Teaching Methodology for 3D Animation

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Abstract

The field of 3d animation has addressed design processes and work practices in the design disciplines for in recent years. There are good reasons for considering the development of systematic design processes for the development of 3d animation and it's teaching. Design methodology understood as a general field has developed through cross-disciplinary efforts, primarily involving architecture, engineering design and industrial design. This body of knowledge is not very well known in the development of 3 dimensional animation or computer graphics discipline, but appears to be highly relevant. In this paper, I introduce a number of systematic design methods for teaching and development of 3d animation. I hope that they will prove useful for teachers and professionals in computer graphics. Several methods that I present here are all mainly oriented towards early phases of the design process, where concepts and ideas are the main currencies. The later phases, including implementation and evaluation, are perhaps less problematic. My choice of methods is not meant to be comprehensive, perhaps not even the best possible. Instead I present examples of methods that can be tried out in a very simple ways without putting too much effort into the learning process.

It is every academic's dream that students can hold their place in the job market or in higher education. Furthermore, schools try their best to acquire equipment and human resources to help students excel. But there are many hurdles and constraints that have to be faced in an academic environment as compared to a production house.

The integration of computing, telecommunication, visualization and new interaction techniques will change and expand the paradigm of teacher-student interaction. The role of a teacher in this century will be different and will be based on traditional teaching techniques with technology and its implementation. The use of advanced visualization tools will play a major role in the teaching and learning process in design methodology by providing a new institutional environment. This institutional environment can be characterized as distributed, highly available, portable, dynamic and cooperative.

Muqeeem Khan developed digital graphics nearly fifteen years ago by working in BASIC language. This curiosity led first to the National College of Arts, Lahore Pakistan (NCA 1988), and then completion of Bachelor of Science and Masters of Arts in Industrial Design with emphasis on computer graphics from ACCAD Advanced Computing Center for the Arts and Design (1996) at Ohio State University, Columbus Ohio. Muqeeem produced the visual effects for movies like Deep Rising, George of the Jungle, Flubber, Armageddon and the newly released Final Fantasy. Currently he is an assistant professor of Digital Design at the American University of Sharjah, UAE, instructing in Computer Graphics.

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Design is a purposeful, systematic, and creative activity, whose aim is produced in limited or mass quantities to satisfy human needs and wants. In that highly active environment, computer visualization will play a very important role and will be an important domain of any teaching aspects of design. Furthermore, a teacher's role and potential in the development of computer visualization will be accelerated in the next century. We observe and see the development of a product in industrial design, in the corporate identity, several phases of spatial decision in the field of interior and architectural design. Similar to these phases, the boundary of design will expand to critically examine the influence of computer and informational visualization. If we are preparing designers for the next century, it would be our responsibility to expand and explore the design thinking and process for a digital visualization.

A carefully examined process or even disclosure of various processes in the field of computer visualization in classroom teaching will be an addition to the embodiment of design knowledge. This activity, or study will help and enhance the elements, academia, and the corporate world.
I created exercises based on design methodology that would separate ideation from the implementation process. This is important in any production related pipeline too. Regardless of required software and hardware capabilities, expectations were set in the beginning and were clear to both instructor and students. Consequently, at the end of the term both, educator and learners were satisfied with the result.

Time and money are two important elements in a production house. The important task for higher-level managers in any production house is to deal with the financial matters. Lower level managers mainly deal with project schedules. They are responsible for overseeing the completion of the job with maximum effort in a required time period.

These lower level managers/supervisors can be compared to instructors and educators in any institution responsible for teaching production related material. The following are some of the issues that they are very familiar with:
- Their own strengths and weaknesses.
- Capabilities of their production house.
- Strengths and weaknesses of their staff.
- An overall picture of the project schedule.
- The necessity to meet deadlines

A teacher in a institutional setting may change the above issues in the following manner:

- Instructor’s own strengths and weaknesses.
- Capabilities of the institution.
- Strengths and weaknesses of their students.
- An overall picture of the academic term
- The necessity for students to meet required deadlines.

By taking these issues with the production methodology on board, an instructor achieves quality work by the required deadline. This applies to teachers with or without production experiences. An instructor, who either has production experiences or not, can have these states of mind. Therefore, it is important to understand how production houses work with the highest capabilities. Almost every production house, one way or the other, uses very systematic, creative, and purposeful design methodology.
The whole process of bringing design methodology to classroom teaching with the emphasis on systematic design process is to compose cyclical design phases. This process is covered with an ongoing evaluation cycle, as can be seen in the diagram. Furthermore, the origin of this whole process is composed of the following:

a) Definition and analysis of concept statement.
b) Designer's background and experience.
c) Environmental influence.

All of these elements tend to proceed towards a thorough research activity, which then synthesize the major steps and decisions within the process. After such research students can easily understand a number of processes and their expected solutions. Good research leads the designer to a systematic design implementation process where creativity and intuition can be combined with all the other systematic design decisions.

Most of the time students are involved in the use of several computer packages available in an institutional facility. It is also important to minimize the gap between student development and technical production of computer animation. During the project development, I tried to find ways of adjoining student's personal design and technical background in order to simplify a complex process of production from concept development to final presentation of an animation.

1: Concept Design and Procedures

The animation that students completed had several sequential design and technical processes. The whole process of making this computer-generated film is a cyclical, creative, intuitive, and analytic process where inductive and deductive reasoning played an important role. The whole process can be subcategorized into several individual group processes as follows:

1.1: Early Sketches

The first step to start this process was to establish a concept statement for the project. A concept statement sets a goal to direct a student to a particular path. During this process several basic line drawings were created which were not very detailed. These drawings and statements are there to create a personal rapport between the student and his/her own creative thinking. The student’s personal experiences and background are important to elaborate and synthesize the creative process. These early sketches will be more purposeful, systematic and creative later in the design process. The main purpose at this stage is just to get a fresh and a meaningful idea for the animation.

Simple shapes within the stories

1.2: Linkage and Development of the Story

In this process of thinking and development, students tried to find a link between the concept statement and story development. As a designer they had to be very sensitive about the importance of a concept and its goal. The ability to think in three dimensions was important in terms of the development of ideas and translating visionary inputs into the design process. In the early stages it is important to consider who would be the audience for this design output.

In the creation of the story, one must clarify the possible hurdles that will be encountered during the implementation process. Most often the challenges were the appearance of objects, texture and lights. There are several issues the student needs to consider before the implementation process:

a) What software is available within the facility?
b) Previous problems related to the software
c) Capabilities of tools
d) Technical Support
e) Previous users
f) Availability of the software in the facility
g) What software libraries are accessible in the facility?
h) Data transfer from other programs and related problems

All of the above issues are relative to each other and dependent on the facility and software available during the design process.

1.3: Story in Segments and time

At this stage, a student should consider the rough duration of time for each of the events within the story. For example, how many seconds a particular scene or movement requires.
It is not very important to estimate a correct time at this stage, however it would be beneficial for future development.

If there is a talking character in the story, a student should estimate the time of its speech. Early detection of these elements will minimize the overall time it will take to complete the story.

1.4: Design Thinking and Evaluation

The Design process in the development of computer animation is also a cyclical process where research, ideation, implementation, and evaluation take place in a parallel fashion. It would be great if the student follows each one after another. In this cyclical process the first step is to complete valuable research related to the story and concept. Several data gathering techniques should be utilized in this process, like literature search, case study, observation, and previous related work. Even during the implementation process, evaluation plays an important role. Important issues related to the primary goal should be considered during the ideation and concept development process.

1.5: Finished Story Board

After completing all of the above stages, a clean and elaborated, but focused storyboard can be generated. Even at this stage, it is not extremely important to consider all the techniques of the development process. A storyboard can show a sequence of events and their linkage to each other. Right numbers of representation of events in the story can be presented in terms of clean and colorful images. A final storyboard can give a feeling of the final product. It can give an idea of space, time, color, camera angle and position. It can also show a rough feeling of camera movement to a particular direction.

The correct number of images should be represented in the storyboard to show an event or events during the particular time duration. The grouping and layout of images can also show a semantic relationship of the storyboard to the final product, the animation.

1.6: Animatics

"Animatics" is a combination of images, from a storyboard, and a time sequence with the possible addition of sound. After having good animatics, timing of major the parts, division within the parts, and transition among the parts can be examined. The minimization of time, sound implementation and synchronization can also be done in the animatics.

Any editing tool can be used in this very important part of the ideation process. Transition from one event to the next can be tested in this stage. Good animatics can also motivate the designer to peruse and implement more ideas in terms of design issues. This stage of ideation is also helpful for the evaluation of the whole process and story. It can raise several questions for the implementation process. Final animatics should result in the following elements:

- Timing of major parts i.e. A, B, C
- Division within A, B, C
- Transition among A, B, C

- Minimization of time
- Sound Implementation
- Sound synchronization

1.7: Character Studies

Character studies are the most important element for the development of any character animation. A character in the story is the representation of cultural, social, and psychological realities of living or non-living entities in animation. The very first attempt to tackle this problem is to actually video taped the possible actions and events. In that way the body gesture, the way a character move, and the character interaction within the space can be studied. Different joints and action should be videotaped to categorize and examine the behavior and psychology within the character’ personality. Camera angle and framing can be analyzed during this process. After good character movement is recorded on video, important events can be taken out into a file strip using any editing software to find the relationship between time and frames. These frame-captured-images can be utilized as a valuable resource in the production process.

1.8: Frame Studies

Using any editing software, a designer can easily generate action information and see the joints movement and position a certain instance of time. One should not need to see each frame by itself. It should be helpful to see every 15th or 30th frame. Again, all of this information is just for the reference and should help in the implementation process. The method that I thought would work is as follows:
1.9: Pose/Action Sheet

After getting stationary information about the actions, students decided to build their own Pose Sheet, in the cartoon industry known as an Action Sheet. A student can note all the possible sounds, its length and related information in this stage. In the Movement Rate column of the action sheet, the student should depict the rate of the movement. Some students developed their own percentage reading for the related action or movement. For example 95% corresponds to fast movement. All of the columns in the action sheet are controlled by the column “Frame.”. One sheet can show all of the above information in addition to the camera movement within fifty frames. The main purpose of making this action sheet was to synthesize the problem to the last stage so the data should be ready for the implementation stage.

2: Implementation of Data

The implementation of data in computer visualization, especially in character animation, is very similar to the traditional design process. Computer visualization is similar to the design stages. For example in design, a designer does the research, gathers all the related information and using creative and intuitive process, passes through the implementation stage. After these stages, the first stage of implementation is to create rough character animation. It is very similar to:

- Form study in Product Design,
- Rough layout in visual Communication Design,
- Spatial relationship within the field of Interior and architecture design.

Like in Product, Visual Communication, Interior Space and architectural design, it is the designer's responsibility to select the right tool for the completion of the project. The completion of computer visualization with the involvement of many software is also very similar to the design implementation process. There were two major factors to complete the process:

a) To reduce the amount of design error, redesign or delay.
b) To make possible a more imaginative and advanced design process.

We can categorize thinking and story development as a creative process and making animation as a systematic design process. Both of these processes are parts of systematic, creative, and purposeful design activities.

2: Implementation

The method is primarily a means of resolving a conflict that exists between logical analysis and creative thought. The difficulty is that the imagination does not work well unless it is free to alternate between all aspects of the problem, in any order, and at any time, whereas logical analysis breaks down if there is the slightest departure from a systematic step by step sequence. It follows that any design method must posses both kinds of thought to proceed one by one if any progress is to be made.

3: Systematic Design Process

I tried to establish a systematic design process in this particular design problem for students where a student deals with not only a creative thought process, but also handling of a number of advanced visualizations. The selection and research on the tools available in the facility was extremely important to complete the task in the early stages of animation development. For that reason, a systematic design process was essential to adopt. The Systematic Design in the development of computer visualization could be explained as:

1) To leave the student mind free to produce ideas and solutions at any time without confusing the process of analysis.

2) To provide a system of notation which records every item of design information outside the memory, keeping design requirements and solutions completely separate from each other. This means that when students move from problem analysis to solution seeking, they feel the need of the three distinct stages, analysis, synthesis, and evaluation.

The making of Computer Visualization with the elements of design and visual communication should be carefully examined. The identification of the task, elaboration and linkage of visual elements, transition from one visual incident to other, implementation of findings and the overall perceptive and cognitive representation of messages are all important to accomplish the required appropriate goal. A very important role and responsibility of a student is to carefully synthesize the possible problems within all the phases of the development of computer visualization.

Clips of student's animation can be seen at:
http://www.muqeem.com/teaching.html