

# Teaching Statement

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I thoroughly enjoy teaching tricky technical concepts and the satisfaction of imparting problem-solving skills. The primary role of a teacher is not only to teach material, but also to develop a creative spark in students, as well as to nurture the interest of students in the taught subject. **My teaching philosophy achieves these goals through four key ideas: visualization, socratic teaching, personal availability, and adaptive curricula.** I served as a TA for 6 different courses at UCSD, spanning the topics of undergraduate programming languages (PL), graduate PL, and graduate program synthesis, and my philosophy has led to 38 different students recommending me as a TA in anonymous evaluations. Notably, all of my anonymous student evaluations would either recommend me, or strongly recommend me as a TA. In the rest of this document, I'll discuss my philosophy in more detail and conclude with several courses that I would be excited to teach.

**Technical visualization.** It is important to visualize technical concepts so that students can develop an intuition for the material. I make heavy use of visual metaphors in my materials and I enjoy crafting a visualization that distills the essence of a concept. In the undergraduate programming languages course, the hardest assignment of the course is implementing an interpreter for a toy functional language modeled after ML. The chief difficulty is implementing recursive functions i.e. 'let rec'; this concept is difficult because it requires a deep intuition for how environments are used and represented, as well as the evaluation rule for function application. To explain this concept in discussion sections, I developed a series of slides for visualizing and explaining environments, the process of function application, and why recursive function application fails for a naive implementation. My slides were very effective and were duplicated and reused by other TAs in later iterations of the course. More generally, qualitatively, on average my students anonymously evaluated my discussion section explanations as 4.5 on a 5 point scale on 38 responses. Moreover no students rated me as below average and the majority (22 of 37) rated me as 5 of 5.

**Socratic teaching.** In my undergraduate education at Harvey Mudd College, I learned the value of a Socratic style of teaching, in which the teacher continually asks their students pointed questions. In my experience, the main benefits of this style are that it develops critical thinking skills, exposes root misconceptions (if they exist), and done with care and a friendly manner, it fosters an inclusive learning environment by encouraging students to share misconceptions. I make use of socratic teaching in both discussion sections and office hours. Qualitatively, many of my students appreciated this method of instruction. In anonymous feedback, 29 of 31 students said that my feedback was helpful and constructive, and my average score was 4.5 of 5. Moreover, 35 of 37 students said that I developed their critical thinking skills on the subject matter, and similarly my average score was 4.5 of 5.

**Availability and accessibility.** The availability and approachability of an instructor is one of their most valuable skills. One of my fondest professors at Harvey Mudd was Zach Dodds, who ensured that he was always available by email, and intentionally memorized the first names of all students in his lecture. This is a very high bar to meet and I have done my best to provide the same attention and care to my own students. At UCSD, we recently switched to using Piazza for hosting the intro PL course. I made it my own personal mission to ensure that every Piazza question had a helpful, informative answer, and I hope that it fostered a positive environment for our students. More generally, In my anonymous evaluations, 32 of 34 respondents answered that I was available outside of hours, and I am proud to have received the following direct quote: "Does he have the fastest Piazza response times on campus? Seriously, I asked some stuff I thought would be horrible to answer and he debugged it in like twenty seconds with a comprehensive response. John, if you're reading this, thank you so much."

**Adapting and modernizing curricula.** An often overlooked aspect of teaching is making sure that both the content taught, as well as the teaching method, align with the needs and abilities of current students. At UCSD, in addition to adopting Piazza as discussed above, I noticed two weaknesses with our PL curriculum during my time as a TA. First, many of our assignments taught in Python 2.7, which is significantly different than the modern Python 3+. Second, one of our assignments very briefly introduced a parser and lexer, which was then unused in the remainder of the class, and was disconnected from the actual material taught in lecture. After several years TAing, I served as a head TA and had the opportunity to address these weaknesses. I updated all of our Python assignments from 2.7 to 3+, which required a change in the grading scripts, and moreover reworked some of the grading metrics to provide for a smoother student experience. In addition, I shifted the emphasis of the interpreter assignment away from developing a parser and lexer from scratch. In

real applications, people reuse and adapt existing parsers and lexers, and now the new PL curriculum more closely aligns with how students will use a parser and lexer.

**Future teaching efforts.** As faculty, I am excited to teach the following classes, at either (or both) the undergraduate and graduate levels: programming languages, formal methods, interactive theorem provers, compilers and interpreters, program synthesis, and of course seminar, reading groups, and independent study in my research areas (PL and formal methods). I would like to finish with several anonymous quotes from my students: “More than explaining material particularly well (which he did), John was extremely talented at asking smart questions and understanding the problem space to guide students to a better grasp of the course.” “Very nice, good explanations.” “Smart and knows where the fault in your understanding is from a few words.” “Easy to communicate with, and easily approachable.” I am excited to bring these qualities as a teacher and adviser at my next university.