PH.D. STUDY AT THE INTERACTIVE ROBOTICS LABORATORY
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The purpose of this document is to help perspective and new Ph.D. students to understand the dynamics and the culture at the Interactive Robotics laboratory (IRL), and to help existing students to evaluate their progress toward the completion of their degrees. This document is in addition to the university, college, and departmental guidelines on Ph.D. study which can be found on the WVU website.

A. Introduction

Getting a Ph.D. degree is an important decision for a student. In my opinion, not everyone is suitable for a Ph.D. In particular, I would strongly discourage a student from pursuing a Ph.D. degree if their sole motivation is:

- to get a higher paid job – you could find a job easier and much earlier without a Ph.D. degree and would probably be financially more sound to start working a few years ahead;
- to stay in school because you are not sure what else to do – go get a real job!
- to have a title of ‘Dr.’ associated with their names – nothing is cool anymore after you own it.

For the rest of us, who have a dream of exploring the unknowns, Ph.D. study provides great opportunities. Think about this: you get paid to be educated, to work on exciting projects, to buy and play with toys of your choosing, and to interact with other intelligent people! What’s the catch? You have to stay motivated and focused, be creative and diligent, and to spend a substantial amount of time reading, thinking, building, programming, writing, and helping others.

B. Objectives

So what should you expect by the time of graduation? You should have:

1. the ability to perform independent cutting-edge research;
2. the ability to effectively convey your ideas and findings both verbally and in writing;
3. enough knowledge of your particular field of interest to be able to identify new research directions;
4. a clear vision of your career path, whether it be in academia, industry, or government agencies;
5. a Curriculum Vitae (CV) that is substantial enough for getting your dream job.

If you are short on any one of these, you are not ready to graduate yet!

C. Action Items

To achieve these objectives, this is what I expect you to be doing during the next a few years:

- **Read.** Reading is the most important way for you to catch up with the fast evolving field. I will provide the initial reading material, but you need to find a lot more! Google Scholar is a great place to start. Exploring the reference section of a paper and who cited it often
brings you more papers to read. The more you read, the more you will feel the need to read more (a positive feedback);

- **Think.** Independent thinking is what makes you a scholar. Standing on the shoulders of giants (after reading their papers), we should be able to think just a little bit further (or different);
- **Build.** We are engineers and we make things happen. Working with physical systems is very challenge, but is also highly rewarding to the see the stuff you built works. You will learn the problem solving skills through solving real world problems.
- **Talk.** This includes ‘asking’ if you have a question; ‘discussing’ if you want other people’s opinions; and ‘presenting’ of your problems, results, and conclusions. So speak up, and you will grow faster. To facilitate this, we are hosting a bi-weekly meeting in the group and every student will be asked to present. These meetings allow you to prepare and organize your thoughts, document your latest work, and keep you up to date on other research activities in the group.
- **Publish.** We should not keep the best only to ourselves. I expect each Ph.D. student to publish and present at least one conference paper per year, and have a minimum of two journal papers accepted for publication before their dissertation defense.

**D. Your Responsibilities**

We are working as a group. Our long-term survival and reputation depends on many factors. During your Ph.D. study, I expect you to:

1. maintain a high level of motivation and efficient time management;
2. keep an open and curious mind;
3. be systematic and meticulous in doing research;
4. be responsible and take ownership of your work;
5. be persistent and not easily discouraged;
6. maintain a friendly relationship with your peers;
7. keep a clean and safe lab environment;
8. maintain the highest level of academic integrity.

**E. My Responsibilities**

As your research advisor, you can count on me to:

1. identify and respect your interest, strength, and limitations;
2. provide interesting, feasible, and clear-defined research topics;
3. locate resources for conducting the research;
4. monitor progresses, perform quality control, and provide feedback in a timely manner;
5. learn, self-improve, and keep an open mind;
6. provide support for scholarship, fellowship, and job applications;
7. provide career advice, information, and other support;
8. host a yearly picnic :)

**F. Stages**

In my opinion, the Ph.D. study should involve three stages:

During the first year, you will be taking most of the required courses. You will also be assigned with detailed tasks. Some tasks will be for training, some will be related to the research
projects, and others will be related to housekeeping. You are expected to be integrated into the research group ASAP. It’s a good idea to ask around and learn something from everyone.

From the second year on, you are expected to grow in your research independence. The tasks that you will be assigned will be at a higher level, without obvious answers. You are expected to read, think, come up with, and test your own solutions (of course, I will be assisting you). You will also start to play leadership roles in the project.

From the third year on, I expect you to have a good understanding of our research field, be able to identify gaps in the state-of-the-art, and be able to provide your own contributions. You are also expected to help mentor and manage the activities of your junior peers.

In general, you should expect to graduate in 3-5 years if you already have a Master’s degree. Direct-track student can expect one additional year (4-6 years).

G. Things to Avoid

You should not treat graduate school as a 9 to 5 job. You will need to spend as much time and effort needed to train yourself and to get the research tasks done. If you are not already working in the lab during nights and weekends, I expect you to spend a significant portion of that time studying at home.

You should not be bothered by seeing other students get away with an easy graduation. If they got a degree without receiving proper training, they have wasted their time in school and will have a harder time in their later career.

You should not feel intimidated by people from BNUs (Big Name Universities). We can and should compete with them! That’s how you get to work on these exciting projects that were awarded by world-famous organizations, such as NASA. If we were not so good, some group at BNU would be eating our lunch by now. In the future you will end up competing with BNU graduates on the job market, so you should start now. We need to be able to come up with the most innovative ideas, conduct the most advanced experiments, and write the best papers and proposals, at least in our core research areas. We need to work smarter and harder.

H. Other Random Advices

1. Travel. The period of graduate study is the best time to see the world. Although you probably don’t have too much money, you also probably don’t have too many other things to worry about, such as children. I will give you extra vocation time if you present me with a good travel plan;

2. Science. If you are not interested in following general science developments, you are unlikely to be very creative in your own research;

3. Health. Go out and play whenever you have free time!

3. Failure. You may actually learn more from a failed experiment than successful ones, as long as you ask the question ‘why’.

4. Self-Doubting is a Human Nature. Be persistent and you will get over it.