middle of the image. This is usually unnoticed in video until you try to place some computer-generated objects into the scene. Then the perfectly straight lines of the computer generated image won't mesh or move correctly with the slightly bulged video image. This is typically handled by using different software tools to first remove the distortion. Then the computer-generated images are composited over the video. At this point the distortion correction is removed from the video so that it goes back to it's original state, and the opposite of the distortion correction is applied to the computer-generated images so that they acquire the correct distortion to match the video footage.

Yet the distortion in our case was unusual. The standard tools for removing lens distortion wouldn't completely remove the distortion. Typically the distortion is centered, but not in this case. Not only was it not centered it didn't appear to be symmetrical or of any intuitive pattern that we could discern. It wasn't lens distortion so much as just odd undulations in the finished video. It was very unnoticeable until you put some completely angular computer graphics over it. We tried various grid

deformations to get rid of the distortion, but without success. We did discover that 3D tracks seemed to compensate for this in that they looked better than the 2D tracks. This really makes no sense to me, but there was no disputing the results. The end result was that some of the tracks appear to be not quite dead-on. This is unnoticeable to the average viewer, I think, but to the class that was concentrating on this so much it was glaring.

Music. The music threatened to disturb the harmony, if you will, that we had for most of the semester. The commercial needed some type of non-copyrighted music in the background, and, like the other questions during the class, I turned it over for discussion. While students can dispassionately discuss modeling, animation, colors, and timing, discussion of music really brings personal tastes and prejudices to a boil. After a couple of classes without any remote chance at consensus, we choose 3 people to be the music committee. They were to go work this out and the rest of us would live with the results. (I have noticed this on other professional projects as well. The discussions on the graphics and animation are quite professional and objective. But when the music is discussed, professionalism and objectivity go out the window. People often confuse their personal tastes in music with what would be appropriate for the current project.)

2D or 3D. Our final shot sequence in the piece required camera tracking. We had a considerable discussion about whether it should be 2D or 3D camera tracking. The shot was incredibly difficult to track as it involved hand-held camera work with lots of vanishing tracker points. This had ramifications down the pipeline since a 2D track would mean inserting a matte painting in the back of the scene, and the 3D track would involve rendering a 3D

animation into the scene. The level of difficulty of the track meant that, in 2D or in 3D, there would have to be a lot of hand adjustment to make the track acceptable. Since we were working on this early enough we decided to do both and check the results for both. The results for both were in the "ok, but needs work" category. We ended up going with 2D simply because it was faster and easier to make alterations on the fly.

Frame Rate. It wasn't apparent till the very end that some of our students were using settings of 30 frames per second (non-drop frame), and some of our students were setting software at 29.97 frames per second (drop frame). I didn't notice this until the end when we came up 2 seconds short. I've never had this happen to me and was totally surprised by the missing 2 seconds. We added a quick logo treatment at the end in the 2 seconds. This wasn't really a big problem, as it was more of a surprise and a chance to learn.

Fields and Frames. I had been preaching to the class about working with fields of video rather than frames of video all semester and on previous semesters with some of the students in the compositing class. At the end, one of the shots as done with its fields reversed. I was considerably heartened when the class immediately recognized what the problem was.

VI.   LESSONS FOR NEXT TIME.

The end result of the class is a project where no one person likes the whole piece for one reason or another. In an effort to get the students to buy into the project, I let all the students have a voice on almost all of the decisions. As such, the final project is the result of a committee. I think there needs to be a better balance between student involvement and buy-in, and keeping the project integrity sharper so

that it doesn't get averaged-out or diluted by the committee process.

I would never do this with a paying client. It was totally stressful enough without money added to the mix. The students do student work; no matter how advanced, it was still student work. And they make student mistakes, sometimes average student mistakes, sometimes advanced student mistakes. While this is part of being in school (make your mistakes here instead of on the job), as the production manager on the project, it made it very difficult to schedule things since tasks frequently had to be done several times just to be correct rather than to be good. This threw off schedules and made planning a very touch-and-go operation. With money involved the expectations would be considerably higher as would the stress. Being in front of a client and being confident of meeting a schedule would be difficult.

The class was a very heavy load on my time. The students would reach a plateau or wall in their different tasks in the animation or compositing and, as good students should, they would approach me looking for assistance. Sometimes this was relatively simple, but frequently the issues took a lot of my time: the lens distortion and the compositing effects for example. In each case the students would be stymied at some point and I would try to work out several pipelines or procedures to get them past their obstruction to determine the best way forward. The problems were real problems and took me time to work out. When people come to you in your office hours for help on a class assignment, you know your way all around the current issue, especially as it's a class assignment, but in the production class on a real project, people were all working on different things and you weren't immediately up on what they had

done, or what they were attempting to do. I think this type of class will always be similarly demanding, but next time I can better prepared for that.

We dealt with tens of thousands of files on this project. We did set up a file naming convention and directory structures for the data that some people used and some didn't. In the end the convention and the directory structures had changed a bit over time by popular consensus. The way it ended up was considerably better than how it started. I think this is an area where time spent early on would be well worth it. Most of the panics throughout the semester were due to missing files, or incorrect versions of files. The next time this class is offered I plan to give this more attention up front.

VII.   CONCLUSIONS

The class was considered a success, and the project won a local Addy award for animation. In a stoke of good fortune, the sports program that the commercial was affiliated with was picked up by Fox College Sports Network so the commercial has been aired nationwide. The class has been continued and it's been broadened in scope to include all digital media (Digital Media Production) so that it could include pure animation, pure video, web, other interactive media, or any combination. I'm teaching it again this semester, and it's being added as a regular part of the class rotation.

I'm breaking the class up into smaller groups to work out different parts of the project rather than submitting everything to the whole group. I'm also making a few more (rather than none) decisions when there is a significant split in class opinion just to keep things moving. I'm definitely not going to be able to fix all the problems or eliminate the workload, but my goal is to try to reduce them by 50%.

From the students' perspective, a number of them have told me that they learned more from the experience that they had anywhere else in college. These were primarily the students upon whom the load fell most heavily. For some of the students that weren't utilized as much, it was nice for them to be associated with a successful project, but the learning experience wasn't that great. I don't know that there is any way around that; some projects will just lean on certain people and talents more than others based on the nature of the project.