101. You and Your Career

Hamming's crash-course on career success

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presented at

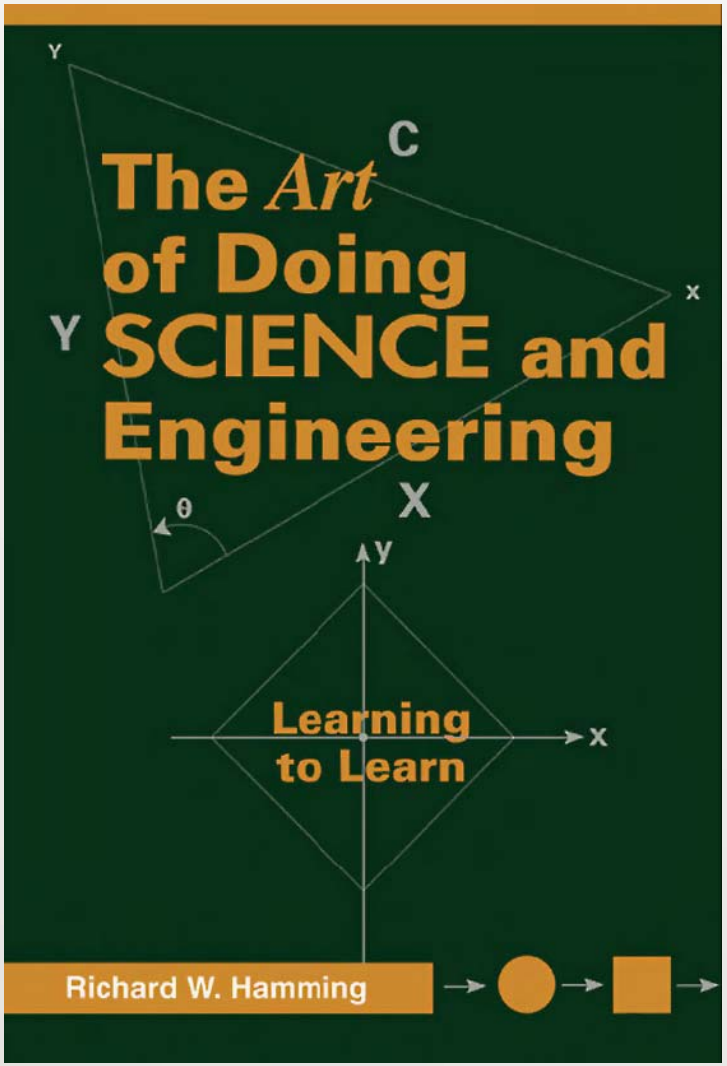
Department of Physics
Sharif University of Technology

101st anniversary of the birth of Richard Hamming

Tehran, April 26 2016

Richard Hamming (Feb 11 1915 – Jan 7 1998)

American mathematician, computer scientist, information theorist



- **Turing award winner (1968)**

For his work on numerical methods, automatic coding systems, and error-detecting and error-correcting codes.

- **Notable institutions**
  - Los Alamos National Lab (1945)
  - Bell Labs (1946 – 1976)
  - Naval Postgraduate School (1976 – 1998)

- **Notable Collaborators**
  - Richard Feynman (@ LANL)
  - Enrico Fermi (@ LANL)
  - Edward Teller (@ LANL)
  - Robert Oppenheimer (@ LANL)
  - Hans Bethe (@ LANL)
  - Claude Shannon (@ Bell Labs)
  - John Tukey (@ Bell Labs)

You and Your Research

- **Why do so few scientists become so famous for their scientific works?**
- **What does it take to become famous or to do great work?**
- **What is the difference between the very capable people and those who do not contribute significantly to the advancement of science?**
- **Is there a broad set of principles that everyone could use to achieve career success?**

**Success and successful people come in many forms and flavors.
However, despite the apparent great variety on the surface,
there are many common elements and traits underlying their success.**

Style is the essence of success

Success is to do the right thing, at the right time, in the right way.

The "style" that can lead to success is remarkably similar among most professions and careers.

Hamming's advice on career success

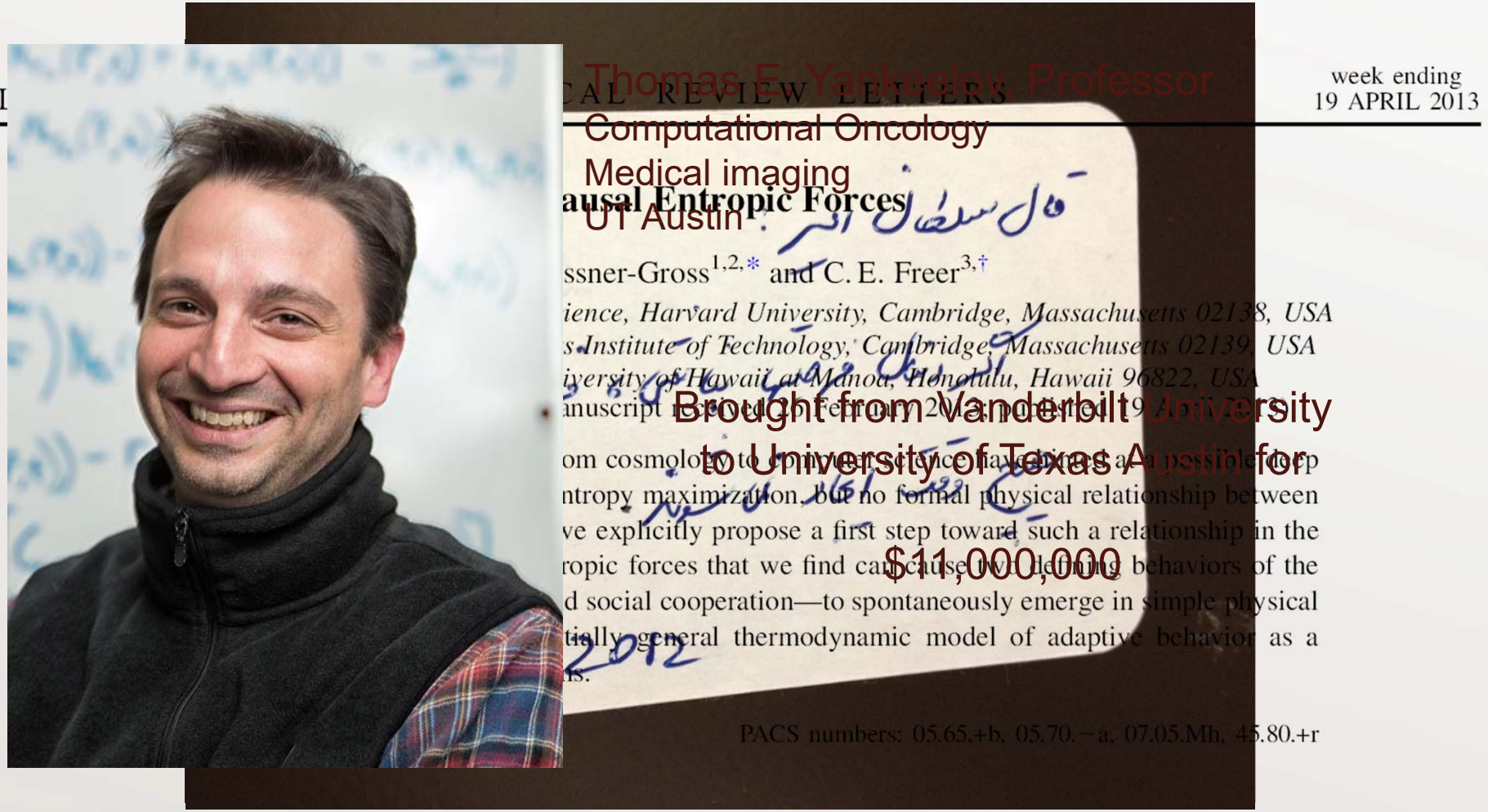
1. **Overcoming the psychological barriers to success**
2. **Developing a long-term vision**
3. **Adopting a style of work and life that leads to success**

I. Overcoming the psychological barriers to success

Luck favors the prepared mind (Louis Pasteur)

Dynamical systems that maximize their future possibilities behave in surprisingly "intelligent" ways.

You prepare yourself to seize the opportunities in life, and when luck hits you, you're ready to take advantage or not.

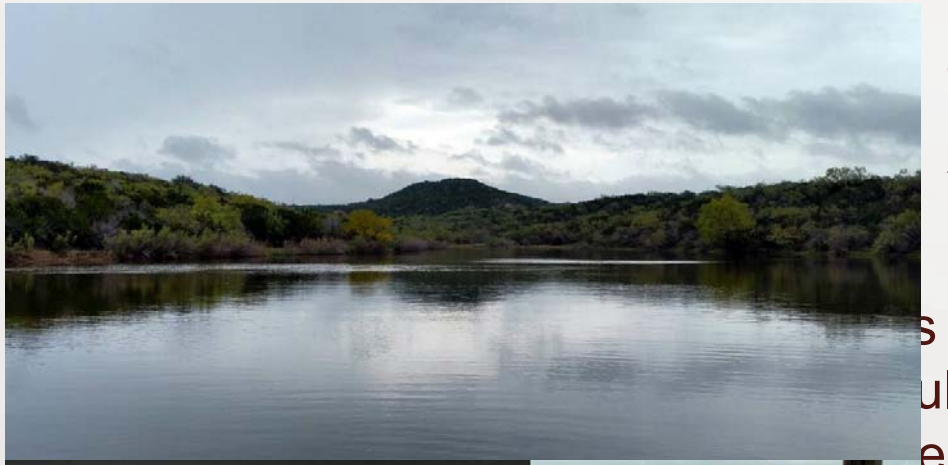


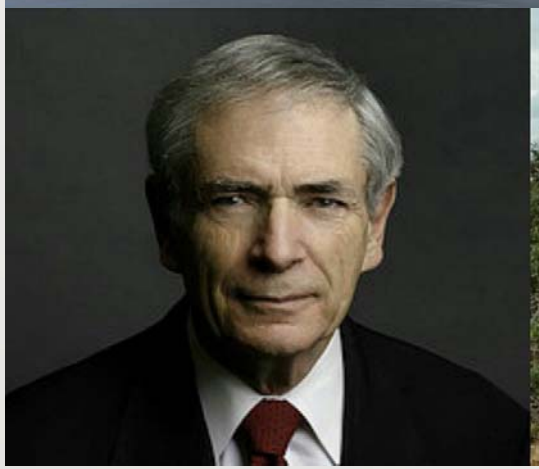
Thomas E. Yankeelov, Professor
Computational Oncology
Medical imaging
UT Austin

Brought from Vanderbilt University to University of Texas - Austin for $11,000,000

Genius is 99% perspiration and 1% inspiration
(Thomas Edison)

To a great extent, success is a necessary condition for success.





J. Tinsley Oden

Associate Vice President for Research, University of Texas at Austin

Director, Institute for Computational Engineering and Sciences

Cockrell Family Regents' Chair in Engineering No. 2, UT Austin

Peter O'Donnell Jr. Centennial Chair in Computing Systems, UT Austin

Professor of Aerospace Engineering and Engineering Mechanics

Professor of Computer Science, UT Austin

Professor of Mathematics, UT Austin

s would think as hard as I did, then
uld be able to make the same
es as I did."

Newton (1642 – 1726)

Confidence and courage are essential components of success

There is a fine line between confidence and stupidity.

Henri Poincaré (1854 – 1912)

- Mathematician
- Theoretical physicist
- Engineer
- Philosopher of science

Claude Shannon (1916 – 2001)
Mathematician, Engineer @ Bell Labs

II. Developing a long-term vision for success

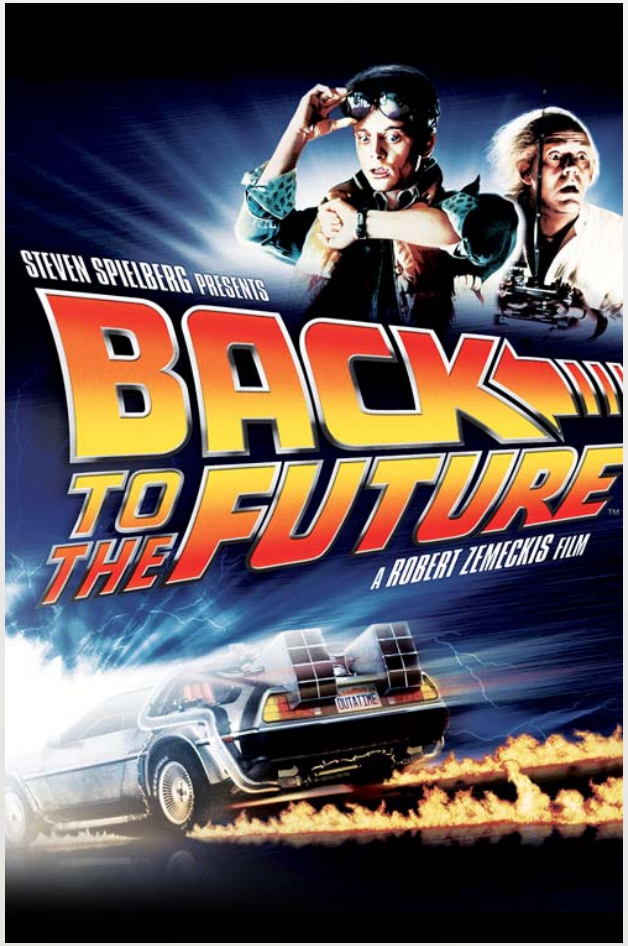
Achieving success requires working on important problems

“Most scientists spend most of their time working on problems they believe are not important nor are likely to lead to anything important” - Richard Hamming

Sometimes problems that are not considered important will become important in the future.

The importance of a problem is in its solvability

An important problem is one that can be approached and attacked, not necessarily a problem with the greatest inherent consequences



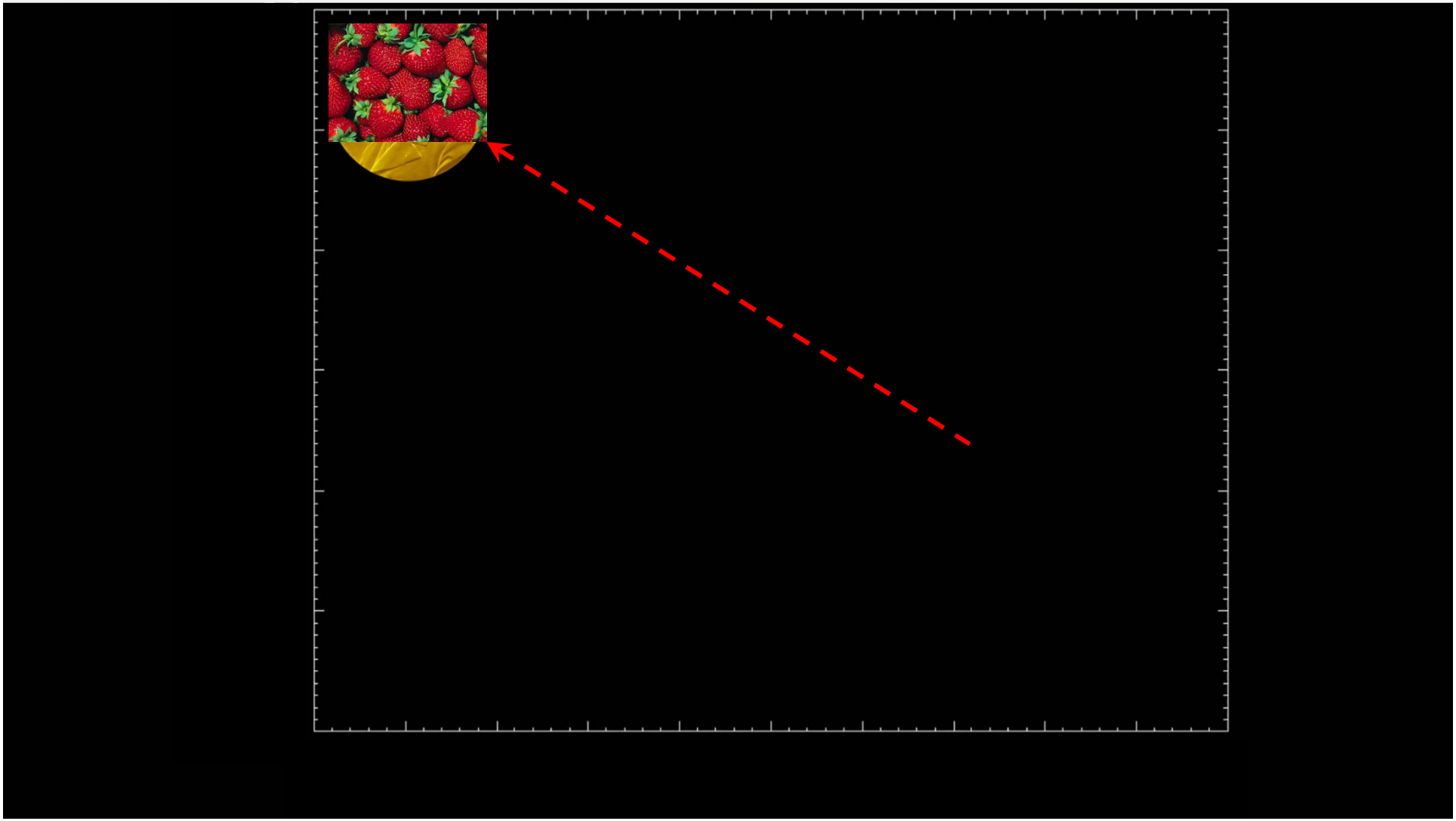
Time travel is of paramount consequence to humanity, yet is not an important problem, according to Hamming.

Great people often have multiple problems in mind that they consider of great importance.

Once they find a clue to solve one, they drop other ideas and get to work on it immediately.

Desire to do excellent work is a key trait for success

A person without a goal tends to wander like a drunken sailor; every step goes in one direction and tends to cancel the previous steps.



III. Adopting the right style for success

Progress is impossible without change

Not every change leads to progress, but progress requires change.

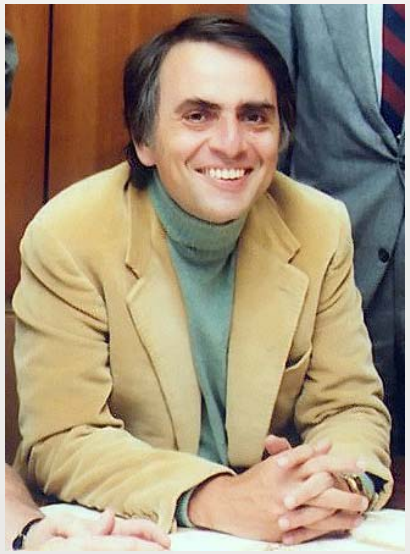
New ideas are often resisted by people or the establishment.

Bernie Sanders vs. Hillary Clinton

Successful people embrace change and are receptive to new ideas, tools, and arrangements.

Great people tolerate ambiguity

They can have varying degrees of certainty about different things but,
not absolutely sure of anything.



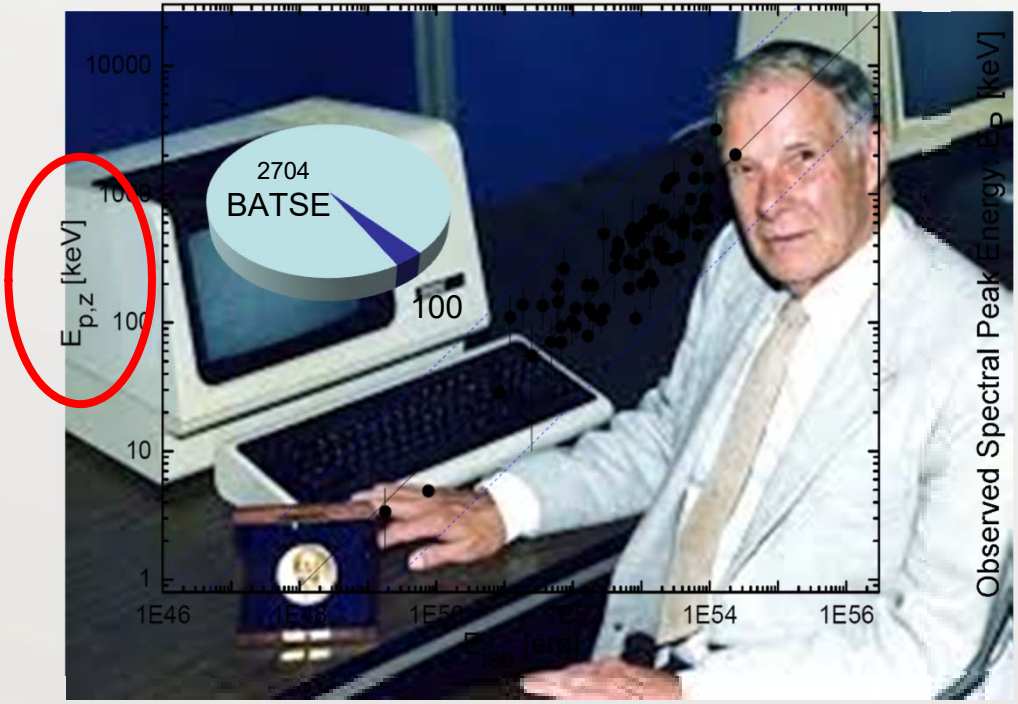
Carl Edward Sagan (1934 – 1996)
Astrophysicist @ Harvard / Cornell

"We must surrender our skepticism **only** in the face of rock-solid evidence. Science demands a tolerance for ambiguity…" - Carl Sagan

Too much belief in some ideas, research, or some organization will obscure the chances of significant improvements.

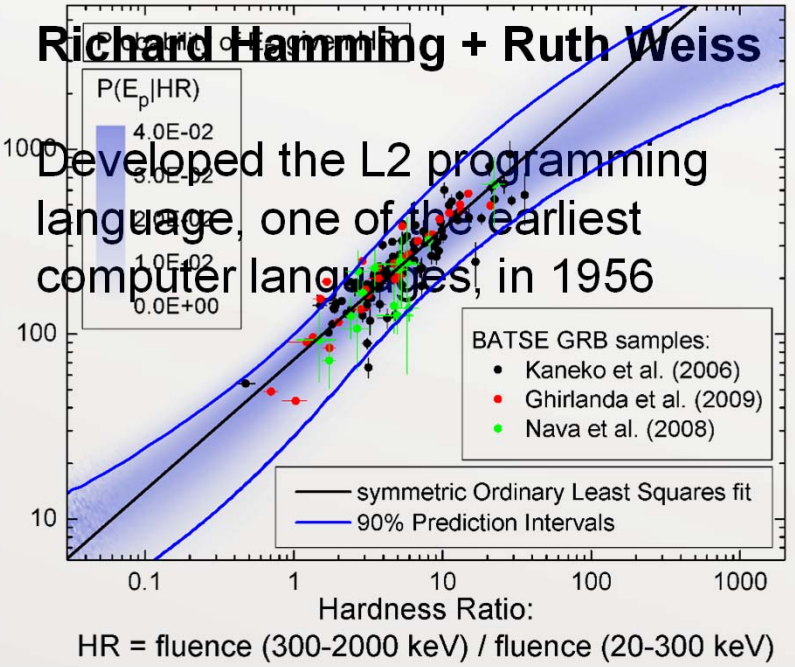
Defects can be often inverted to career assets

When stuck, inverting and reformulating the problem can often lead to a significant step forward



Richard Hamming + Ruth Weiss

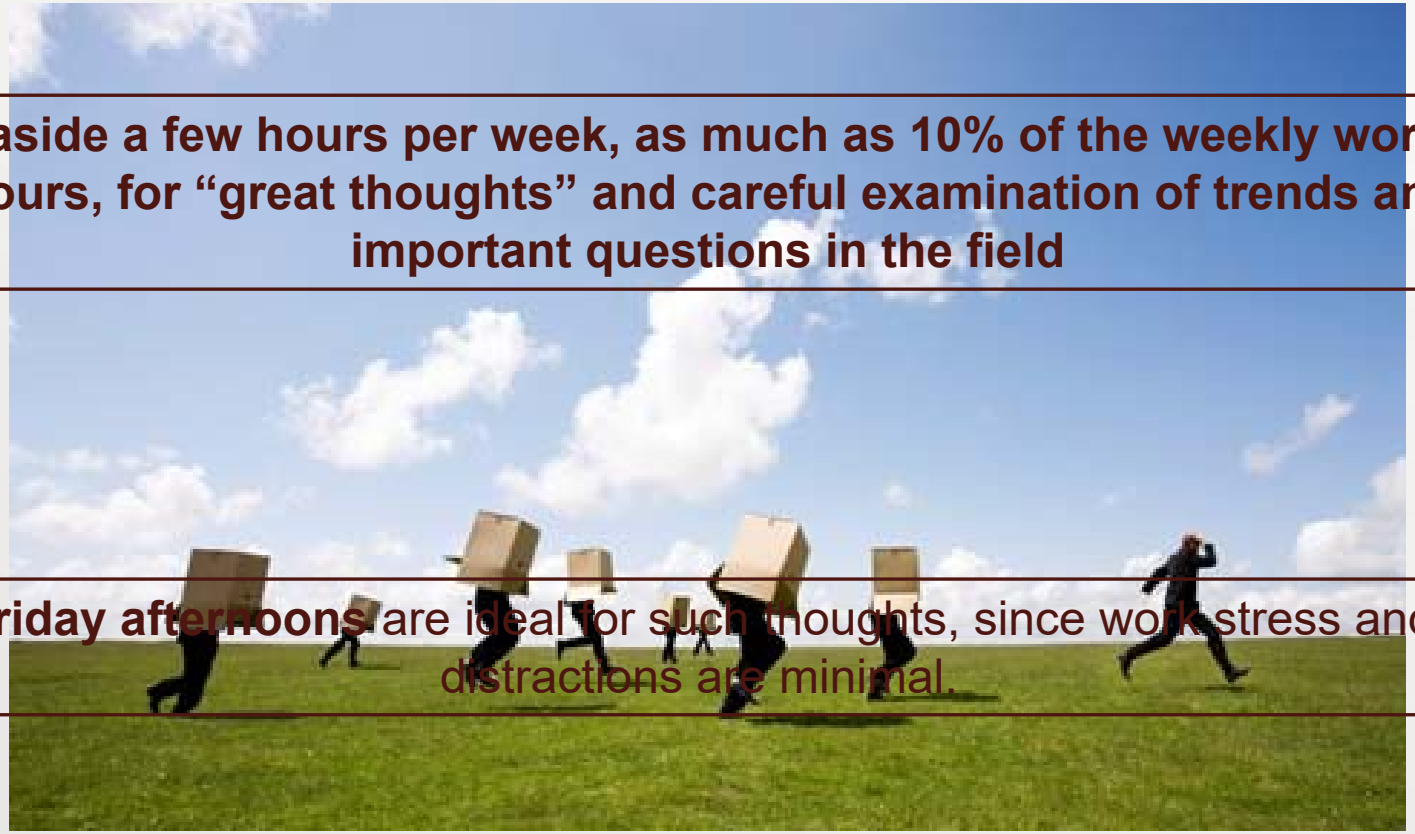
Developed the L2 programming language, one of the earliest computer languages, in 1956



- Shahmoradi & Nemiroff, **2010**, MNRAS, 407, 2075–2090

Keeping the right vision requires thinking out of box regularly

Set aside a few hours per week, as much as 10% of the weekly working hours, for "great thoughts" and careful examination of trends and important questions in the field



Friday afternoons are ideal for such thoughts, since work stress and distractions are minimal.

Open doors often lead to open minds

Great people frequently exchange ideas with others

William Henry Press (1948 – present)

Adviser to President Obama on Science an Technology
Deputy director, Los Alamos National Laboratory
Professor of Physics, Harvard University
Professor of Astronomy, Harvard University
Professor of Computer Science, University of Texas Austin
Professor of Biology, University of Texas Austin

Graduate students:
If the door is open, please come in.
(and his office door is almost always open)

"…those with the closed doors, while working just as hard as others, seem to work on slightly wrong problems … [and] those who have let their door stay open get less work done but tend to work on the right problems!"
- Richard Hamming

Good ideas must be presented well

Selling new ideas requires mastering **three forms of communication**:

Ernst Stueckelberg (1905 – 1984)

ormal presentations

Swiss mathematician and physicist

orts (peer-reviewed papers)

Developed

- Exchange particle model

ntations as they happen to occur

- S-matrix theory
- Renormalization group
- Feynman diagrams

Claus O. Wilke(? – present)

Hamming advice:

rivately critiquing the style of other people's presentations.

Physicist, Computational Biologist

Chairman, Department of Integrative Biology

inions of others about their presentations.

The University of Texas at Austin

Yet, Stueckelberg did not contribute in a clearly visible way to the advancement of his field of science (the theory of elementary particles) **in spite of his exceptionally original and novel ideas**.

- Ad les that seem to be personally effective for better communication.

s includes the gentle art of telling jokes.

Good ideas must be presented well

How not to present yourself? A real personal example:

Fw: Wish to join your research group Inbox x UTAUSTIN x UTAUSTIN/#Teaching x

Orbach, Raymond L <orbach@austin.utexas.edu> 9/6/15 Reply
to me

Dear Amir: Do you know anything about him or his university? Thanks, Ray

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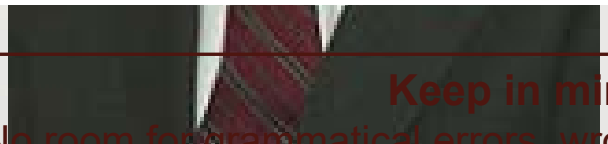
From:
Sent: Saturday, September 5, 2015 3:14 PM
To: Orbach, Raymond L
Subject: Wish to join your research group

Dear Professor Orbach, Raymond,

I'm going to apply to the PhD (or Master) program in material science and engineering at University of Texas at Austin for fall 2016, and I'm especially



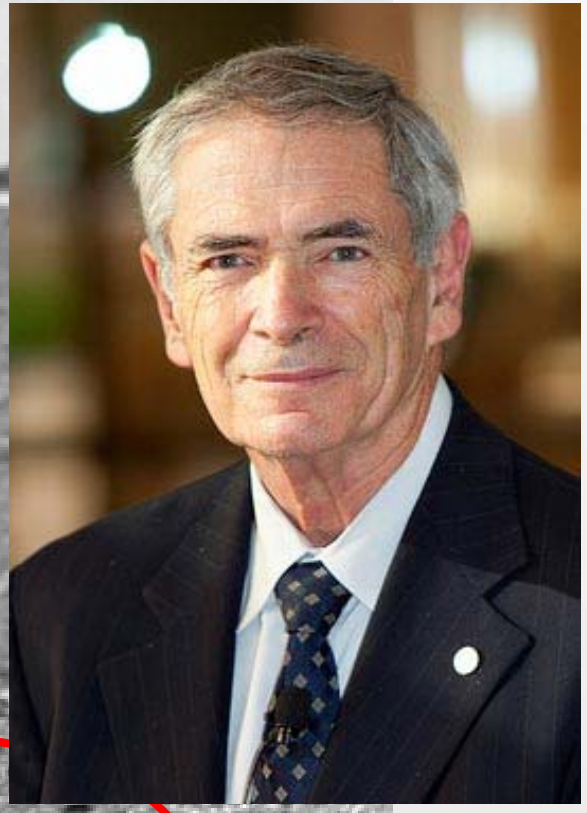
Keep in mind when applying for graduate schools:
No room for grammatical errors, wrong/inappropriate names or titles in correspondence or applications!

Your dress matters as well (personal opinion)

Neither me nor you are Albert Einstein

Raymond Orbach

William Press



Tinsley Oden

Fame can be a curse to quality productivity

Counter example:

Firouz Naderi (1946 – present)
Aerospace Engineer
Director for Solar System Exploration
NASA's Jet Propulsion Laboratory (JPL)

T … cientists are often done early on in their careers, w … s much supply of tools and freedom as they were … ven after becoming famous.

F … to continue to work on the same problems which … ut which are also sometimes no longer of great importance to society.

Let success prospects shine in your work and lifestyle

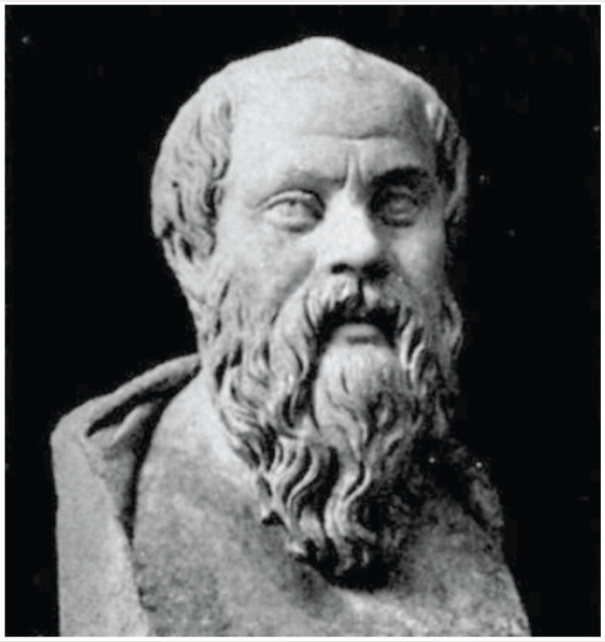
- "style" is the most important feature of success.
- "It is not important how much you do, but how you do it ".
- Follow the philosophy of "**do the best I can in the given circumstances**".
- Study more **success** than **failure** stories.
- Adopt success elements and approaches from those who have already achieved career success.
- Reorganize life and make more effective use of the **time that is often wasted** every day by reading irrelevant material, in front of TV, in rush-hour traffic, or by making love-stories of your life.
- Do not deprive others of your knowledge. Do not cling to exclusive rights.
- It is often easy to see the energy, vigor and "the **drive to do great work**" in the lifestyle of successful people.

Richard Feynman
Theoretical Physicist

Is the effort required for excellence worth it?

Those who have achieved success, they all say it's well worth the effort.

"The chief gain is in the effort to change yourself and it is less in the winning you might expect" - Richard Hamming



"The unexamined life is not worth living"
- Socrates

contact: amir@ices.utexas.edu

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3. Shahmoradi, Amir, 101. You and Your Career, 2016.

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  author={SHAHMORADI, AMIR},
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