TEACHING STATEMENT

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A university is defined by its students and its teaching culture, and I was fortunate to be able to participate in teaching at an early stage in my PhD program. I find working with students inspiring, motivating and rewarding. Students continue to surprise me with their creativity, dedication and abilities.

I find novel pedagogical concepts, such as flipped classrooms, where students acquire factual knowledge themselves and class-time is used to reflect, discuss, and give examples highly valuable. A flipped classroom naturally works best in smaller classes, where teachers have ample opportunity to engage with students. However, I also see potential in applying similar concepts to larger classes. I have been lucky to co-develop **CS 171 (`http://cs171.org`), Harvard's visualization class** together with Prof. Hanspeter Pfister, for which I acted as the head teaching fellow for two years and **which I will be teaching independently in the spring**. In this class we introduced *group reflections*, a concept where students were allowed to discuss and improve their homeworks in small groups, after they initially submitted an individual version. Submitting the individual version ensured that students had engaged with the material before they contributed in a group setting, where learning was reinforced through discussion and collaboration. We also introduced in-class *design studios*, where students work in groups to develop solutions for problems by rapidly iterating over multiple designs. They then could use these designs in their homeworks and projects.

I believe that flipped classrooms and similar approaches where class time is used to repeat and discuss the material is an ideal complement to *massive open online courses (MOOCs)*. This model could be the pillar of physical universities that distinguishes them from online-only classes in the future. Students could prepare for class by watching units of a MOOC or pre-recorded lectures; the time with the teacher is then employed for discussion and reflection. While the classes I am involved in at Harvard are not massive (with an enrollment of 150-400 students), they are open and also available online. A sizable portion of our for-credit students are registered as online-only through the Harvard Extension School. Teaching to both audiences has been a very valuable experience.

Another successful concept we introduced in the visualization class were iterations on projects: students handed in multiple versions of the same project. Thus, we were able to give feedback that students could then implement as opposed to a traditional model where feedback is often an afterthought in the evaluation process. CS 171 also gave me the ability to hone my presentation skills, as I gave multiple lectures, and develop my organizational skills: as the head teaching fellow of the class, I was responsible to lead fifteen teaching fellows, lead the homework and projects development and was the primary point of contact for the students.

In 2013 I developed a course aimed at master's students on **Visualization in Molecular Biology—BioVis** (`http://goo.gl/wEMLut`). To teach this class as a visiting lecturer at the Johannes Kepler University Linz in Austria I submitted an "excellence in teaching" scholarship application, a program funded by the local state government, which I won. I taught the class as a two-week intensive course on-site, and later supervised the students in completing their projects online. I plan to offer this class at the Harvard Summer School, catering not only to students but also reaching out to Boston's and Cambridge's large life science community.

I was a teaching fellow for Hanspeter Pfister's and Joe Blitzstein's **CS 109—Data Science** class (`http://cs109.org`) in 2013, which teaches students data analysis using statistics, machine learning and visualization. This interdisciplinary class is not targeted specifically at computer science concentrators, but is open to all fields of study. The class was offered for the first time and was immensely successful, with more than 350 registered students in its first incarnation.

In the Austrian higher education system, where I received my PhD, PhD students are only admitted

after completing a Master's degree. Consequently, the role of PhD students is different, and selected PhD students are employed as lecturers ("Universitätsassistenten") to contribute to the department's teaching and also to independently teach, in addition to their research responsibilities. I was in the fortunate situation to be one of those few, and as such I co-developed undergraduate classes lead by my advisor, Prof. Dieter Schmalstieg and others, on **computer graphics**, **distributed systems**, and **scientific methods**. These classes were large and taught me not only to teach outside of my core research area, but also to organize and run a class with hundreds of students. To tackle the large number of homework submissions, for example, I introduced unit testing to automatically give students feedback and partially grade assignments.

My most formative teaching experience at the time was a class at Graz University of Technology, where I taught **selected topics in computer graphics** to graduate students, together with colleagues, for two years starting in 2010. Being able to "select my topics" I focused on visualization and visual analytics. In this class I learned the ropes of designing and running a class without supervision, which was a challenging but enjoyable experience.

Together with colleagues, I was invited to teach various tutorials for expert audiences. One example is a tutorial on **visualizing relationships**, which I taught at IEEE VisWeek 2012. Another example is a tutorial on **cancer subtype and pathway visualization** which I was invited to teach at the University of Tokyo in 2013 and at VizBi 2013, a conference on visualization for biology.

MENTORSHIP

I was fortunate to work with and mentor many excellent students completing bachelor's, master's and PhD theses at Graz University of Technology, Harvard and MIT. As a postdoctoral fellow I had the pleasure to work with PhD students on all but one of my projects and papers; seven of the undergraduate or master student's projects I was involved in turned into publications and three of the students I mentored have since enrolled in a PhD program focusing on visualization. As part of Harvard's visualization class I mentored a small group of students in developing a visualization technique to identify the mutations that cause a breakdown in function in a protein. We later submitted this project to the BioVis contest and published it in BMC Proceedings.

While some of these students worked on projects in the context of my research, others have approached me with visualization ideas of their own, covering a broad range of topics such as the visual themes of writing systems or visualizing global culture.

While I mostly acted as a co-advisor together with my respective supervisors, I have recently independently supervised two successful and two ongoing master's thesis at the Harvard Extension School.

COURSES

For **undergraduates**, I would like to teach *visualization*, *data science*, *human computer interaction* and *computer graphics*. I would like to design the former two classes to target an interdisciplinary, yet programming-savvy, audience. As a software engineer by training I believe that good engineering skills are highly valuable. With my extensive software engineering experience I would like to teach courses on *programming*, *object-oriented design*, *software development methodology*, *distributed systems*, etc.

On the **graduate level** I would like to teach courses related to data analysis and visualization, such as an *advanced visualization* and *visual analytics* class, and a *biology visualization* class, aimed at students from both the life- and computer sciences. I would also like to develop a class on *design studies*, teaching students how to design, create and evaluate solutions to the data analysis problem of a domain expert.

The primary role of a University in society is to educate and to enlighten, to foster critical thinking, discussion and skill. I believe that students learn most if they engage with the material and interact with peers, and consequently strongly believe in project and team based work for my classes.