



## UNIVERSITY OF WASHINGTON

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To whom it may concern,

This is a recommendation letter for **Chris MacGregor**, with reference to work he performed under my employment in the period 2003–2008. In that time, I employed Chris on a part-time basis to work on three different projects, all connected to my scientific research program in the School of Oceanography at the University of Washington.

Chris has been an ideal employee (a better term in this case would be "collaborator"). He is a very capable programmer, who designed and implemented streamlined, intuitive and extremely effective solutions to the software challenges members of my laboratory and I presented to him. He is extremely helpful and responsive. He is invariably cheerful and easy to talk to. Beyond all of that, he seems to enjoy the challenge of understanding the hows and whys of our research – to want to understand our research objectives in a deep way so that he can think broadly and creatively about how best to achieve them.

Chris' work, some of which I will describe below, is now the foundation of the experimental work that we do in my laboratory. He has given us capabilities for observing and quantifying movements of marine organisms that are unique among laboratories focused on similar topics anywhere in the world.

The first project Chris worked on for us was a controller interface to a stepper motor-controlled platform. The job of this platform is to move a camera to specific vertical positions at specific times, so that video sequences can be recorded for quantifying organism's position and behavior. "Organisms" here means primarily fish and plankton (sizes between 10 microns and several centimeters). These organisms swim inside observation tanks that create spatially structured environments, and the organisms must find food, preferred salinities and temperatures, etc. The goal of the research is to understand how quickly and effectively these organisms locate and exploit favorable habitats, so that we can better predict their population dynamics in their natural environments.

There are technical services people available to me on campus to do these sorts of jobs. However, their proposed solution to me was expensive, inflexible, accomplished only a subset of our needs, and was tied to a Windows platform (we are a linux-based lab, and have no Windows machines).

In essence, they were proposing to do slight modifications to work they had already done many times before.

When I contacted Chris, it quickly became clear that he was operating on a different level, both in expertise and in his desire to create software that met the objectives. Chris' final product is a perl script (StepIt) that can flexibly control not only the camera platform from any computer with a serial or USB port, but can also manage other processes (such as video capture) that must be synchronized with camera motion. All this can be done remotely and/or through shell scripts, essential for observations lasting in some cases several days and in uncomfortable places like environmental chambers and cold rooms.

In short, Chris used his creativity and skill to envision and implement code beyond what we could imagine, and it has made an enormous impact on our productivity.

The second project that I have employed Chris to work on was video analysis. We obtain massive amounts of video. From each frame, we must determine which pixels represent each organism, and later these pixel locations must be translated into physical distance units and associated to form coherent paths (first in 2-D stereo, and from that in 3-D). For a given experiment, this can amount to millions of localizations of organism positions. When Chris arrived, we were on our second generation of video processing software. This used an open source image analysis package that had good macro capabilities but was slow and capable only of holding 30 seconds of video in memory at one time.

There were open source video editing packages available (we already used some) but none had anything remotely like the image analysis tools we need. Once again, Chris was able to envision and implement a modification of one of those packages (avidemux) that put the best of both approaches into one package. This has changed analysis of video from a major bottleneck in our work to a quick and manageable step. Chris also has integrated his changes with the main avidemux tree. The result is that someone else has undertaken to produce versions for Windows, OS X, and other linux distributions, which is quite helpful to us and shares the benefits of Chris' labor with other scientists interested in this sort of work.

As always with Chris' codes, this version can be automated through the command line, run remotely, and integrated with other elements of the experimental protocol. In concert with StepIt, we can set up an experiment in the evening and come back in the morning not only to a sequence of captured video, but the analyzed location data. Incredible, given where we were a couple years ago.

The final project I employed Chris to work on was an interface for an acoustic Doppler velocimeter, which is a device for measuring the speed and direction of water flow on a very fine scale. The company that makes this equipment has the reputation of making outstanding equipment, which is not matched by its proprietary software (again, clunky and Windows-only). Chris has quickly and effectively written another perl script replacement, which replicates the most important functionality and can be used off any platform with serial or USB ports. This is a service not only for me but for the whole oceanography community.

The bottom line is that Chris is a great employee with a terrific skill set, wonderful insight, and a fantastic attitude. I wish more of the people I work with were in the same league. Obviously, I will certainly turn to Chris again when I have projects, and I would strongly encourage anyone with a software design or coding task to hire Chris. He is exceptional.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Daniel Grünbaum', is centered on a light blue rectangular background.

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