Creating a Modern Classic Visual Effect

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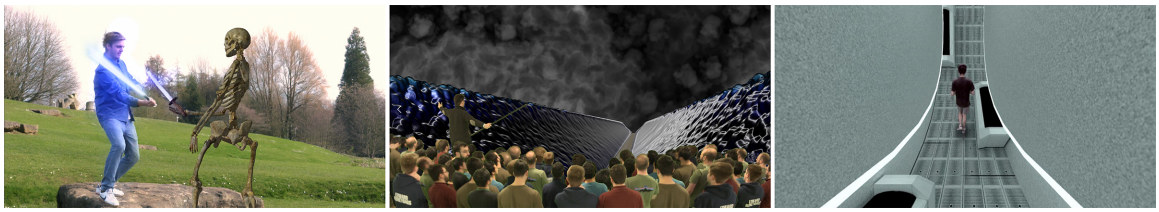

Figure 1: Examples of recreated classic VFX shots: (a)Jason and the Argonauts, (b)Ten Commandments, (c) 2001: Space Odyssey.

ABSTRACT

While much of the traditional terminology of visual effects survives, the role of computers has transformed the way in which filmmakers are able to realize their vision. To support these filmmakers, effects teams must understand both how visual effects have been created in the past and how to develop software to deliver them in the modern context. The assignment we present here is designed to be part of a computing programme that provides an opportunity for students to develop such software in a near realistic setting. We do this by asking the students to work in small groups to replicate a classic visual effect that was originally created in camera.

CCS CONCEPTS

• **Computing methodologies** → *Ray tracing*; *Image and video acquisition*;

KEYWORDS

Visual effects, production, rendering, vision, modeling, motion capture, teaching.

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1 CONTEXT

This assignment is the sole assessment of a course offered as an option within both a Masters and Doctor of Engineering programme in Digital Entertainment. Students taking this course are typically competent programmers. However, they are not expected to already be specialists in visual effects. They will have completed both computer animation and computer vision courses as part of the overall programme.

2 AIMS AND OBJECTIVES

This assignment aims to:

(1) To give students an understanding of modern visual effects pipelines and techniques. The ultimate focus is on how research in vision and graphics extends to advanced research and development in modern visual effects.
(2) To equip students with an understanding of some of the important core theories and concepts involved in modern visual effects production. This includes: compositing, digital mattes, rig removal, 2D and 3D matchmoving, environments, rigging and creature effects, animation, effects, lighting and look development.
(3) To enable students to understand the approaches necessary to create different visual effects depending on the requirements of a scene, sequence or shot.
(4) To give students exposure to modern visual effects tools and programming techniques based on computer vision and/or graphics - to problems typical in an advanced visual effects research and development environment.

On completion, we wish students to be able to demonstrate:

(1) Application of modern visual effects techniques, computer vision and/or graphics, to create advanced tools and solutions typical in a research and development visual effects environment. For example, taking an algorithm and adapting/extending it to solve a real world visual effects problem in a working system.
(2) The ability to analyze a visual effects sequence and understand how it was created.
(3) Identify the techniques required to create a visual effects shot.
(4) An understanding of future visual effects trends and directions, and how these relate to research in computer vision and graphics.

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Learning Outcomes	Students should be able to research and develop the parts of a modern effects pipeline to achieve the desire visual effect.
Classification	Rendering, Vision
Audience	Graduate, potential for undergraduate.
Dependencies	The students must be experienced programmers.
Prerequisites	Some visual computing experience.
Strengths	The scope of the assignment beyond pure software development help students to understand the wider context.
Weaknesses	A weak member of the group puts the completion of the effects shot at risk.
Variants	Unlimited selection of effects to replicate.
Assessment	The effects shot produced by the group. A report produced by each student on their part of the pipeline

Table 1: Assignment Metadata

3 COURSE STRUCTURE

The course is structured as a short, front loaded lecture series. Four two hour lectures are delivered within the first two weeks. Each covers a specific area:

(1) A history of visual effects and the modern visual effects pipeline.
(2) Filming and asset capture for visual effects.
(3) Modelling
(4) Rendering and Compositing.

The lectures are by their nature only an overview of each field, intended to be signposts for each student's own research for the role they have been allocated by their group. The lecture weeks are followed by the assignment and student groups are allocated a weekly meeting with a supervising staff member who will help them to remain on track and facilitate their access to the resources they will need from the university such as cameras, motion capture/green screen studio access and cluster compute time. The staff member will in effect take on the role of a producer.

4 THE ASSIGNMENT

Having been split into groups of three to four students, each group is required to select a classic visual effects shot that was originally done practically and re-create it using modern software methods. However, they are expected to develop the software themselves rather than use existing effects packages. The still frames in Figure 1 demonstrate some of the shots produced by previous students.

This assignment is structured to ensure we achieve all of the aims and objectives previously stated. And all shots must combine a live action and rendered element. It requires students to research how the shot was originally created and then break down the shot into the component parts of a modern effects pipeline. This is done as a group activity. The students then divide the stages between themselves and each becomes responsible for the delivery of their stage. This requires each student to consider what asset capture is necessary for their stage and how they will transfer the data between stages.

The assignment has been structured to have multiple formative and summative assessments. The first assessment is formative and requires the students to form groups, select a shot and complete the breakdown process. The group must submit a document that explains how they will create the shot, their shooting plan, which student will be responsible for each stage and the format to be used to exchange data. This assessment must be completed before access is permitted to the motion capture studio, camera or other resources to maximize the value of the time the students have access to these.

The second assessment is summative. Each group must deliver their completed effects shot. We have deliberately separated delivery of the shot from the reports by a week to ensure that students at the end of the pipeline are not trying to deliver the shot and their report simultaneously. We have one further formative assessment that takes place between the delivery of the shot and the individual reports. Students are invited to premiere their shots to the department's Visual Computing group of staff, researchers and students. This gives students an opportunity to show off their work and receive feedback that assists them in writing their report.

5 LESSONS LEARNED

Having run this assignment for three years, we have found it effective in achieving the learning outcomes for the students.

Over time, we have increased the amount of detail required in the planning document before students shoot for two reasons. Firstly, to ensure they have an agreed shooting plan they all understand and secondly to ensure that they have all agreed how the data is to be transferred from one student to another. These changes are a result of experiences with groups where this had failed to some extent when not demanded.

We have also built an escape clause into the assignment. If a student is unable to get their code working sufficiently well, such that it cannot be used to produce the shot, the group may substitute a standard package for that component. Likewise, if there is a stage for which there is no student assigned.

6 CONCLUSIONS

This hands-on approach to the task follows in the tradition of the constructionist model of teaching. By working together, particularly to film the live action component, they have an experience that is more realistic and allows them to understand the wider visual effects context.

ACKNOWLEDGMENTS

I'd like to thank the students who have chosen to do this course for their feedback to help improve the course for their successors and allowing the shots they have produced to be shared. And Professor Darren Cosker for helping a new course leader refine a coursework specification.