

Teaching Statement

Yinzhi Cao

My enthusiasm for teaching came from my father, a university professor, who taught computer graphics and mathematics modeling to undergraduate students at HeFei University of Technology in China. His passion for teaching influenced me significantly, ever since I was a child watching him. Later, when I became a graduate student, and was involved in teaching as a teaching assistant and group project mentor, I gradually developed my own philosophy of teaching in computer science, especially computer security, as follows:

Fostering Students' Interests. I believe that my students' interests are their motivations to study. In practice, I want to illustrate real-world examples, to awaken students' desire for knowledge. For instance, once I was teaching Web security, particularly same-origin policy, at Huawei Technologies Co. Ltd., I felt that my students were confused about the motivation for learning Web security. Therefore, I told them a true story about how the Web site of the EECS Department of my university was hacked due to a mis-understanding of the same-origin policy, and how we fixed it. Immediately, I saw their desire to learn the subject grow.

Teaching Students How to Approach Problems. There is an old Chinese saying: "Give a man a fish, and he will not starve for a day. Teach a man how to fish, and he will not starve for his entire life." When facing a computer science problem, instead of telling a student what to do, I prefer to tell him how to solve the problem. After repeated practices (and perhaps many failures), he could then find his own solution to the problem. For example, when I was teaching EECS 354 - Network Penetration and Security, I liked to teach my students about the root causes for buffer and heap overflow, instead of specific exploits. Once they understood the mechanisms of buffer and heap overflow, they could locate and exploit those vulnerabilities themselves.

Interpreting the Breadth of Computer Science. Computer science is a relatively new field that grew out from mathematics and electrical engineering. When teaching computer science, I want to present its interaction with other related fields, such as law, mathematics, and electrical engineering. For example, when teaching computer privacy, I would introduce its broader impact on social behavior, such as how lawmakers enforce restrictions on computer privacy, and how journalists report people's reactions to privacy leaks. In particular, third-party Web tracking records Internet surfers' browsing history. Facing this significant problem, journalists from *The Wall Street Journal* report the prevalence of the problem, and lawmakers try to restrict such behaviors by enacting specific laws. Their efforts push the evolution of techniques in computer privacy.

Teaching Students How to Design and Implement Complex Computer Systems with Security Properties. One of the key tasks of computer science is to let students build a real system individually, or as members of a team. In particular, in computer security, together with other properties of a computer system (such as speed, scalability, and memory usage), security, often as the opposite side of those existing properties, needs to be weighed. For example, to create a secure browser, the most secure and extreme way is to execute each individual Web site in a physically isolated machine, but this would make the browser unusable for a Web user. I believe that, during practice, a student could find the balance between the security and other properties of a complex computer system.

If I become a faculty member, I would love to teach ordinary courses, such as Internet secu-

rity, operating systems, compilers, data structures, and computer networking, given my abundant background in computer systems and programming languages. More importantly, I also consider starting two new courses, if permitted by the department, which are Introduction to Browser Architecture and Introduction to Network Penetration.

Introduction to Browser Architecture would be a course that teaches students to build a simple functioning browser consisting of an HTML parser, document object model (DOM), a CSS engine, a JavaScript execution and rendering engine. Instead of letting them implement a full browser with complete HTML, JavaScript and CSS, the course would use a reduced set of those languages, and teach students the inherent working mechanisms of a modern browser. Students could learn the parsing, execution and rendering flows inside a browser when an HTML file is received from the network. Given the popularity of browsers in people's daily lives as well as my extensive research background in Web security and my understanding of WebKit browser source code, I believe that I could make the course a success.

Introduction to Network Penetration would be a course that teaches students to exploit real-world vulnerabilities. We would introduce those vulnerabilities, ranging from old ones, such as buffer overflow and heap overflow, to the modern ones, such as cross-site scripting (XSS) and execution after redirection (EAR). More importantly, students would be given many vulnerable programs to exploit as projects. They would enjoy the fun of being hackers. For superior students, we would also organize them to attend CSAW CTF, an undergraduate cyber security competition. A version of this course has already been opened by my advisor Yan Chen at Northwestern University, who achieved great success. Meanwhile, during my internship at UCSB, as part of their excellent hacking team - Shellphish, I attended Defcon CTF and learned much from the group. Combining my experience from both Northwestern University and UCSB, I believe that I could attract many students for the course.

In sum, I like teaching, perhaps something that I inherited from my father. Later, during my teaching experience at Northwestern University as project mentor, guest lecturer or teaching assistant, I developed my own teaching philosophy¹. I hope that in the future, I could teach these traditional system and network-related courses, and possibly start new courses, if permitted by the department.

¹The confidential survey report performed by Course and Teacher Evaluation Council (CTEC) gives me an average score larger than 5 out of 6 in total for each course that I am serving as a teaching assistant.