Teaching Portfolio

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Teaching History

Following the advice of my PhD advisor, Prof. Bruce H. McCormick, I made teaching Computer Graphics the "bread and butter" of my academic career. I have thus made it a point to teach Computer Graphics classes at both the introductory undergraduate and advanced graduate levels. I have covered a range of topics, including digital imaging, ray tracing, photon mapping, fractal terrain modeling, and particle systems.

In my introduction to Computer Graphics I teach the basics of viewing and affine transformations, modeling, lighting and shading, and interaction (using quaternions for object rotation). Time permitting I may also cover spline curves and boundary representation surfaces constructed via volume of revolution (e.g., of the spline curves). This course tends to carry a "tough" reputation among students although it appears to attract relatively large audiences. Perhaps my greatest success story thus far is of Zach Cole, a student who, at the end of the course, professed that he had finally found "his calling" and that Computer Graphics was the career direction he was looking for. On my suggestion, Zach went to SIGGRAPH where he conducted interviews and eventually landed a job at Industrial Light & Magic (ILM) in California. A position at ILM is particularly difficult to obtain, and I am therefore gratified that Zach was able to achieve this success. He and his ILM team received an Oscar for lighting on *Pirates of the Caribbean: Dead Man's Chest.*

I have also enjoyed teaching introductory graphics courses to non-Computer Science students under the auspices of Clemson's Digital Production Arts, or DPA, program. This program, patterned after Texas A&M's Viz Lab, aims to bridge Computer Graphics and Art in order to prepare students for the film and gaming industries.

Two aspects that appear to be consistently evaluated at a high level by my students is the amount of work and its difficulty. This stems largely from my emphasis on project-based learning. My graphics courses, at both undergraduate and graduate levels, maintain a heavy workload throughout the semester. A good example of a project-based workload was the $\tau\acute{\epsilon}\chi\nu\eta$ version of CPSC 212: Data Structures and Algorithms, wherein I taught sophomore undergraduates how to convert their ray tracer, written during the semester prior, into a photon mapper [3]. Exemplar images are shown in Figure 1. Jason Anderson's Cauchy-based refraction was especially impressive, particularly since that concept was not discussed in class and he investigated the approach independently. He is now pursuing his Computer Science PhD.

Beyond Computer Graphics, I also enjoy teaching research-oriented classes. As a result of my Clemson University Innovation and NSF CAREER research awards, I introduced a course on eye tracking (CPSC 412/612) in the Fall of 1999. I have refined both the subject matter for the course as well as my teaching style to reflect the somewhat unusual interdisciplinary makeup of the class. Students from Industrial Engineering, Marketing, Packaging Design, and Psychology form teams such that each team has at least one member from Computer Science. The team construct reflects my own approach to research, one that to a large extent relies on collaboration. The course is research-oriented, centering on a semester-long experiment culminating in a term paper written by the team and made to resemble a conference publication. Thus the course is run as a small conference, where instead of the final exam, student teams present their papers (in effect, all papers have been "accepted" to the conference following [my] peer review). This approach has been particularly well received by graduate students in the class as some have gone on to publish their results in peer-reviewed conferences or journals following the conclusion of the class (e.g., EuroGraphics Symposium on Virtual Environments [6], Graphics Interface [1], Symposium on Applied Perception in Graphics and Visualization [5], Eye Tracking Research & Applications [2, 7], and Transactions on Applied Perception [4]).
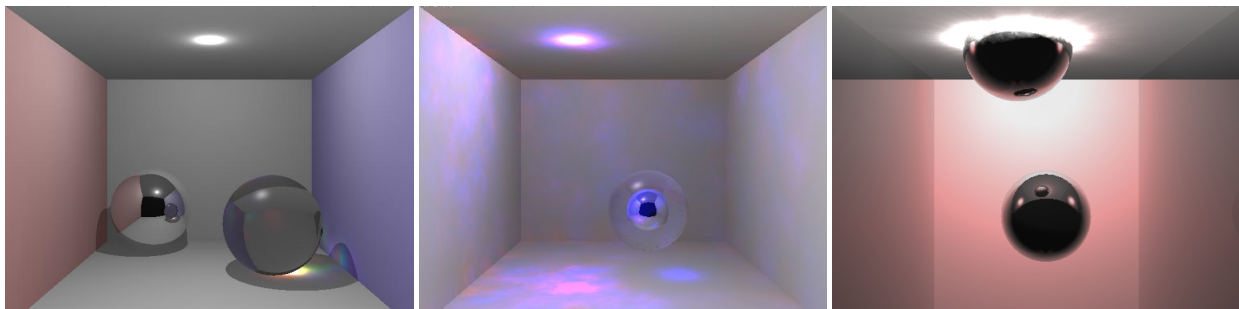
(a) Students' work, left-to-right: Jason Anderson, Daniel Willard, and Shi Zheng.

Figure 1: Example student images from Fall 2011 and Spring 2012 CPSC 212: Data Structures and Algorithms.

Responsibilities, Strategies, and Objectives

My teaching portfolio at Clemson University consists of the courses listed in the table below. I would be happy to continue teaching similar course offerings.

Course	Level	Course Description	Semesters Taught
CPSC 102	U	a course on C programming	F10†, S13
CPSC 212	U	a course on data structures and algorithms	F06†, S11, F11, S12
CPSC 215	U	a course on C/C++ programming under Unix	S01†
CPSC 405/605	U/G	an introductory course on computer graphics	S99–S02, S04, S06
CPSC 412/612	U/G	an interdisciplinary course on eye tracking methodology	F99†, F00–F17
CPSC 414/614	U/G	a survey course on Human-Computer Interaction	S02†–S07
CPSC 481/681	U/G	a course on 3D game programming	S05†
CPSC 805	G	an advanced course on computer graphics	S98, S99, S03, S08, S10
CPSC 808	G	an advanced course on computer animation	S00†
CPSC 815	G	an advanced course on digital effects production (compositing)	F99†–F03
DPA 400/600	U/G	an introductory course on digital production arts	F16–F17
DPA 401/601	U/G	an introductory course on digital production arts	F15, S16

†Newly developed.

In general, I have chosen a teaching style where initial concepts are presented through the aid of analogy and example. Once received, these lessons are then generalized to abstractions, where appropriate, hence I sometimes start "bottom-up" instead of "top-down". Further extension and use of abstract notions are then again derived through examples. I emphasize good programming design and good programming habits, and above all, I attempt to motivate students to think logically.

Student Evaluation

I consider student evaluations to be of prime importance to the improvement of my teaching abilities. I encourage student participation in class, and I pay special attention to student comments during and after each course. I am always ready to adapt my teaching style to student feedback.

Teaching Philosophy

My primary goal in teaching is to empower students with self-confidence through the realization that knowledge has been gained and can now be drawn on to solve practical problems. Since Computer Science is, in my opinion, inherently applied, the ultimate evidence of successful teaching is the students' mastery of the presented material and their ease in its implementation.

Closing Statement

I strongly believe in the dual functions of a university as a research facility as well as an educational institution. I take the responsibility of teaching very seriously and I put forth the best teaching effort that I am capable of at each stage of my professional career. I enjoy teaching and I look forward to improving my effectiveness as an educator.

References

[1] M. Ashmore, A. T. Duchowski, and G. Shoemaker. Efficient Eye Pointing with a Fisheye Lens. In *Proceedings of Graphics Interface*, Victoria, BC, Canada, 2005. ACM Press.

[2] D. S. Best and A. T. Duchowski. A rotary dial for gaze-based pin entry. In *Proceedings of the Ninth Biennial ACM Symposium on Eye Tracking Research & Applications*, ETRA '16, pages 69–76, New York, NY, USA, 2016. ACM.

[3] A. T. Duchowski. $\tau\acute{\epsilon}\chi\nu\eta$ photons: Evolution of a course in data structures. *Computer Graphics Forum*, 33(1):294–304, 2014.

[4] A. T. Duchowski, D. Bate, P. Stringfellow, K. Thakur, B. J. Melloy, and A. K. Gramopadhye. On Spatiochromatic Visual Sensitivity and Peripheral Color LOD Management. *ACM Transactions on Applied Perception*, 6(2):1–18, Feb. 2009.

[5] J. Heminghous and A. T. Duchowski. iComp: A Tool for Scanpath Visualization and Comparison. In *Proceedings of the ACM SIGGRAPH Symposium on Applied Perception in Graphics and Visualization (APGV)*, Boston, MA, July 28-30 2006. ACM. (Poster).

[6] D. Vembar, N. Iyengar, A. T. Duchowski, K. Clark, J. Hewitt, and K. Pauls. Effect of Visual Cues on Human Performance in Navigating Through a Virtual Maze. In *EuroGraphics Symposium on Virtual Environments (EGVE)*, Grenoble, France, June 8-9 2004. EuroGraphics.

[7] J. O. Wobbrock, J. Rubinstein, M. W. Sawyer, and A. T. Duchowski. Longitudinal Evaluation of Discrete Consecutive Gaze Gestures for Text Entry. In *ETRA '08: Proceedings of the Symposium on Eye Tracking Research & Applications*, Savannah, GA, March 26-28 2008. ACM.