Quiz: Will I do great work?

A summary of Richard Hamming's lecture "You and Your Research"
By Joel Esposito

Question	Pre-Test Answer	Follow Up Action
Q1: Is one of my career goals to do truly world-class, memorable *scholarship*[1] ?		
Q2: How many hours a week do I dedicate to scholarship?		
Q3: How many days per week do I make contact (e.g. reading, writing, discussion) with my scholarship for at least 5 minutes?		
Q4: How do I keep abreast of developments and issues of interest in my field?		
Q5: What are the most important open questions in my field?		
Q6: Am I working on them?		
Q7: What obstacles hold me back from doing truly great work?		
Q8: Am I good at "selling" my work?		
Q9: Do I have any personality quirks, pet causes, or social habits that detract from my mission of doing great scholarship?		
Q10: Do I exploit the unique advantages USNA has to offer regarding my scholarship?		

[1] Feel free to substitute "scholarship" for any other creative activity (e.g. teaching, painting, writing, piano, etc.).

You and Your Work

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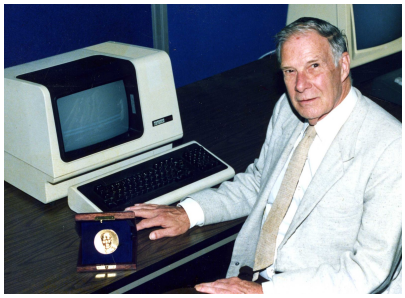

Who is Richard Hamming (1915-1998)?

- Applied mathematician in early days of scientific computing. Most known for coding theory, numerical methods, spectral window, founder of Assoc. Computing Machinery, recipient of IEEE Hamming Medal, Turing Award
- Worked at Los Alamos, Bell labs, and Naval Post Grad School (photo from NPS site)

Question: Why do some scientists do great work and others are entirely forgettable?

- Scientific computing was essentially a support service to the other sciences. "At Los Alamos, I was brought in to run the computing machines so the physicists could get back to business. I saw that I was a stooge. ...although physically we were the same, I knew they were different."
- Hamming reflects on the traits and behaviors of many of the great minds he worked with over 50 years (Feynman, Shannon, Tukey, Shockley, etc.)
- What did they do that separated them from the average scientist?
- This talk is not about the safe road to tenure, how to have a work-life balance, etc. But rather to improve the chances you will do something great.
- Much of this applies to non-research endeavors as well! e.g. teaching, art, architecture, etc.

Do you want to do great work? I think so.

- "Our society frowns upon those who ask or answer this too loudly. You are supposed to do it by accident."
- Depressing fact: The modal number of times a scientific paper is cited? Zero
- You only have one life to lead "and it seems to me it is better to do significant things than to just get along through life"
- And there is value and *joy* in the struggle (though not always when you are doing it).

Action 1: If you hesitated in answering yes to "Do I want to do great scholarship?", consider why. Is it a question of desire or confidence or the cost associated with it.

Is it "brains"? No.

- Most of us with a Ph.D. have more than enough.
- "Many people who seem to not have great IQs have done great things".
- Examples of those who don't necessarily succeed in traditional schooling. Delayed speech in Feynman, Einstein, & Teller

Is it luck? Not really.

- It helps but "Luck favors the prepared mind" (Pasteur). "It both admits there is an element of luck, and yet claims to a great extent it is up to you."
- "the prepared mind sooner or later finds something important and does it".
- Examples of Einstein, Edison and Feynman

Is it hard work? This is definitely necessary.

- Success comes from a steady application of effort over a long time. Must take the time to "plant the little acorns from which the mighty oak trees grow".
- "Knowledge and productivity are like compound interest" One person who works 10% harder than another can twice outproduce the other over a lifetime.
- "Creativity comes out of your subconscious."
- "If you deeply immersed and committed to a topic, day after day, your subconscious has nothing to do but work on your problem...don't let anything else get your attention….keep your sub conscious starved so it has to work on your problem, so you can sleep peacefully and get the answer in the morning, free."
- "It comes down to emotional commitment"
- Story of hiking with Feynman
- Few successful people retire early. Most have very long careers Lloyd-Wright, Picasso, Hamming

Action 2: Identify one extra hour per week to dedicate to scholarship.

Action 3: List ways to make contact (reading, writing, discussion) with your scholarship at least once a day, even if it's only for 5 minutes.

Is hard work sufficient? Nope.

- "drive misapplied doesn't get you anywhere." Don't spend too much time organizing your paper clips.
- Minimize components of your job that will not lead to greatness.
- "The misapplication of effort is very serious business!"

What else do you need? Courage and vision!

- "If you don't work on important problems, it's not likely you'll do important work."
- The average scientist works on unimportant problems.
- You must "...believe that you can do important problems"
- Courage = ego? Maybe.
- Think about where your field is going and then go there so you have a chance to do something important.
- "Even if you think it's luck, like a lightning strike, then stand on a mountain top. Do not hide in a valley."
- A balance between not giving up too soon and quitting before you waste a career. Einstein's unifying theory.
- Non-Hamming quote: "Research is a little like baseball: if you do something good ⅓ of the time, you will be a super star."
- "Look at your successes, and pay less attention to failures"

Action 4: Develop a list of the most important problems in your field.

Action 5: If you are not already working on the most important problems in your field, think of ways you can bring your interests or techniques to bear upon them.

How will you know what problems are important?

- "if you have the door to your office closed, you get more work done today and tomorrow, and you are more productive than most. But 10 years later somehow you don't know quite know what problems are worth working on"
- Open door = open mind?
- His stories of having lunch with the chemists and physicists. Asking the chemists what was important and if they worked on it. They became angry but followed up later to thank him.

Action 6: What can I do, on a weekly basis, to interact with other experts about the most important problems in my field?

But I can't do great work because _____!

- You can tell other people all the alibis you want but to yourself try to be honest.
- "Ideal working conditions aren't always the ones you want. the interaction with harsh reality tends to push you into significant discoveries which otherwise you would never have thought about while doing pure research in a vacuum of your private interests."
- "In my opinion the Institute for Advanced Study at Princeton ruined more good scientists than any other institution has ever created"
- " Some of the best science done at Cambridge Physical Labs was when they were working in shacks….
- "It's a poor workman who blames his tools."
- Take a defect and turn it into an asset -- both on a technical level and a personal level.
- "Many scientists when they found they couldn't do a problem they began to study why not?"
- "We didn't have enough computers or technicians here so I started to think about how we could write programs more easily".
- My example about human computer interaction studies

Action 7: Think of at least one way you can turn a perceived obstacle to an advantage

So hard work, courage and a little luck are enough? No. You have to sell it!

- "The world is supposed to be waiting, and when you do something great, they should rush out and welcome it. But the fact is everyone is busy with their own work."
- ``It ain't what you do, it's the way that you do it.''
- In the Q&A he says he probably spent 50% of his time "selling" his work in some way.
- You will more likely be remembered for your expository work (Hilbert and Courant).
- Example a from my own work: Matlab Toolbox for the Roomba.
- My most cited paper (not my best paper) is with a co-author who is very good at "selling it".
- Do you have a website? No? You won't do memorable work.

Action 8: Think of at least one way you can reach a wider audience with your work.

How can you do even more? Embrace "The System".

- "If you learn to work with the system, you can go as far as the system will support you -- which is much farther than you can on your own."
- But it's hard because you need to have some ego and unique personality to do good work yet...
- "I didn't say you had to conform. But the appearance of conforming will go a long way"
- "I know enough to not let my appearance get in the way of what I care about"
- "Was I going to assert my ego and dress the way I wanted to and have it steadily drain my effort from my professional life?"
- Examples of people insulting secretaries, bosses, dressing poorly, political causes.
- Dean Phillips comment at the new faculty orientation about tilting at windmills.
- "Very few of you have the ability to both reform the system and become a first class scientist!"

Action 9: List one small "personal, political or social" change that would benefit your work.

Action 10: List at least one new way in which you can exploit the unique nature of USNA to advance your work.

Should I go into management?

- "The day your vision is bigger than what you can do single handedly move into management."
- "Then, rise as high as you need to get it done."

"Now go forth and do great work!"

Further reading:

- R. Hamming, "The art of doing science and engineering: learning to learn": http://worrydream.com/refs/Hamming-TheArtOfDoingScienceAndEngineering.pdf