Statement of Purpose (MIT)

My primary research objective and interest is in the area of computer graphics. I am currently studying computer science at Princeton University, and I am actively involved in a research project that is developing an automated system to assist archaeologists in reconstructing excavated frescoes. My work focuses in particular on analyzing fracture patterns from images of frescoes and developing a model of brittle fracture. This project has opened my eyes to a broad range of research in computer graphics and motivated me to undertake further study through a Ph.D. program. I am especially interested in problems of visualization, computational photography, and simulation, but I am open to trying new ideas as well.

Under the supervision of Professor Thomas Funkhouser, I conducted research that analyzed fracture patterns observed in frescoes excavated from Akrotiri (modern Santorini, Greece), an ancient Bronze Age city destroyed by earthquakes around the 17th century B.C. I developed a two-stage processing pipeline for this purpose. In the first stage, I used an interactive program to trace detailed fragment boundaries in high-resolution images of manually reconstructed frescoes. The output was a polygonal mesh, with each polygon representing a fragment. Next, I implemented geometric analysis algorithms to study the shapes and contacts of the fragment boundaries. Specifically, I produced statistical distributions of the lengths of cracks, the angles at which cracks met, the fragment areas, and the adjacencies found in fragment arrangements. The main contribution of my study is a statistical model for crack patterns of fractured frescoes, which can guide scoring functions used in computer-assisted fragment reconstruction algorithms and also suggest a generative model about fracture processes.

Last summer, I participated in a workshop at the archaeological site of Akrotiri, where I presented my study and learned about the diverse research that others had undertaken (both technical and non-technical). The work ranged from scanning of fresco fragments or constructing virtual reality models of the ancient city to historical interpretation of the fresco paintings. It was an eye-opening experience; I was able to place my research in the context of a broader study and application. In addition, I was motivated by the feedback I received to plan a direction for my research in senior year.

I recently published my study at the VAST International Symposium on Virtual Reality, Archaeology and Cultural Heritage. I am continuing the research this year, implementing methods to verify the suggested model of the fracture process by simulating factures using physics-based heuristics. I am also collaborating with a graduate student to record and analyze the actual fracture process with a high-speed video camera. In addition, I plan to utilize the statistical model to improve existing reconstruction algorithms and to develop new algorithms that reverse the fracture process.

These experiences attracted me to various research problems in applications for cultural heritage, such as scanning, modeling, visualization, computational photography, and user interface dealing with 3D data. In my graduate study, I wish to do research in the area of computer graphics with broad applications in other disciplines, including but not limited to cultural heritage, such as medicine or education.

For these reasons, the EECS department of MIT is especially attractive to me. I am intrigued by several interesting research projects carried on by its faculty members. In particular, Professor Wojciech Matusik's and Professor Frédo Durand's research application in Virtual Humans is fascinating; their work on "Hair Photobooth: Geometric and Photometric Acquisition of Real Hairstyles" and Matusik's work on "A Statistical Model for Synthesis of Detailed Facial Geometry" were especially interesting to read. My

research interest has also led me to follow other works of Durand's. I especially enjoyed reading the paper about "Procedural Modeling of Structurally-Sound Masonry Buildings." It would be a privilege to study in the EECS department of MIT under the guidance of its remarkable faculty.

I have enjoyed being able to apply what I learned in classes such as computer graphics and computational geometry to my research. On the other hand, I have also cultivated a broad interest in other areas, such as photography and art, as a source of inspiration. I seek different kinds of creativity in engineering and in art; both come from the persevering effort driven by the will to create something new and better. It is this creative will that I wish to pursue in MIT's Ph.D. program and afterwards as a researcher in academia. My learning experience under the guidance of my advisor has convinced me not only of the potential of research but also of the value of teaching. I have also enjoyed working as an undergraduate teaching assistant for introductory computer science courses. Through my graduate studies, I expect to become, and will work hard to be, an effective researcher and teacher.