Advice for Finishing that Damn Ph.D.

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*** = Current Affiliation**

My Qualifications to Give Advice

I myself got a Ph.D., and I remember it well! Oy!

I watched my ex-wife get a Ph.D. Oy!

I graduated 29 Ph.D.s in 42 years (12 W, 17 M), …

including 6 externally co-advised (3 W, 3 M)

I have 1 more in the pipeline (1 M).

My Qualifications, Cont'd

Only 3 of my Ph.D. students have failed to finish.

None could get his or her s--t together!

My Operating Principle as Advisor

I say to my students:

I will give you all the feedback you ask for. However, I will leave you to set your own pace and to your own devices. I have all the degrees I need, so it's your problem if you don't finish, not mine. So do not expect me to rescue you or even press you. You see, if you cannot get your own s--t together, you are not going to make it as a research leader.

Ph.D. Dissertation Requirements

Kevin Ryan offers these requirements for a good Ph.D. dissertation, and for that matter, a good paper.

You need:

1. **a worthwhile topic,**
2. **a correct structure, and**
3. **a good method.**

Worthwhile Topic

Discovery or selection of a worthwhile topic is a potential killer.

It is certainly the most anxiety generating step.

If you cannot find such a topic, you are not suited for a Ph.D. career, because your future research depends on finding good topics.

Finding Topic

Unfortunately or fortunately, depending on your success, luck plays a part too.

Many attend graduate classes and seminars to get ideas.

Reading the literature shows you what needs to be solved.

Finding Topic, Cont'd

The topic must be

- **real, (Anthony Finkelstein *emphasizes* this requirement)**
- **unsolved,**
- **solvable enough to finish, but**
- **hard enough to solve that it is interesting.**

Finding Topic, Cont'd

The topic should be of *real* interest to and understandable to at least

- **you, and**
- **at least one of your committee members, preferably your advisor**

(Thanks to Todd Barlow for pointing this out!)

Ignorance Helps

It sometimes actually helps to find a topic that you don't know very much about.

See "The Importance of Stupidity in Scientific Research" by Martin A. Schwartz (*Journal of Cell Science* 121:11, p. 1771 (2008))

and "The Importance of Ignorance in Requirements Engineering" by Daniel Berry (*JSS* 28:2, pp, 179–184 (1995)).

Ignorance, Not Stupidity

In spite of the differences in the titles, these articles are about the same thing, the importance of ignorance.

A reading of the article shows that Schwartz means “ignorance” not “stupidity”.

He says, “Productive stupidity means being ignorant by choice.”

The importance of stupidity in scientific research

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I recently saw an old friend for the first time in many years. We had been Ph.D. students at the same time, both studying science, although in different areas. She later dropped out of graduate school, went to Harvard Law School and is now a senior lawyer for a major environmental organization. At some point, the conversation turned to why she had left graduate school. To my utter astonishment, she said it was because it made her feel stupid. After a couple of years of feeling stupid every day, she was ready to do something else.

I had thought of her as one of the brightest people I knew and her subsequent career supports that view. What she said bothered me. I kept thinking about it; sometime the next day, it hit me. Science makes me feel stupid too. It's just that I've gotten used to it. So used to it, in fact, that I actively seek out new opportunities to feel stupid. I wouldn't know what to do without that feeling. I even think it's supposed to be this way. Let me explain.

For almost all of us, one of the reasons that we liked science in high school and college is that we were good at it. That can't be the only reason – fascination with understanding the physical world and an emotional need to discover new things has to enter into it too. But high-school and college science means taking courses, and doing well in courses means getting the right answers on tests. If you know those answers, you do well and get to feel smart.

A Ph.D., in which you have to do a research project, is a whole different thing. For me, it was a daunting task. How could I possibly frame the questions that would lead to significant discoveries; design and interpret an experiment so that the conclusions were absolutely convincing; foresee difficulties and see ways around them, or, failing that, solve them when they occurred? My Ph.D. project was somewhat interdisciplinary and, for a while, whenever I ran into a problem, I pestered the faculty in my department who were experts in the various disciplines that I needed. I remember the day when Henry Taube (who won the Nobel Prize two years later) told me he didn't know how to solve the problem I was having in his area. I was a third-year graduate student and I figured that Taube knew about 1000 times more than I did (conservative estimate). If he didn't have the answer, nobody did.

That's when it hit me: nobody did. That's why it was a research problem. And being *my* research problem, it was up to me to solve. Once I faced that fact, I solved the problem in a couple of days. (It wasn't really very hard; I just had to try a few things.) The crucial lesson was that the scope of things I didn't know wasn't merely vast; it was, for all practical purposes, infinite. That realization, instead of being discouraging, was liberating. If our ignorance is infinite, the only possible course of action is to muddle through as best we can.

I'd like to suggest that our Ph.D. programs often do students a disservice in two ways. First, I don't think students are made to understand how hard it is to do research. And how very, very hard it is to do important research. It's a lot harder than taking even very demanding courses. What makes it difficult is that research is immersion in the unknown. We just don't know what we're doing. We can't be sure whether we're asking the right question or doing the right experiment until we get the answer or the result. Admittedly, science is made harder by competition for grants and space in top journals. But apart from all of that, doing significant research is intrinsically hard and changing departmental, institutional or national policies will not succeed in lessening its intrinsic difficulty.

Second, we don't do a good enough job of teaching our students how to be productively stupid – that is, if we don't feel stupid it means we're not really trying. I'm not talking about 'relative stupidity', in which the other students in the class actually read the material, think about it and ace the exam, whereas you don't. I'm also not talking about bright people who might be working in areas that don't match their talents. Science involves confronting our 'absolute stupidity'. That kind of stupidity is an existential fact, inherent in our efforts to push our way into the unknown. Preliminary and thesis exams have the right idea when the faculty committee pushes until the student starts getting the answers wrong or gives up and says, 'I don't know'. The point of the exam isn't to see if the student gets all the answers right. If they do, it's the faculty who failed the exam. The point is to identify the student's weaknesses, partly to see where they need to invest some effort and partly to see whether the student's knowledge fails at a sufficiently high level that they are ready to take on a research project.

Productive stupidity means being ignorant by choice. Focusing on important questions puts us in the awkward position of being ignorant. One of the beautiful things about science is that it allows us to bumble along, getting it wrong time after time, and feel perfectly fine as long as we learn something each time. No doubt, this can be difficult for students who are accustomed to getting the answers right. No doubt, reasonable levels of confidence and emotional resilience help, but I think scientific education might do more to ease what is a very big transition: from learning what other people once discovered to making your own discoveries. The more comfortable we become with being stupid, the deeper we will wade into the unknown and the more likely we are to make big discoveries.

Importance of Ignorance

Ignorance of the topic makes it easier to think out of the box and come up with a creative, never-thought-of solution.

Ignorance of the topic makes it easier to detect flaws in the reasoning of people who have done the existing work in the area.

Ignorance, not Stupidity

There is an important distinction between stupidity and ignorance.

It's hard to get a Ph.D. if you are stupid, …

but all Ph.D. theses start from ignorance about solutions to some problem, maybe even about what is the problem …

and end up with a clear problem, a new solution, and thus, new knowledge.

Finding Topics and Postdocs

I cannot overstress the importance of being able to find *your own* topic …

and not relying on your advisor to find one for you.

(Of course, you may need to work on your advisor's topic to get paid, …

but at least be *able* to find one on your own!)

Biggest Problem of a Postdoc

A postdoc, fresh out of grad school with a brand new PhD, with a half dozen publications, all with the advisor, under the belt …

spends the entire postdoc trying to find a topic for the next paper and …

cannot find one.

The thesis topic has been wrung dry, and …

no suitable new topics present themselves.

A Failure to Launch

The postdoc is so used to the advisor's finding topics that he or she has not learned to find them.

He or she is great at solving problems, but is incapable of finding problems to solve.

Failure to Launch, Cont'd

I have even seen some postdocs, who …

when thrown some new, open, previously unconsidered questions related to, but not directly arising from his or her thesis research …

not only cannot begin to answer the question (which is actually OK)

but also cannot see the potential research lurking in the questions.

Failure to Launch, Cont'd

This postdoc is destined to go nowhere in a career that depends on finding research.

This is why I say that the most important part of graduate studies is finding a topic and …

that it's best done by the student him- or herself!

You Gotta Be Curious

As I said a few slides ago, “If you cannot find such a topic, you are not suited for a Ph.D. career, because your future research depends on finding good topics.”

You gotta get to the point that you are naturally curious about a whole lot of things.

You Gotta Be Curious, Cont'd

If you are, then questions in your research area and elsewhere will come to you often enough, …

in fact, giving you more questions than you can ever hope to answer in a lifetime, or two, or three, ….

But who knows, you might end up moving into other areas, as I explain later.

Correct Dissertation Structure

According to Kevin Ryan:

1. **Frame the problem — real and unsolved**
   - **Context**
   - **Scope**
   - **Testable objectives**
2. **Related to previous work — read widely**
3. **Approach**
4. **Solution**
5. **Show evidence that problem is solved**
6. **What was achieved**

Another Good Structure

Silvia Miksch has lots of tips on *How to do Research*

including on “How to Organize your Thesis”

http://www.ifs.tuwien.ac.at/%7Esilvia/research-tips/

Still Another Good Structure

My favorite:

- **Statement of the problem**
- **Why problem is important (Thanks to Orlena Gotel)**
- **Why problem is difficult**
- **Past attempts at solution**
- **Why past attempts failed to solve problem**
- **New approach to solve problem**
- **Why believe that new approach will solve problem or at least will not fail**

Another Good Structure, Cont'd

- **Plan for demonstration of effectiveness of new approach**
- **Do it!**
- **Report success or failure to do what you set out to do**
  - **If success, lay out future work**
  - **If failure, analyze why and lay out suggestions for future attempts at a solution**

It is still acceptable if...

In a true scientific discipline, failure to prove hypothesis is acceptable, and a dissertation reporting the reasons for the failure is acceptable. Without the analysis, the dissertation is not acceptable.

It is also acceptable for the solution not to be entirely technical, even to be non-technical, *if* the problem is genuine and that's where the solution went.

Failed to Prove Hypothesis?

If you don't get the results you or your advisor hoped for, …

remember that in a true science,

"You own the science, not the hypothesis!"

Extreme Example

Suppose that the problem you're solving is of how we can ensure that programmers produce only correct and reliable software.

Clearly, this is a tough, unsolved problem.

Clearly, if you solve it, you have made a big, important contribution to software engineering.

Extreme Example, Cont'd

If you could prove by a well-designed internally and external valid controlled experiment that feeding all programmers milk and cookies at the beginning of each programming day significantly improves the correctness and the reliability of the software that they develop, …

Extreme Example, Cont'd

then in my book, not only do you deserve a Ph.D., but you should probably get some kind of scientific prize, for having solved a *very difficult problem* and in an unexpected way (given our traditional preference for technical solutions).

Extreme Example, Cont'd

Of course, this all depends on the quality of your experiment and how you measure correctness and reliability of the software …

and those measures may be part of your contribution.

Myth

“A (Computer Science) Ph.D. thesis must have a strong theoretical component.”

Poppycock!

Reality

A Ph.D. thesis must contain a creative solution to a heretofore unsolved difficult real problem.

Whether it has or even needs theory depends on the discipline from which the problem comes and the discipline in which you are getting the Ph.D.

Different Kinds of Theories

If you are a math major, and you are trying to forge some new mathematics or solve a problem that has defied solution for centuries, then your thesis will have a lot of theory, i.e., mathematical theory.

Different Theories, Cont'd

If you are an engineering major, and you are trying to show that a new method to build bridges is much better than those used in the past, you may use mathematics to calculate parameters of any particular bridge and to show how to measure how much better your method is than existing methods.

If you are a physics major, and you are trying to advance string theory, your thesis will have a lot of mathematics.

Different Theories, Cont'd

If you are a physics major, and you are trying to show that string theory corresponds to reality, then your thesis may not involve much new theory, but it will involve experimentation to show that a hypothesized effect predicted by the theory is reality.

Different Theories, Cont'd

If you are a sociology major, and you are trying to explain a social phenomenon, then you will devise a theory explaining the phenomenon and then you will do a controlled experiment testing whether a hypothesized effect predicted by the theory holds.

For example, you would need to explain *how* eating milk and cookies makes one a better programmer.

Different Theories, Cont'd

The difference between the physics and sociology theory are in the tolerances of acceptable deviations from the prediction under which the theory is accepted as valid.

Different Theories, Cont'd

Note also, that the word "theory" has different meanings:

mathematics theory
physics theory
sociology theory
legal theory.

are all different.

Key Requirement for Thesis

The key issue is whether you are finding a creative solution to a heretofore unsolved difficult real problem, however each term in that phrase is defined for your field.

Computer Science Ph.D. Thesis

So what about a Computer Science Ph.D. thesis?

It depends on the area..

The beauty of Computer Science is that it both admits of and needs approaches of many different fields.

Computer Science Ph.D., Cont'd

You may use mathematical methods in CS Theory and in Formal Methods.

You may use engineering methods in System Security.

You may use mathematical, engineering, and sociological methods in Software Engineering.

Methodological Advice, Cont'd

(* means from Kevin Ryan)

***Don't try to solve all the world's problems.**

Scope the work to something doable in 1 calendar year.

***Measure your progress.**

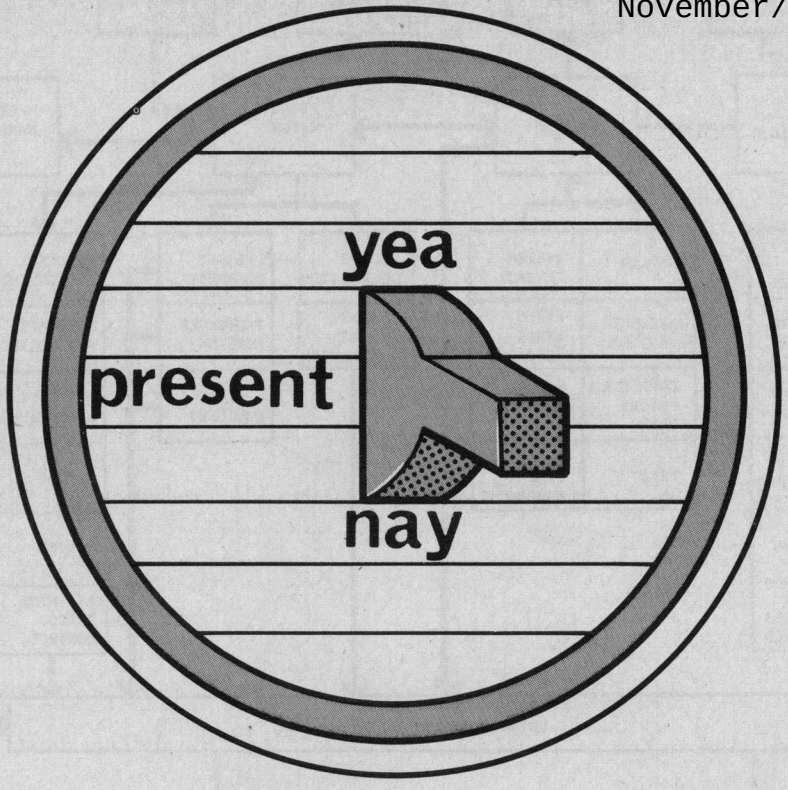
***Stay focussed.**

But DO Get a Life!

It’s nice to have a diversion from the onerous burdens of getting a Ph.D., …

like one Dr. Frank B. Ryan, the creator of the first ever e-voting software, had:

IEEE Computer November/December 1972



The Electronic Voting System for the United States House of Representatives

Frank B. Ryan

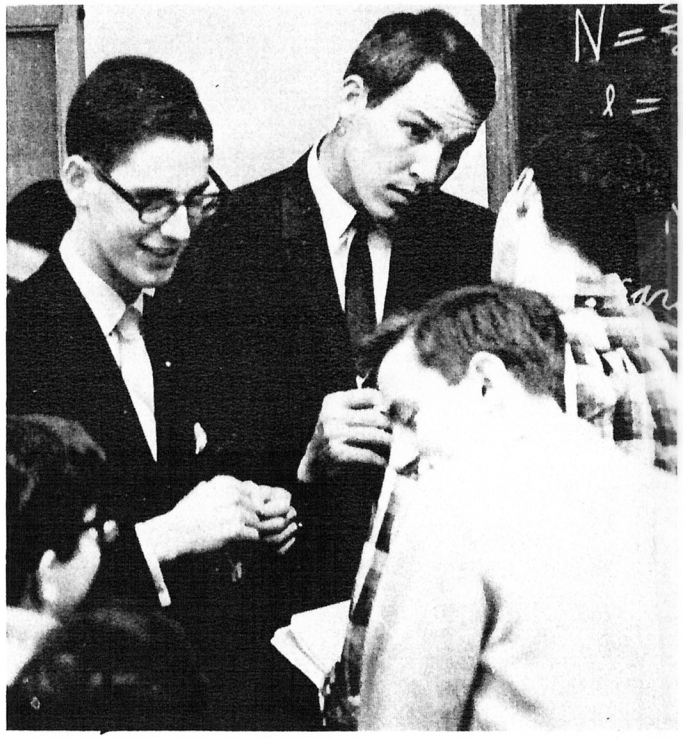
identifying himself to the system, and then depressing one of three buttons on the station – YEA, NAY, PRESENT – to indicate his preference. Cathode ray tube devices, as well

Shaker Mathematic Society Creates Sensation

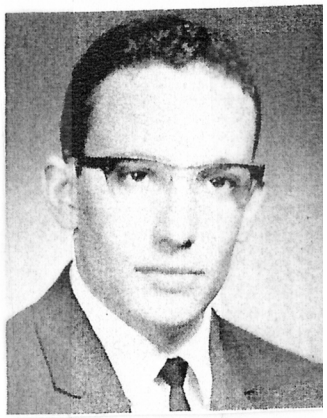
Frank Ryan on sets: "After I get set in the pocket, I look for the setback . . ."

Planning weekly meetings and writing the biennial math review kept the Math Club officers busily calculating. The high point of the year was Frank Ryan's visit. He spoke to the members and various other avid admirers on the set theory. President Larry Barker, who invited Mr. Ryan to speak, boosted Math Club's prestige immensely by that meeting.

For the rest of the year the club settled back into the routine of average speakers and medium sized audiences. The vivacity of club sponsor Jim Bristol added much to the interest of the meetings, which were held for the most part in his room.



Frank Ryan autographs Harvey Mechanic's T-shirt.



DANIEL BERRY Bowling 2, 3; Debate Club 3, 4; Math Club 2, 3, 4.

Dr. Frank B. Ryan is currently Director of House Information Systems, U.S. House of Representatives, and is on leave of absence from his position as Associate Professor of Mathematics at Case Western Reserve University.

Dr. Ryan was born in Fort Worth, Texas, on July 12, 1936. He was educated in the public schools of Fort Worth and attended the Rice Institute on an athletic scholarship in football. He received a BA Degree in Physics from Rice in 1958. This was followed by an MA in Mathematics in 1962 and a Ph.D. in Mathematics in 1965, both earned at Rice University. His active research pursuits in mathematics include boundary behavior of analytical functions, with an emphasis on geometric function theory.

Along with his ongoing interests in mathematics and computer sciences, Dr. Ryan continued in athletics as a professional football quarterback in the NFL for 13 years. This career included stints with the Los Angeles Rams, the Cleveland Browns, and the Washington Redskins. Dr. Ryan led the Browns to the World's Championship in 1964 and was three times elected to the Pro Bowl Game.

In his current assignment with the House of Representatives, Dr. Ryan heads up a staff attached to the Committee on House Administration. His duties include the design, purchase, and installation of all computer systems related to the House of Representatives. In addition, his staff will coordinate the computer activities and data processing systems of all supportive units and offices of the Congress over which the Committee has jurisdiction. He will also act as Congressional coordinator of computer operations for the House in conjunction with other branches and agencies of government.

Creative Means of Support

The acknowledgements in Ryan's 1965 Math PhD Thesis, "A Characterization of the Set of Asymptotic Values of a Function Holomorphic in the Unit Disc", says:

"My thanks to Rice University, the Air Force, and the NFL for financial support during the preparation of this thesis …

Most of all, let me thank my wife for her patience during the past seven years."

Weight of a Dissertation

A dissertation is the equivalent of from one to three journal papers, depending on paper sizes, the journal, and the university. Therefore, it does not have to be a life's work. It's only your first of many, many papers (that is, if you go into academia).

Weight of a Dissertation, Cont'd

Each dissertation requires four months of uninterrupted work.

- **The last month of work takes .5 calendar month.**
- **The second last month takes 1.5 calendar months.**
- **The first two months can take years, and usually does, ...**

Weight of a Dissertation, Cont'd

but you can get it down to 4 calendar months. (How do I know? I had one Ph.D. student, Richard Schwartz, who did the entire dissertation from conception through to filing in 6 months. Of course, the fellow is very motivated and he is into his third successful start up already.)

Ph.D. Thesis is Like a Tunnel

When you are deep in the throes of research and writing, the goal is to finally see the light at the end of the tunnel.

One of my early Ph.D. students, Dick Kemmerer, once remarked that finding a thesis topic is like looking for the dark at the beginning of a tunnel that is well hidden by a dark forest!

Confront Your Fears

Anthony Finkelstein says “Identify your biggest fear and confront it!”

Fears

Two closely related fear phenomena:

- **fear of making mistakes**
- **imposter syndrome**

Fear of Making Mistakes

The fear is of making mistakes in public, either in writing or speaking.

Since writing undergoes reviewing before going out, the greatest fear is of making mistakes while speaking, when one is speaking without the benefits of notes:

Fear of Mistakes, Cont'd

e.g., during

- **research brainstorming**
- **discussions at workshop or conference sessions**
- **questioning after a prepared talk**

The latter is most frightening, because if a question that you have not thought of before comes up, you might make a HUGE mistake in answering it.

Fear of Mistakes, Cont'd

And you cannot bow out of answering a question about your work, while you can simply not speak up during brainstorming and discussions.

What Makes a Ph.D.

What makes a Ph.D. is not that you never make mistakes.

It's that you take chances with cool ideas, trying something out of the box.

Some ideas are wrong, but enough are right that you end up making significant new contributions to knowledge.

What Makes a Ph.D., Cont'd

What makes me able to stick my neck out with solution ideas, questions, comments, on-the-fly answers to hard questions, observations, hypotheses, thesis ideas, and research problem ideas is that I really don't give a s--t if what I say happens to be wrong or a mistake.

What Makes a Ph.D., Cont'd

It does not bother me to reveal that I am ignorant on some topics.

I know that I am not stupid, even though I may be ignorant about the topic at hand.

(Recall the distinction between stupidity and ignorance.)

Also I know that I am not ignorant about a whole lot of things.

If You Publish a Mistake

So what if you make a mistake!

No less than Don Knuth has. He published a correction.

Actually, he published a correction to his correction!

I Published a Mistake!

Someone wrote to me about a mistake I made building a dynamic PostScript font for Arabic and Persian letter stretching.

While I stretched, I did not respect calligraphy rules.

I ended up being on the committee to evaluate his Ph.D. thesis that showed my mistake and how to fix it.

I gave him a high evaluation, and he passed!

Words to Remember

There is nothing wrong with being wrong, …

if it's occasionally and …

***especially* if you learn from it!**

Imposter Syndrome

Someone has the imposter syndrome when he has a deep seated fear that he is not smart enough to have *earned* the Ph.D. that he received, …

and therefore lives in constant fear of being discovered to be an imposter Ph.D.

Imposter Syndrome, Cont'd

He believes that each mistake he makes publically runs the risk of exposing his impostering.

The imposter syndrome happens to be common more in women, but does occur in men too.

Self Fulfilling Prophecy

The irony is that the imposter syndrome sets up a kind of a self-fulfilling prophecy.

Your fear of being discovered to be an imposter causes you to fear to take chances, to fear to speak up.

***That* causes people to wonder how you managed to get a Ph.D. or to believe that your star has burned out, and …**

people begin to think of you as an imposter.

The Facts Are

You *are* good!

Otherwise, you would not have gotten where you are today, close to or with a Ph.D.

On average those who determine whether your work deserves a Ph.D. are not idiots.

The Facts, Cont'd

Certainly by the time you get the Ph.D., you have passed through enough people that the chances of slipping through with only idiots judging your work is zilch.

Besides which, you are insulting us, your advisor and committee members, by implying that we don't know a good Ph.D. thesis when we see one!

Methodological Advice, Cont'd

***Be skeptical; don't believe everything you read.**

***Be skeptical; don't believe everything you are told, even by your advisor.**

Read a lot, particularly, of published works (A published work has been reviewed by at least a few people.

Ask a lot of questions about these works.

About Asking Famous People

I have noticed many people, particularly students, are scared to ask famous professors questions, particularly about papers the profs have written.

Don’t be scared!!

Your questions show

1. **that you are *interested* in the prof’s work, and**
2. **that you have *read* the prof’s papers.**

Asking, Cont'd

What prof could complain about either of those?

I for one am *really pleased* to see that someone other than the authors, the three referees, the copy editor, and the typesetter has *read* the paper, and has read it closely enough to have questions.

So forget the fame of the prof and just go up and ask or just send e-mail and ask!

Asking, Cont'd

And if you don't get an answer after a week, then send the questions again.

- **Important e-mail does get filtered out as potential spam.**
- **Important e-mail does get lost among all the spam.**
- **Many profs are just overloaded to the point that their e-mail boxes have become pushdown stacks that never get popped.**

Methodological Advice, Cont'd

***Shut up and write!**

Don't only talk with your advisor, send e-mail; this way you have written what you said and you may have even written a section of your dissertation.

On the other hand, do *meet* with your advisor face to face.

Methodological Advice, Cont'd

***Expose your ideas regularly.**

***Write early and often. (Vote early but only once!)**

Publish!

Rejection Letters

Don’t be afraid of rejection; you’ll live!!

See the rejection letter that Ike Nassi and Ben Shneiderman got on their first paper about what became known as Nassi–Shneiderman Diagrams:

http://www.cs.umd.edu/hcil/members/bshneiderman/nsd/rejection_letter.html)

Ike & Ben's Rejection Letter

One reviewer wrote, "I feel that the best thing the authors could do is collect all copies of this technical report and burn them, before anybody reads them."

Nevertheless, they published elsewhere.

The work ended up making them famous and spawning a lot of research activity by others.

We Are Sorry to Inform You

“We Are Sorry to Inform You” by Simone Santini in *IEEE Computer* 38:12, December 2005, shows rejection letters for some of the most seminal papers in CS:

Abstract: The author ponders how much damage could occur when a reviewer has a bad day.

We Are Sorry, Cont'd

- **Edsger Dijkstra, "Goto Statement Considered Harmful"**
- **Ted Codd, "A Relational Model of Data for Large Shared Data Banks"**
- **Alan Turing, "On Computable Numbers, with an Application to the Entscheidungs Problem"**

We Are Sorry, Cont'd

- **Claude Shannon, "A Mathematical Theory of Communication"**
- **Tony Hoare, "An Axiomatic Basis for Computer Programming"**
- **Ron Rivest, Adi Shamir, and Len Adelman, "A Method for Obtaining Digital Signatures and Public-Key Cryptosystems"**

We Are Sorry, Cont'd

Each was later published, usually in another journal.

Dijkstra's was published as a letter to the editor at the suggestion of the rejector, to avoid peer reviewing!

Read the reviews in the article!

My Opinion of the Reviews

To my mind, rejecting a paper on the grounds that

1. **no one will ever use what is described in the paper because it's too different from what we use now, and what we use now is just fine, or**
2. **it will never work given computer memory and speed constraints,**

is illegitimate, given how accurate predictions about computing have been and how fast things change and get faster and larger.

My Opinion, Cont'd

But, some of the comments have to do with the lack of evaluation of the ideas presented in the paper, and *those are* legitimate.

It's interesting to see that the insistence on evaluation is not as new as it might seem.

What to Do with Such a Review

If you get reviews like that, and the paper is rejected, …

Revise the paper to deal with the real problems the reviewers found.

Add paragraphs dealing with the issue in the illegitimate comments, e.g., “Some believe that … will never …. However, …”

What to Do, Cont'd

Submit to another journal.

The first journal lost your paper …

as a result of its EiC's shortsightedness in listening to the rejecting reviews!

Resubmitting a Rejected Paper

Make sure that you have revised the paper to deal with *all* real problems any reviewer found.

There is a good chance that the sets of new and old reviewers have a non-empty intersection.

Resubmitting, Cont'd

Your not having revised a reviewed paper is grounds for summary rejection!

Reviewers' time is valuable; don't waste it, …

***even* when *your* paper's reviewers are idiots.**

Publishing

Go for journals, not conferences, to publish your results. Journals are a lot easier and count more in hiring and promotions. Conferences are very hard, because the committee has to reject 80% of the submissions by a short deadline. The slightest problem with the paper leads to its rejection. In a journal, the same problem would lead to the referee saying, “Accept the paper pending certain revisions.”

Publishing, Cont'd

Of course, you may need to have a paper accepted to a conference to get the funds to attend the conference.

Also, it's good to go to conferences

- **to learn what is going on in your field and**
- **to meet your future colleagues and to network.**

Publishing, Cont'd

When your paper is rejected, treat all the stupid remarks from the idiot referees as indications that *you* did not write clearly enough that even *they* would get your point.

Don't take criticism personally; it's criticizing your work, not you. It's criticizing the work, even if they say "*You* made a MISTAKE! Nya Nya!"

Publishing, Cont'd

Actually, some critics may *be* personal; there are lots of people with low self-esteem around, who have to put down others. However, *you* have the choice not to take it personally. You *know* that you're smart but human, and thus you make occasional mistakes that do not detract from your basic smartness.

Something is Rotten in the State of Conferences

Some reviewers of some conferences, particularly the flagship conferences in some CS areas, including SE areas, have inflated views of these conferences.

Each of these reviewers believes that the conference in question has become more than a just a conference, even more than just a journal.

Rotten, Cont'd

The conference has become more prestigious than its area's journals, in that a publication in the conference counts more in hiring and promotions than do the journals.

Rotten, Cont'd

The reviewer believes that his or her job is to protect the journal's virtue and prestige by driving its acceptance rate down, by rejecting as many papers as possible.

Often this reviewer is a key person in the field that people in the field respect and listen to.

Rotten, Cont'd

The clearest symptom that you got one of these reviewers is that your 10-page paper was rejected and you get a review that reads like:

"This well-written paper presents the beginnings of a good idea X." (and you think, "So, why wasn't the paper accepted?", but you read on.)

"However, it fails to consider or deal with A, B, C, D, E, F, G, H, I, and J."

Rotten, Cont'd

And you realize that to do A through J, would require an additional 10 pages, 10 pages over the page limit of 10 pages.

You know this because you had written a 20-page full paper and spent two weeks deciding what to cut out to get it down to size, hoping that the brief summary of what was cut out would satisfy the reviewers (it did not! ☹)

Rotten, Cont'd

What to do?

Just go to a journal. The conference missed a chance to have your paper.

The divine justice will be that the same conference will beg later to publish a summary of your journal paper in its journal-first track! ☺

Rotten, Cont'd

I no longer submit to ICSE and FSE/ESEC.

After 3 rejections in a row like this, in which the corresponding full papers were all accepted in the first round by journals, …

I just stopped submitting to these conferences.

I am thinking of doing the same for RE.

Rotten, Cont'd

Some ideas require more than a conference-sized paper to do justice. It's not worth the effort to cut it down, …

especially when everything you would cut out is critical to the paper.

Methodological Advice, Cont'd

Believe in yourself.

Have confidence in your results.

Be aware of a tendency to procrastinate.

Doug Dykaar calls graduate students "gradual students"!

Newton's 3 Laws of Graduation

From somewhere in the Internet:

1. **A grad student in procrastination tends to stay in procrastination unless an external force is applied to it.**
2. **The age, *a*, of a doctoral process is directly proportional to the flexibility, *F*, given by the advisor and inversely proportional to the student's motivation, *m*.**
3. **For every action toward graduation there is an equal and opposite distraction.**

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NEWTON'S THREE LAWS OF GRADUATION

Though famous for his seminal work in Mechanics, Isaac Newton's theories on the prediction of a doctoral graduation formulated while still a grad student at Cambridge remain his most important contribution to academia.

FIRST LAW

"A grad student in procrastination tends to stay in procrastination unless an external force is applied to it"

This postulate is known as the "***Law of Inertia***" and was originally discovered experimentally by Galileo four years before Newton was born when he threatened to cut his grad student's funding. This resulted in a quickening of the student's research progress.

Galileo's observations were later perfected by Descartes through the application of "Weekly Meetings."

Before Galileo's time, it was wrongfully thought that grad students would rest only as long as no work was required of them and that in the absence of external forces, they would graduate by themselves.

(From Encyclopaedia Britannica)

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JORGE CHAM ©THE STANFORD DAILY

title: "Newton`s Three Laws of Graduation" - originally published 3/8/2001

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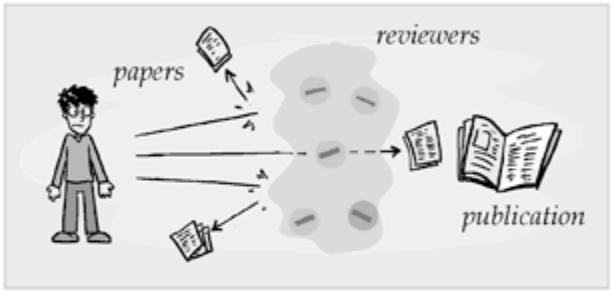
An Introduction to

QUANTUM Gradnamics

During the first half of the 20th Century, scientists struggled to explain graduation phenomena that could not be accounted for by classical Newtonian graduation mechanics*.

In particular, scientists struggled with the paradoxical *dual nature* of the relationship between grad students and their advisors.

On the one hand, graduate students were known to produce discrete papers like their supervisors and assumed to be intellectually on par with them.

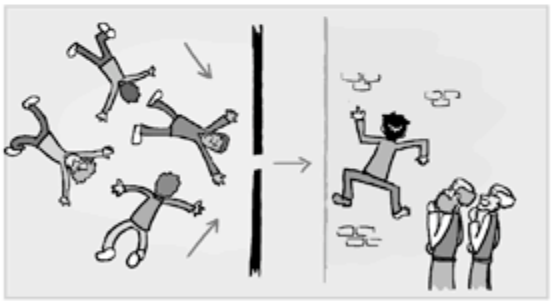


Ernest Rutherford's "Foiled Submission" experiment demonstrated that academia is made up of indiscrete matter that is largely empty.

Yet simple experiments showed that graduate students had no idea what they were doing and only followed what their supervisors told them to do.

Thus the question became: are graduate student indentured servants (slaves) to their supervisors, or are they as intellectually capable as professors (part equals)?

This became known as the "Slave/Part-equal Duality" and it forms the basis for the branch of physics called Quantum Gradnamics.



The infamous slit experiment, wherein grad students made to pass through a narrow slit (quals) are later found in a scattered and incoherent state.

*see http://www.phdcomics.com/comics.php?n=221

title: "Quantum Gradnamics, pt. 1 of 3" - originally published 10/24/2007

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An Introduction to

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Another principal concept in Quantum Gradnamics is the observation that graduate students do not move toward graduation in a steady and continuous manner. Rather, they make progress through discrete bursts of random productivity called "wanta" (short for "want data") whose energy is proportional to the frequency of meetings with their advisor.

Grad students, or "p-ons" as Einstein called them, can only occupy a discrete number of energy states:

"I discard all hope of predicting hitherto unpredictable quantities, such as my graduation."
- Werner Heisenberg

A direct consequence of this is the "Heisenberg Uncertain-Thesis Principle", perhaps the most well-known theorem of Quantum Gradnamics. Developed by Heisenberg during a particularly unproductive period in his graduate career, the principle states that it is not possible to know where a grad student is and where it is going at the same time:

no idea what they are doing × *no idea what they're doing with the rest of their lives* > *Normal amount of Uncertainty*

When probed under pressure, a grad student will either blurt out what they are doing (but won't know if it means anything), or they will blurt out what they *plan* to do (but won't know *how* to do it). Simply put, there is an inherent degree of certainty and precision that is missing from their everyday life.

Heisenberg attributed this to the fact that meetings with professors are *non-communicative* (that is, the order in which orders are given doesn't tell you whether they are worth doing).

title: "Quantum Gradnamics, pt. 2 of 3" - originally published 10/26/2007

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Although Quantum Gradnamics explains many of the phenomena in pursuing a Ph.D., most aspiring scientists still object to such an uncertain and probabilistic description of academic reality.

The Austrian scientist Erwin Schrödinger was particularly uncomfortable not knowing whether he would ever graduate or not, and illustrated this with his now famous thought experiment known as "Schrödinger's Cubicle."

According to the experiment, grad students exist in a state of both productivity and unproductivity (many students do report feeling like...

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Schrödinger's Cubicle

1. Place grad student inside closed cubicle
2. Set up computer, coffee and internet connection
3. Wait a few years

Years

...they're in limbo the whole time). Only direct intervention reveals whether or not an enormous amount of time has been wasted, a phenomenon known as "expectation collapse".

Einstein was also uncomfortable with this indeterminate view of academia and openly disagreed with the Copenhagen Interpretation, which states that graduation is an entirely random process. In deciding whether or not to graduate a student, Einstein famously said, "Professors don't throw dice (do they?)."

More recent theories describe grad students as soggy strings of ramen noodles, which is just as useful.

(thanks to Wikipedia for all the background info)

title: "Quantum Gradnamics, pt. 3 of 3" - originally published 10/29/2007

Methodological Advice, Cont'd

Procrastination, the ultimate seduction!

The biggest problem with many a person doing research and in particular writing a research paper, such as a Ph.D. thesis, is the lure of the immediate, easily disposed of duties: …

Immediate Duties

e.g., checking his or her e-mail; replying to important e-mail; browsing the news sites for all places in which he or she has lived; dealing with Facebook friends; staying up to date with Twitters; updating his or her blog; staying ahead of the students in the class he or she is teaching; doing his or her daily errands, including buying food; keeping in personal touch with his or her family and friends; etc.

Immediate Duties, Cont'd

Very quickly, the day is over and he or she has done almost nothing towards finishing the research or writing.

"Methodological Advice, Cont'd"

See what Jorge Cham, the author of *Ph.D. Comics* at www.phdcomics.com has to see about the reasons for procrastination. Read it, laugh at it, but don't be like its characters!

The following strips are reprinted from *Piled Higher and Deeper* by Jorge Cham by permission of Jorge Cham.

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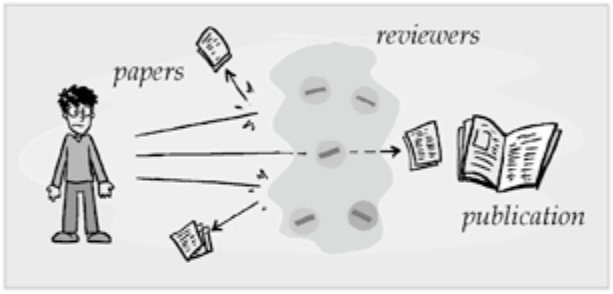

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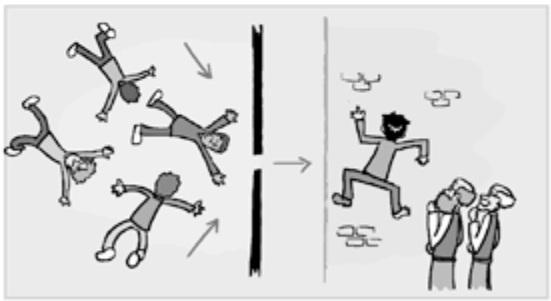

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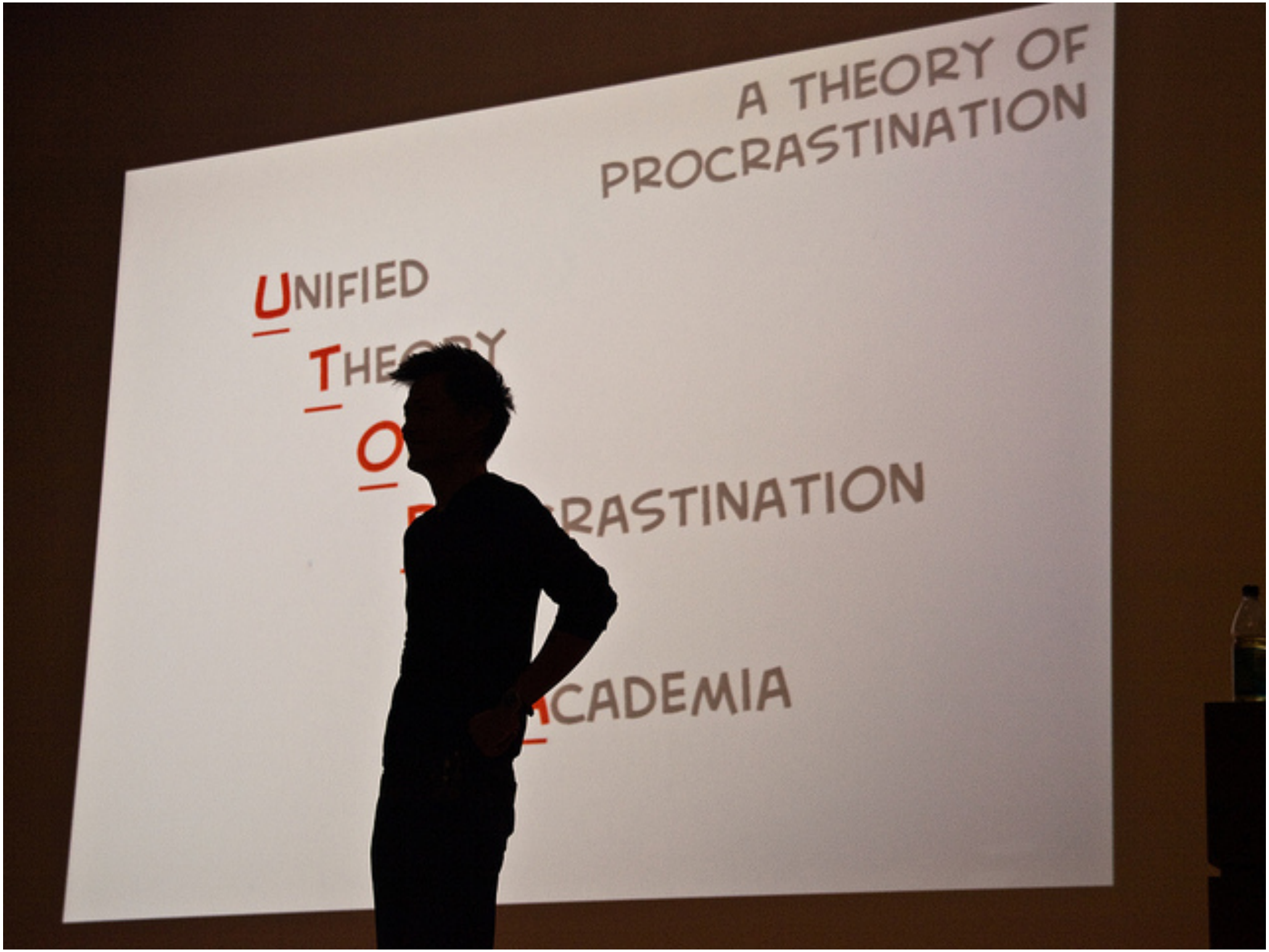
About Jorge Cham

BTW, the author of these comics, Jorge Cham, unlike his strip's characters, finished his Ph.D. in due time and got an academic job at Caltech (the venue of *Big Bang Theory*).

About Jorge Cham, Cont'd

He resigned and became an adjunct after he determined that he could make a *lot* more money by working full time on …

- **writing new episodes often,**
- **syndicating his comic strips,**
- **editing books of collections of strips,**
- **maintaining his Web site,**
- **scripting and producing a movie made based on the strip, and**
- **traveling the world, giving a lecture on procrastination (It's GREAT!).**


A THEORY OF
PROCRASTINATION
UNIFIED
THEORY
RASTINATION
CADEMIA

PHD Comics Jorge Cham & Dan Savage

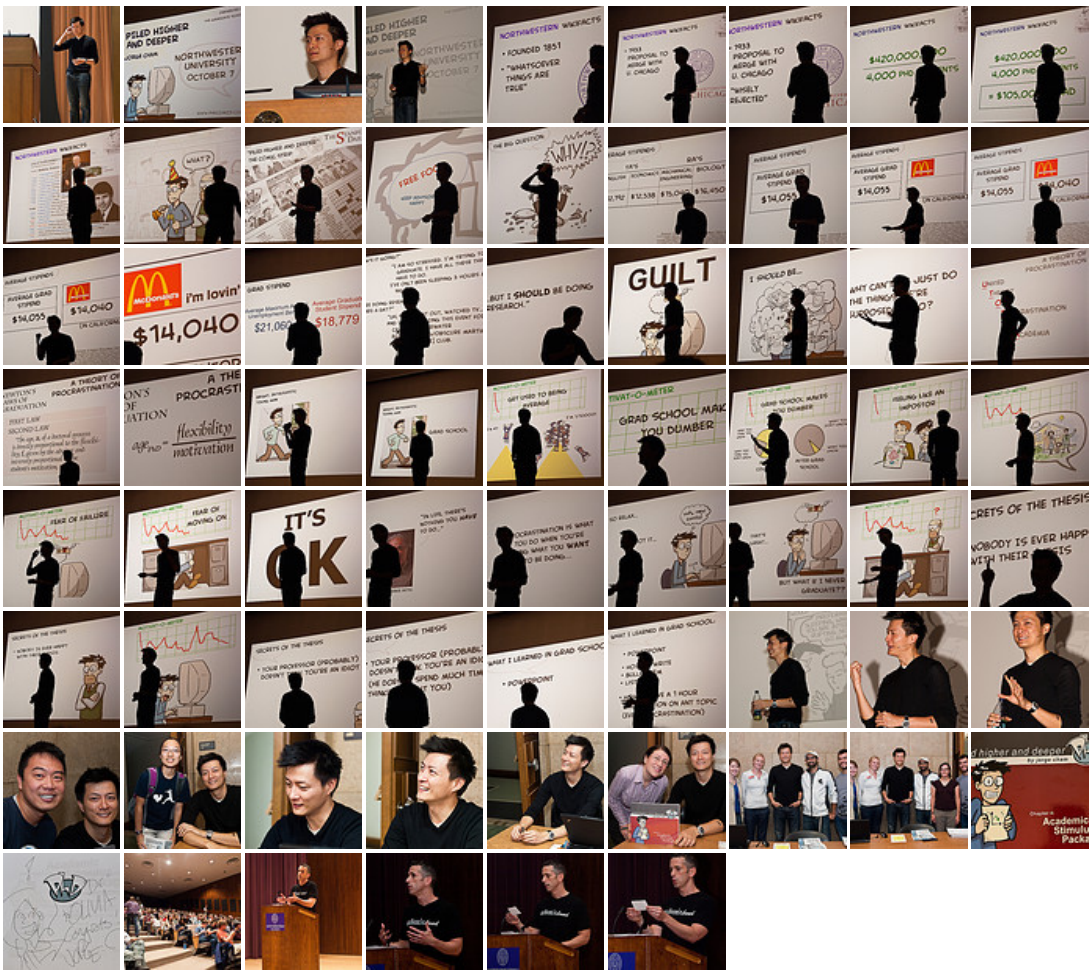
October 7, 2010
Northwestern University

PHD Comics author Jorge Cham talks on "The Power of Procrastination"

Dan Savage
"Savage Love Live"

69 photos | 83 views

items are from 07 Oct 2010.



The Life Lesson in Jorge's Life

So once you have your Ph.D., it does not have to be your whole life.

Go where your interests take you.

For example, I write and publish Biblical commentary and scientific humor.

Methodological Advice, Cont'd

Beware of university deadlines.

Know when you're done.

Methodological Advice, Cont'd

Tell your advisor that you are done when you are done; don't wait to be told when you are done.

If you cannot tell when you are done, you do not deserve the Ph.D. because you will not be able to know when to stop your future research to publish.

Methodological Advice, Cont'd

If I am not for myself, who will be?
If I am only for myself, what am I?
If not now, when?
—The Ethics of the Fathers

You gotta really really want to get this Ph.D. because there's so much s--t work involved that it's not worth it otherwise.

It is as much a tale of perseverance as it is of creativity, knowledge, and work.

Methodological Advice, Cont'd

Some advisors treat their students as equals. Such an advisor expects you to be his or her equal.

Some advisors treat their students as assistants. Such an advisor expects you to be his or her assistant.

Methodological Advice, Cont'd

If your advisor expects you to be his or her equal, then act as your advisor's equal, calling him or her by private name, e.g., "Hey Dan!".

If he or she is wrong about a technical issue, then say so. Your advisor will appreciate the chutzpah.

Methodological Advice, Cont'd

If your advisor expects you to be his or her assistant, then act as your advisor's assistant, calling him or her "Prof. X" or "Dr. X".

If he or she is wrong about a technical issue, then you must nevertheless inform him or her, but very gently! Your advisor will appreciate the respect.

Methodological Advice, Cont'd

Some advisors don't care one way or the other.

Each advisor is different.

So learn about your advisor.

Build a good working relationship.

The Exams

There are three exams that you will probably have to do,

1. **the Knowledge Exam, proving that you know the field,**
2. **the Proposal Exam, in which you present the proposal for your Ph.D. research and dissertation, and**
3. **the Defense Exam, in which you defend your Ph.D. dissertation**

The Exams, Cont'd

A given place may not have 1 or 2 or even, rarely, 3.

Most places have all three.

Sometimes 1 is written; sometimes course grades are used in place of 1.

Almost every place has 2 and 3.

2 is missing more often than 3.

Knowledge Exam

The knowledge exam is the *toughie*.

It is where a number of students get flushed out.

This is where you really need to study!

It’s a serious exam in all senses of the word!

Don't Fret the Others

Most students fret the proposal exam and the defense exam, but really, these exams are not all that hard.

I have never heard of anyone flushed out in either of these exams; at most you may have to repeat it.

They really should not be called exams, but tradition reigns!

In any case, the proposal exam can and should be used to your benefit.

Proposal Exam

First, the proposal exam is not a real test in the sense of making sure you know your stuff.

At that stage of your career, it is already abundantly clear that you know your stuff. The knowledge exam (or its substitute) proved that!

The issue is whether what you propose to do is enough to warrant getting a Ph.D. if you do what you propose.

Proposal Exam, Cont'd

Of course, the committee is concerned that you know all the background and previous work relevant to your dissertation topic, but if you have done your homework, you probably know this stuff *more* than any committee member.

You are already one of the world's experts.

Proposal Exam, Cont'd

Instead of fretting, use the proposal exam to your benefit, to get a commitment from the committee as to

- **the scope of your work and**
- **most importantly, what is required to get the Ph.D.**

This is where you try to arrange that a smaller amount of work be accepted as having completed the Ph.D.

Proposal Exam, Cont'd

This is where you get a commitment that doing an experiment correctly earns you the Ph.D., *regardless* of the conclusions.

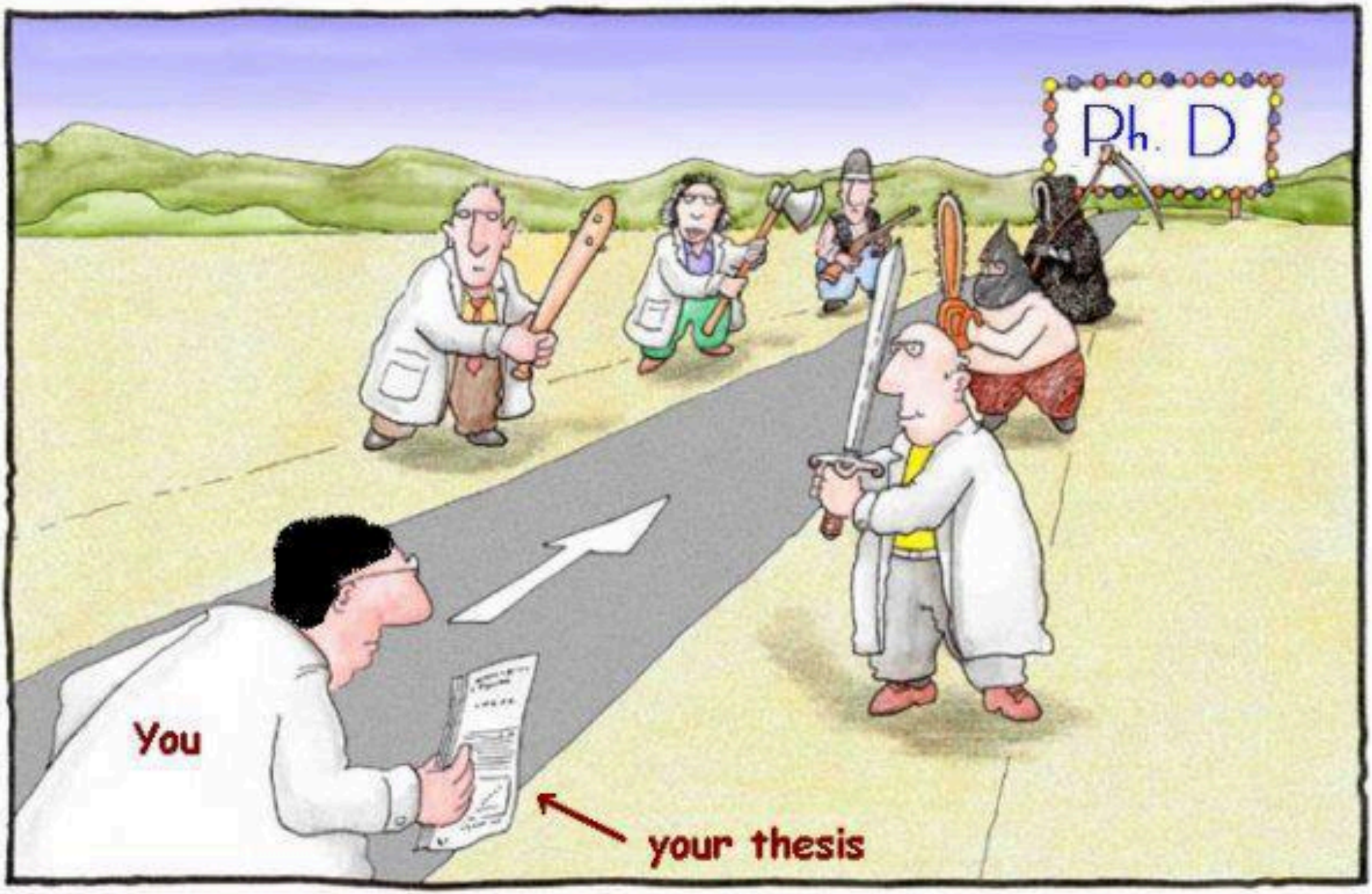
This is where you get a commitment that building a prototype of the tool and using it in a substantial case study earns you the Ph.D., *regardless* of whether or not the tool solves the problem it is supposed to!

Proposal Exam, Cont'd

Treat the exam as a negotiation; …

you are trying to minimize your requirements, and …

they are trying to maximize your requirements.


Ph. D
You
your thesis

Defense Exam

Most of all, do not fret the defense exam, …

***if* you and your advisor agree that you are ready and that you have met the scope and requirements agreed to at the proposal exam.**

Remember, *you* are the world's expert on the topic, even more than your advisor, and certainly more than any other committee member.

Defense Exam, Cont'd

You should be able to walk circles around any question about the topic thrown at you by any committee member.

So, focus on being relaxed, able to quickly access all that you know, and able to think on your feet.

Go to a good movie the night before, a comedy! (not a horror movie!)

Thoughts by Martin Glinz

Not everybody is a full-time Ph.D. student as I have been tacitly assuming

Some are:

- **doing a Ph.D. while employed in industry**
- **doing a Ph.D. while employed as an academic assistant**

More Thoughts by Glinz

Either of these can be a full- or part-time job.

In Europe, academic assistants are full time, while in North America, they are considered part time.

More Thoughts by Glinz

There are problems for all such employed Ph.D. students.

How to:

- **devote enough time to do the research,**
- **get one's head clear of daily business, and**
- **minimize context-switching overhead (in the head).**

More Thoughts by Glinz

There are *opportunities* for each!

In particular, one may find a Ph.D. research question and input from his or her employment work, and

sometimes these are the best, empirically based topics.

Acknowledgements

I thank my own Ph.D. advisor, Peter Wegner; a colleague, Jerry Estrin; and all my M.Sc. and Ph.D. students for teaching me about good advising.

These slides and pointers to other resources are at http://se.uwaterloo.ca/~dberry/#FinishingPhD

The End of Grad School

“The End of Grad School” is based on “The Sounds of Silence” by Paul Simon.

Alternate lyrics by Steven A. Wolfman, with thanks to the CSE Band, especially to Ken Yasuhara, for scansion assistance and word choice suggestions.

The Sounds of Silence:

Hello darkness, my old friend
I've come to talk with you again
Because a vision softly creeping
Left its seeds while I was sleeping
And the vision that was planted in my brain
Still remains
Within the sound of silence

The End of Grad School:

Hello caffeine my old friend
I've come to wire myself again
I should be back home in my bed sleeping
Instead I'm trying to write this thesis thing
But the chapters get jumbled in my head
Feels like lead
This is the end of grad school.

In restless dreams I walked alone
Narrow streets of cobblestone
'Neath the halo of a street lamp
I turned my collar to the cold and damp
When my eyes were stabbed by the flash
of a neon light
That split the night
And touched the sound of silence

Late last night I worked alone
That's when I heard the telephone
Headhunters spoke with tongues of honey
Weaving fever dreams of money
And the sound of ka-ching is rare for a PhC
We work for free
That was the end of grad school.

And in the naked light I saw
Ten thousand people, maybe more
People talking without speaking
People hearing without listening
People writing songs that voices never share
And no one dared
Disturb the sound of silence

“Fools”, said I, “You do not know
Silence like a cancer grows
Hear my words that I might teach you
Take my arms that I might reach you”
But my words, like silent raindrops fell
And echoed
In the wells of silence

“Fools,” said I, “you do not know
Research like a cancer grows
Hear my words that I might teach you
Tenure track will soon defeat you.”
With those words, to lecture I am bound
Abandoning the sounds of grad school

And the people bowed and prayed
To the neon god they made
And the sign flashed out its warning
In the words that it was forming
And the sign said, “The words of the prophets are
written on the subway walls
And tenement halls”
And whispered in the sounds of silence

And then some students knock on wood
Pray for three letters and a hood
A decade older than the new first-years
Sixty credit cards in deep arrears
Someday they'll think: "If I'll end up at Google,
I might as well go today.
I need the pay,
To make an end to grad school."

Footnote

The Ph.C., or Philosophical Candidacy, is the utterly meaningless degree one receives upon qualifying for the Ph.D. program, as with a successful preliminary, generals, or thesis proposal examination.

Preparing Conference Talks

The following advise was sent by Jennifer Widom (Stanford professor, and SIGMOD ’05 Program Committee Chair) to presenters at the upcoming SIGMOD conference. Many of these points are useful for any technical (or non-technical) talk that you might present, and therefore they are worth remembering for the future.

Tips for a good conference talk

- **Plan very carefully what you can cover in the allotted time. You have 25 minutes, and a conscientious session chair will ruthlessly cut you off if you attempt to exceed that limit.**

- **Design your slides with a large room and audience in mind. Use large fonts so your slides are visible from far away. As a general principle, don’t put too much on each slide.**

- **Given the time limit there's simply no way you can present all the results in your paper, so don't even try. Think of your talk as an advertisement — your goal is to entice the audience into wanting to read your paper. Motivate the problem; describe your overall approach and your major results. If your work includes experiments, pick a representative graph or two.**

- **Don’t put everything you want to say on your slides and then read them during your talk. You will captivate your audience by forcing them to listen to you, looking at the slides only for cues and diagrams.**

- **Keep your examples simple, emphasizing the main points, and give the audience enough time to digest each example.**

- **It is strongly recommended that you practice your talk several times, especially if you haven't given many conference talks in the past. Time your runs; get your friends to listen and criticize.**

- **If you are not a native English speaker, make an effort to speak slowly and clearly enough for a large audience to understand you. Even if you are a native speaker, you will need to speak loudly and clearly.**

- **Position yourself carefully with respect to the screen — be sure not to block the audience's view.**

- **During the question & answer session at the end of your talk, be sure that your audience knows what question you are answering — repeat a question if not everyone was able to hear it. It's often a good idea to repeat questions regardless, to make sure you have them right and to give yourself a moment to think.**

Most of all, have fun, and remember — your talk serves as an advertisement for your work and your paper.