

MIT GERMANY PROGRAM



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Course 18C, Class of 2017

Pupil Labs UG

Berlin, Germany

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Summer 2015 Report

DEUTSCHLAND!

Berlin, Germany

Expectations before going

Heading into the summer, I didn't have too many expectations for my summer in Berlin. I had transited through Frankfurt airport once or twice before, but otherwise I had never set foot into the land of the Germans. I knew Berlin was the capital of Germany and it must be rich in history, thus having a lot to explore. But I didn't know much about Berlin's hipster culture, or how Germans *really* lived (beyond the basic conceptions from an American perspective).

As for my internship, I had completed a software engineering internship the summer before, so I had a general idea of what the work would be like. I had never worked at a startup before, so I was also excited to experience working at a small company, where only my boss, me, and another coworker would work together at the office.

I didn't even
need to move
the dot!



ABOUT *PUPIL LABS*

Eye Tracking Tools for research and other purposes

Pupil Labs is a startup founded in 2013 by two MIT Masters '12 alumni, Moritz Kassner and William Patera, and Andreas Bulling. The company designs eye-tracking headsets in house, which includes both hardware and software.

The pupil headset includes an eye-facing camera and a world-view camera. It can be configured with multiple cameras.

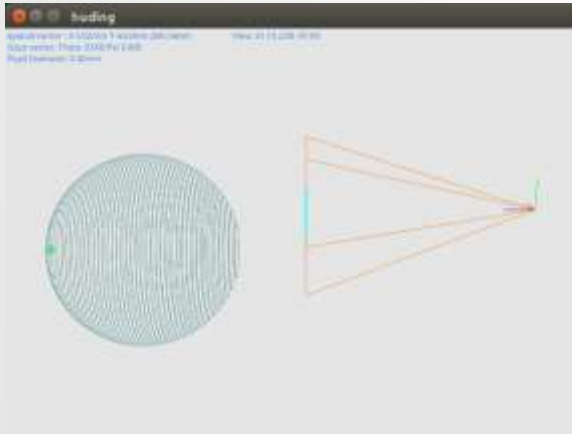
The software involves detecting the pupil ellipse from the eye camera and mapping the gaze location to the world-camera.

Since the company's founding, devices have been sold all over the world, including the MIT Media Lab, BMW, the CIA, and others. Two headsets will also be heading up to the International Space Station this fall!

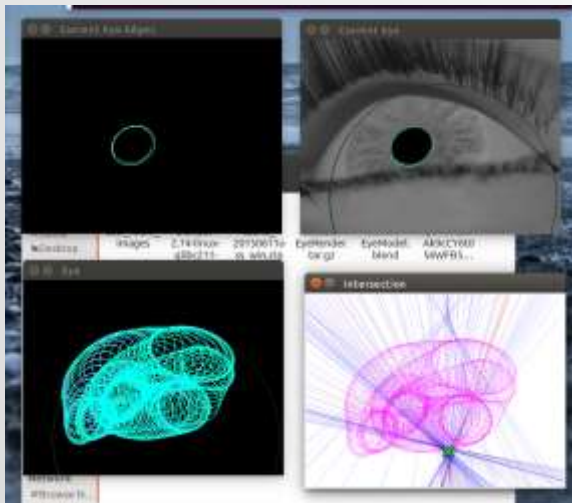


INTERNSHIP DETAILS

Project Description: Improving Eye Tracking by implementing a 3D eye model algorithm



*Above and below:
Visualizers for the Algorithm*



Currently, Pupil Lab's eye tracking model involves using computer vision algorithms and detecting the ellipse in the eye camera stream. Having reliable pupil detection is critical for the software's integrity, and sometimes if the pupil strays too far from the screen, or lighting conditions are suboptimal, then the detection may be compromised.

For this summer, I worked with my boss, Moritz, in implementing a 3D eye model algorithm proposed by a Cambridge University research paper. The key idea behind the algorithm is that with the video stream, the eye pupil will be recorded from multiple angles. The eye pupil will appear as an ellipse (since it is a projected circle) on the video screen, and thus it is possible to reconstruct the 3D eyeball by unprojecting the ellipses into back into 3D space (as circles) and constructing an eyeball sphere that best fits the circles.

With this implementation, images with incomplete pupils should also be recorded by the eye model, and movement in the headset should also be detected.

... MORE INTERNSHIP DETAILS

What was learned about working in a different country and culture? How is work culture different?



Above: Assembling "Pupil Dev" headsets
Below: My workplace for the summer



My internship ran from early June to the end of August. I worked from 9am to 5.30pm every day. For most days I would get lunch with my boss at a beer garden or a Doner store; some days we also cooked at the office.

In addition to working on the software aspect, I also helped out with some hardware manufacturing. Since each pupil headset is 3D printed and the cameras are bought, we assemble all parts together in the office. I also helped out with the website backend and worked on some promo videos for the website.

Work culture at a startup is relaxing and not very stressful. Moritz was a great host and boss, as he assigned me tasks that I could complete, and helped me out when I was stuck. While I didn't work at a typical German corporation or research institute, I did enjoy working at the startup, as it was a very unique experience.

WITHIN THE COMMUNITY

Berlin: a city with unique history

I would argue that Berlin is the city with the most unique history in the past century, especially with its involvement in World War II and subsequently the cold war. Relics from the past are seen all across the city: parts of the Berlin Wall are now monuments, historical museums on the Nazi Regime, and even railway infrastructure no longer used, now converted to public parks.

Berlin itself has developed a very unique vibe and culture. West Berlin was an island within communism for four decades, and its culture developed in many ways independent of outside influence. Today, the city is vibrant and full of all walks of life: anything you want to see, be it swing dancing or exploring abandoned theme parks, Berlin offers.

Berlin is also a very international city, and English is spoken by almost everyone.



LASTING IMPRESSIONS

What did I learn about myself? How did this experience influence my path back at MIT?



I definitely would love to come back and live in Europe. Europe is a land of great cultural diversity, with so many cities in so many countries to explore.

I have gotten better at coding. Through small tasks and projects, I have become more familiar with C++, XML, Javascript, and other coding practices.

I understand German culture better. While in Deutschstunde (German Class) at MIT we only speak German, living in Berlin for a summer is a truly immersive experience. Being able to enjoy German food, and meeting German people my age added to an unique experience that is quite different than a summer in America.



ADVICE FOR FUTURE INTERNS

If there is anything worth remembering, it's this:

1. **Find housing before arriving:** Something that I procrastinated a bit too much, I arrived in Berlin without a place for the summer, and stayed at my Startup office for the first two weeks (fortunately, Moritz provided a bedroom and bathroom for me). I eventually moved into a shared apartment for the summer, but finding a place earlier would've made a richer summer experience.
2. **Get a bike:** I borrowed my apartment host's bike for the summer, and it made exploring Berlin much more fun. I also made bike trips to Potsdam and Poland, which really made travelling about the "journey" as much about the destination.
3. **Travel around Europe, but not too much:** Being in Europe for a summer is a very unique experience, and definitely make the most out of it. Paris, London, Rome, Amsterdam are great cities to checkout. However, it's also important to balance weekend trips with exploring your host city.
4. **Meet people beyond MIT and workplace:** for the more authentic experience, one should reach out to local Germans. I met people through *Couchsurfing* and *Meetup.com*, and learned a lot of subtle German culture that isn't found in a guidebook.

NEXT STEPS

Will you continue any work with your host/advisor? Any patents, publications or presentations? What challenges (cultural, language) did you overcome?

I plan on staying in touch with Moritz and Will, as I enjoyed working at Pupil Labs this summer.

The 3D eye model that I worked on will continue to be developed, and hopefully it will be deployable soon. Currently the algorithm successfully detects pupil ellipses and creates an eye sphere that is realistic in modeling the eyeball's true location, and further steps would be to implement the algorithm to help pupil detection.

As for my language skills, my German has gotten better this summer. By simply living in Berlin for the summer, and seeing German everywhere, one's German will improve. I plan on keeping up my German through more German classes at MIT and finding time to read German books.

FINAL THOUGHTS

My quote

“Thank you very much, Moritz and Will, for hosting me and offering me an internship at Pupil Labs this summer. I enjoyed working on my project, and the company culture was relaxed, which I really appreciated. I gained knowledge in coding through the summer internship, and I hope my contributions will help the company out! I hope to be back in Berlin again, as it is such a magnificent city.”

