

HOW TO SURVIVE A PH.D. EXAM?

Maarja Kruusmaa
Centre for Biorobotics
Tallinn University of Technology

You have spent many years working on your dissertation and now it is finally almost over. All what is left now is to pass the Ph.D. exam that in most countries is a public event.

These recommendations are based on my observations as a supervisor, examiner, committee member and an audience member to make you better survive your big day. I here presume that

1. your thesis presents work that is qualified as a Ph.D. thesis by the standards of your university
2. this work is conducted by yourself so that you can answer questions regarding technical details of your work.

If both are true you actually have no reason to worry because you will most certainly get your well-earned doctoral degree. Now the question is how to make the Ph.D. defense (exam) a memorable event where you can demonstrate results of your hard work to the examiners and get recognized for it.

Collecting and classifying data, building a mockup, debugging your code, statistical analysis of your experimental results, etc., normally takes 90% of your time. Therefore you focus less on the wider context, the candidates can handle HOW? And WHAT? questions much better than WHAT FOR?

It is good that you already in your presentation give a wider context for your work. Try to explain what motivated to take up this work, why do you think it was important and what are the main conclusions. Do not go too much into technical details in your introductory presentation, most of the audience might not be experts and get bored. Also, your examiners then get a chance to ask you about technical details. And since you know them well, you get a chance to demonstrate your expertise on low-risk questions.

In general, there are two types of questions: open-ended questions and closed questions. A closed question is a question where the examiner assumes there is a single right answer and she already knows it or it can be verified if it is true. A closed question is for example “what is the value of the drag coefficient in your calculations?” or “is your method inductive or deductive?”.

An answer to a closed question you either know or not. If you are worried what to do if you do not know the answer, here are few options:

Admittance. If you few times openly admit that you do not know you give an impression of yourself as a self-critical and trustworthy person. If you then answer confidently to all other questions, people are most likely to believe and trust you.

Guessing. For the same reason, when you are just guessing, it is worth admitting that: “I guess this method is deductive because...”.

Can't remember. You can openly admit that you cannot remember all details of experiments you conducted several years ago. However, good practice assumes you have everything documented. You can say: "I cannot remember the value of the drag coefficient but I looked it up from the handbook and it is recoded in my input files".

Admit being nervous. It is quite normal that you feel stressed and nervous and in a different situation you would answer difficult questions better. Your examiner knows that too. Sometimes it is a good strategy to admit it by saying something like "I do not know the answer right now, I feel I would need more time to think if my method was inductive or deductive, I feel that there are aspects of both of them." You can be sure that the examiner understands you and often she starts helping you by directing you to the right answer. The role of your examiner is to find out what you know, making you nervous does not help her to do her job and she knows that. Actually it is not so bad to look nervous. It only shows that you are taking your exam very seriously. A too laid-back attitude is much worse. By any means, avoid showing that you take the exam less seriously than your examiner.

Wasn't me. Sometimes you can say, especially if your work was conducted in collaboration with other people, that this is not exactly your field of expertise and your thesis more handles other aspects: "experimental fluid dynamics is really not my strongest point, it was therefore I collaborated with people who calculated the drag coefficient, my contribution was more on the side of data analysis".

Play it down. It is not tragic to admit that you have made some mistakes here and there, this makes you more human and you come across as an honest and self-critical person "I realized later that it was not a right way to calculate the drag coefficient but I wanted to proceed with the field tests quickly, before the navigation season was over". If you had made a crucial mistake in your work though, you're in trouble of course.

So if your mistake was small emphasize it : "the drag coefficient actually does not affect the results so much, my method works anyway".

Blur it. You can also turn a closed question into an open question by suggesting that there is more than one solution to the problem. "Well, actually calculating drag coefficients is not so straightforward as it may appear...". You let the examiner know that truth is actually much more complicated and you are well in the gray zone.

Open-ended questions are usually either asked to get your opinion or to make you to substantiate your claims and decisions. Your answers to open ended questions are supposed to demonstrate your critical thinking, which is a substantial quality of a Ph.D.

A special advice to monosyllabic Estonians: answering an open question takes several complete sentences. Preferably, your answers should be at least as long as questions; otherwise you give an impression that the examiner does the entire job. But this is YOUR show!

DO NOT ANSWER "I DON'T KNOW" TO OPEN ENDED QUESTIONS. It makes you come across like a person without a capability of analytical thinking. Try to think of something even if you indirectly admit you don't know.

One type of open questions is where the examiner expects you do justify your decisions, presumptions or conclusions. It happens sometimes that your decisions were not made rationally but you only realize it afterwards. Provided that these were not crucial decisions and your work still achieved something, it is OK to admit it. Here are few examples how:

I'm only human. For example if you are asked “Why did you choose this method to calculate the drag coefficient?” you can answer “at this point I just wanted to move on with my experiments and this was the first method I could think of and many other authors had done the same”. It indirectly admits you didn't think at all, but also that you are aware of it and it is human to want to get your work done quickly, most of examiners would sympathize with you.

Group decision. Avoid blaming yourself or someone else. Don't say that your supervisor told you to do so. Ph.Ds are expected to be able to think with their own heads. Instead you can say “at this point it looked like an obvious solution to us”. Use “us” to indicate that you participated in the decision-making and were not spoon-fed by your supervisor.

Optimal decision under present constraints. On the other-hand, if your decision was a consequence of constraints forced on you by contract/sponsors/supervisor, you should not take the blame. Explain that you made an optimal decision under those circumstances. You can say: “with this budget we could only afford 40 hours of ship time, the only option was to use a fast but inaccurate method to validate my models. If there were more resources to spend on field trials I had taken another approach.”.

Another type of open-ended questions is where you are expected to give your subjective opinion about general matters. The following is a list of open-ended questions that often are asked and often cause problems to candidates.

“What is the contribution of your work?” is the most basic question that you should be able to answer in a heartbeat but surprisingly many candidates have trouble precisely formulating it. Before your exam, formulate the main outcome or contribution in one or two sentences and learn it by heart. E.g. “the contribution of my work is a new method for calculating hydrodynamic forces in high Reynolds number environments on a moving body”.

“Where can the results of your work be used?” Remember that you have probably spent quite a few years by now on taxpayers' money and they have every right in the world to expect something in return. Show that you are aware of it. Try to anchor your results to the real impact on real lives of people. For example “this way we can design and build better ships and this makes seagoing safer”. Safety, economic growth, life-quality, clean environment are things that make your research topic tangible to everybody.

“When I was a Ph.D. student I already heard that this technology/method/discovery is just around the corner, now 30 years have passed but there is still no progress”. Some senior professor of your university usually asks this. First of all, remember that this is not your fault. You are not responsible for the unsuccessful attempts of your predecessors. An elegant answer is that with all the effort put in it by the very bright people in your community you can only hope that your humble contributions brings the solution to this very complex problem closer. Of course, if you have a good insight you can explain what you think is done wrong previously, and you, who have understood it, will be more successful and therefore the results are really just around the corner. This really puts the grumpy professor off. However, usually the professor jumps up so unexpectedly that you have no time to think of a good answer.

“Where do you think your field is going and where would it be in 5 years time?”. Please do not answer “I don’t know”, this is so embarrassing. As a Ph.D. you will be very soon formulating your own research problems and supervise your own students or make decisions in the private sector, so you SHOULD have an understanding where the world is going. A hint for you: technologies always develop to become more perfect, this means usually higher precision, better energy efficiency, wider use, smaller size, less harmful side effects, etc. Models develop to more precisely predict a large range of different phenomena, methods become more precise, easier to implement on a wider range of problems. Discoveries lead to other discoveries and new interpretations of new knowledge. Think of something along these lines and fill in the details.

“What could be the possible research topic of your own first Ph.D. student?” is again a question to check if you are capable of defining a significant research problem yourself and are now a researcher in your own right. You can pick something from your future work list.

“If you were to start your work all over again, what would you do differently?” is my own favorite question. If you say “nothing, I would do the same” it shows that you have not learned at all about the process. With the expertise you have gained by now you could hopefully avoid many mistakes and make better decisions. What would they be?

“Was it worth it?”. If you think yes, say that you believe that what you have done is useful for someone and it makes you feel good. Or say that you developed as a person, had fun, exciting times. If you worked in a bigger group it is also a good place where to recognize the support of your colleagues.

On the other hand, if you think “no” as an answer, you may want to say it indirectly. The road to the highest academic degree may have been a tough journey for you. Especially towards the last final pull, you may feel frustrated about your supervisor who was too busy, a colleague who was undermining your work, a reviewer who did not appreciate your paper, university administration that rejected your scholarship application, a partner who did not support your career decisions. Though you are feeling as if you were just about to throw up out of frustration, time can put things into a different perspective. There is also a slight chance that most of your difficulties are your own making and everybody else in the room realizes that. Try to avoid blaming yourself or others and emphasize that because of all the difficulties you appreciate the opportunity to develop as a person and as a researcher. If your supervisor didn’t give a damn about you, you can say “yes it was worth it, I have learned how to motivate myself, set my own goals and I have become an independent thinker”. If you worked in a big group with a hysterical research manager who changed the research goals every week, you can say “I have become a better researcher but also learned a lot about all aspects of team work from resource planning to conflict handling”. If you feel insufficient, insecure and dissatisfied with yourself, say: “I appreciate the opportunity to push my boundaries”, time will tell if you are too hard on yourself.

“If you had had 2 million euros (or two years) more to spend, what had you done differently?”. Now this is a tricky question. Our fictional Ph.D. candidate would be here tempted to say that he would conduct more experiments to accurately calculate

the drag coefficients. However, previously he claimed that his quick hack was good enough, so why spend more money on it? Avoid saying that you would waste even more resources because this questions really is about the return of investment. In some cases the real hard constraint in the Ph.D. work is not money but the candidate's lack of enthusiasm, bad decision-making or poor skills. You won't fix them with more money. Instead, show how you could SAVE or achieve more if you had more resources. Perhaps some really promising idea that you had no time to explore? Or a piece of equipment you could have bought and SAVED time of highly qualified people who now had to go through all the data manually?

“How would you explain your work to a 9 years old?” is yet another one of my favorite questions. Surprisingly many people have difficulties explaining their work in plain English but if you manage to do so, it makes you look really intelligent.

“Have you thought about that this work can be used to kill people?” This or a similar question can come from the audience on a public defense when you already have answered all the difficult questions of the examiners, are relaxed, proud of yourself and off your guard. It may sound really hostile. However, people have a right to ask about ethical aspects of your work and it is good if you have already thought of it in advance. The standard answer is that technology/knowledge does not kill people, people kill other people. But to sound responsible, say that you are also aware of the possible misuses and you try to educate people so that they can make informed decisions. Mention also all the good cases where your work can be used to show that the benefits weight out the risks.