

Evolution of Corporate CS Research

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Le Garage

Reinventing the startup

The Seeds of Innovation and Entrepreneurship

Innovation is often symbolized by the image of a few friends toiling in a garage at night to create something new and disruptive. Many of today's industry giants were built from modest beginnings - literally in someone's garage.

Corporate research is dead,
long live *Le Garage!*

Study change in the nature of corporate CS research

We identify and compare two eras

- Golden Age - pre ~1980
 - Characterized by large centralized research labs
- New Age - post 2000
 - Characterized by integrated R&D
- Note transition period in between

Where is this heading?

We Apply Three Frameworks

- PEST & Horizons Framework
 - Studies changing context of research
 - **P**olitical, **E**conomic, **S**ocial and **T**echnological
- Pasteur Quadrant Analysis
 - Studies theory v/s practice

PEST Framework

Political

- company leadership

Economic

- financial strength of the company

Social

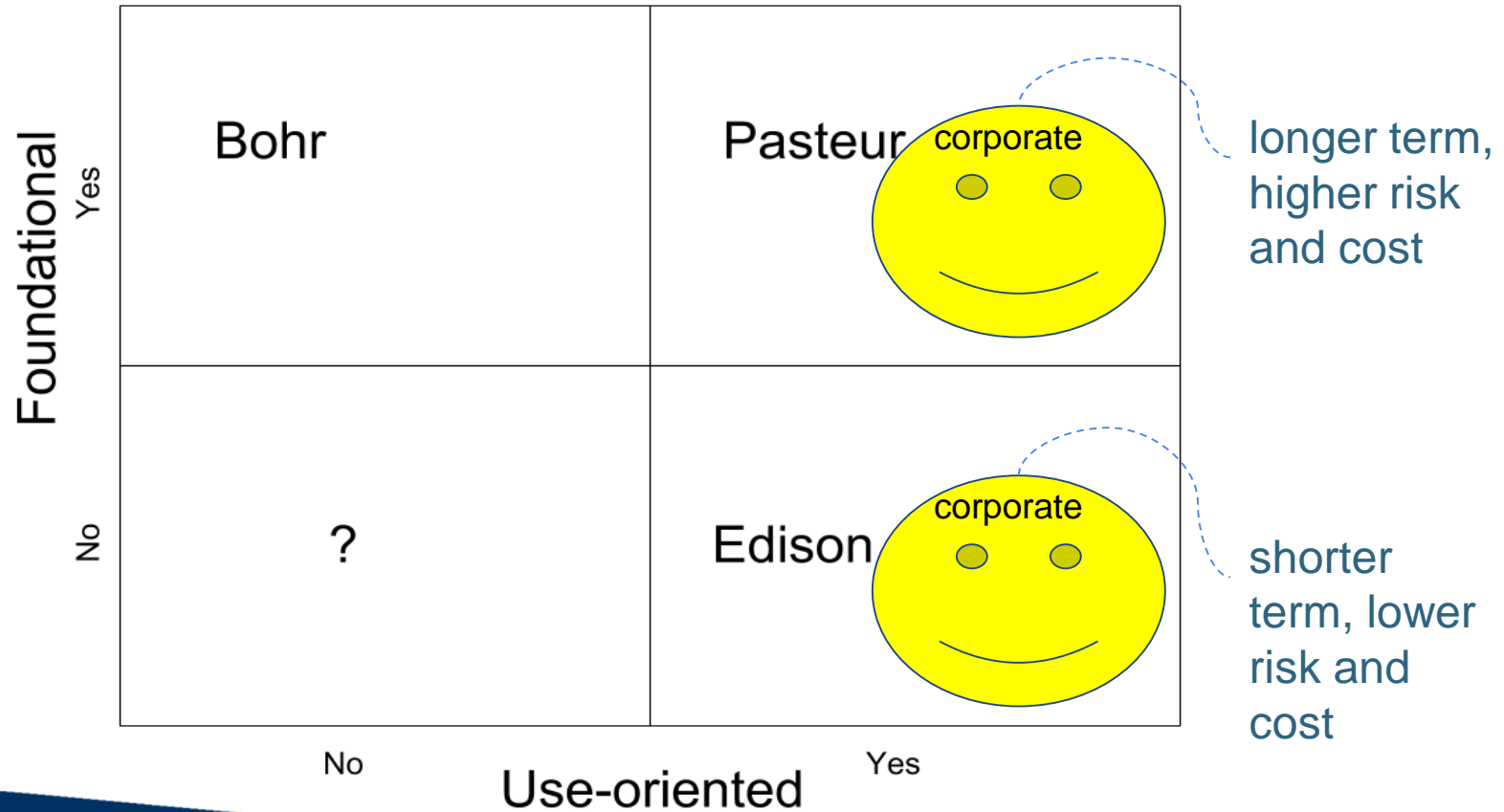
- attitude towards research of the society at large

Technological

- technology maturity

	Golden Age	New Age
P	technologists at the top	financial background, shareholders, cost, risk
E	monopolistic position, surplus	fierce competition, cost control
S	high esteem of basic research	startup, maker movement
T	new industries, research directly drove societal and financial benefit	maturating technologies in the ICT domain
Horizon	1-2-3	1-2

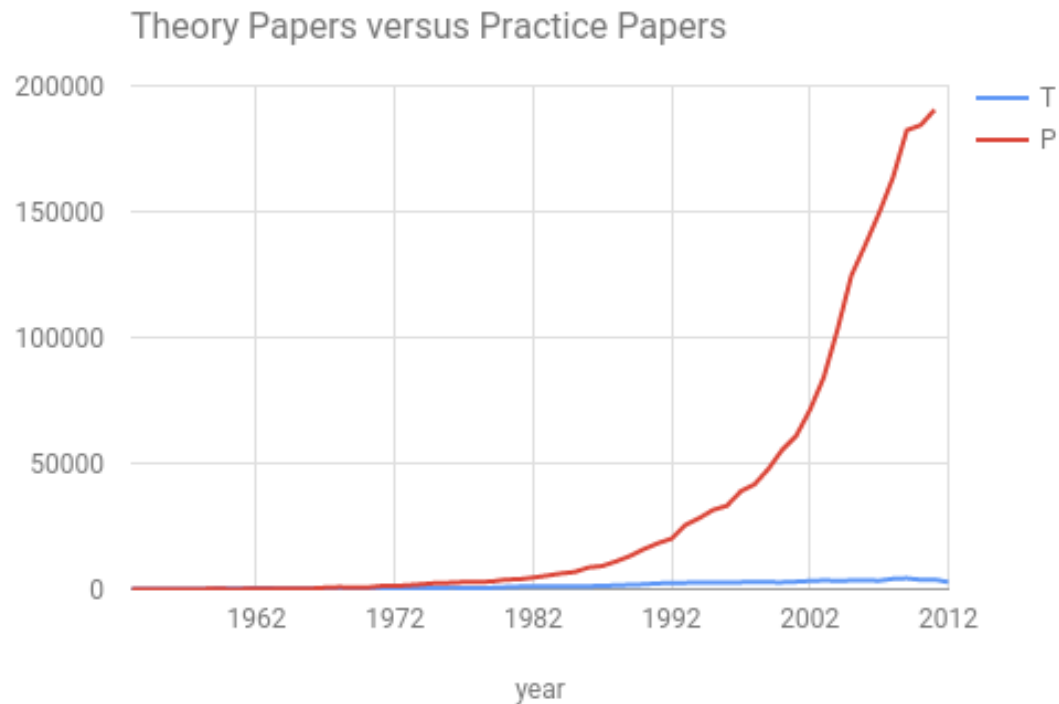
Pasteur Quadrant



Mapping Papers into Quadrants

- Use DBLP + ACM [data-set](#)
 - year of publication, citations, conference/journal of publication
- Basic Idea:
 - Curated list of theory conferences and journals
 - Paper category = Theory, if published in one of these

Theory Papers, Practice Papers



Take Away #1:
Practice papers growing exponentially.
Theory papers growing (slow) linearly.

Citation Ratio

“Pasteurs” influenced by both theory and practice papers

- influence = citation
- citation ratio = #citation of theory papers/#citations of practice



Take Away #2:

From 1980 to 1995. Theory papers cited 2 Practice paper for every theory paper cited.

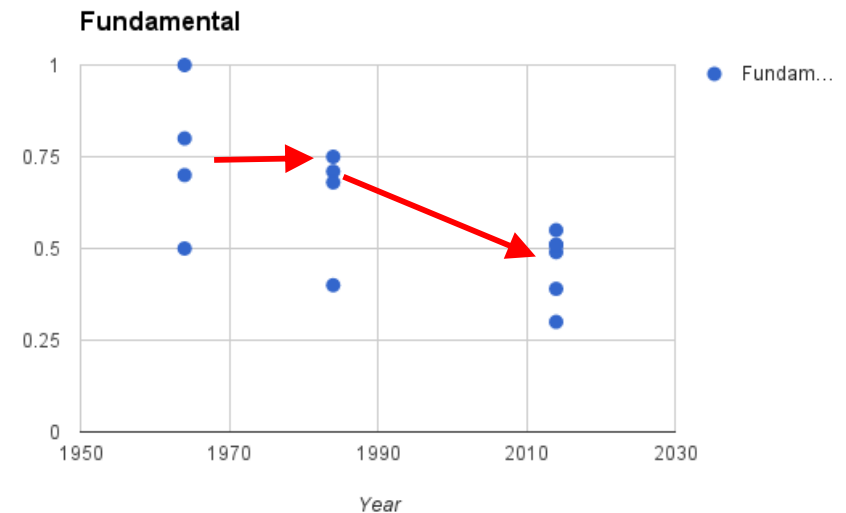
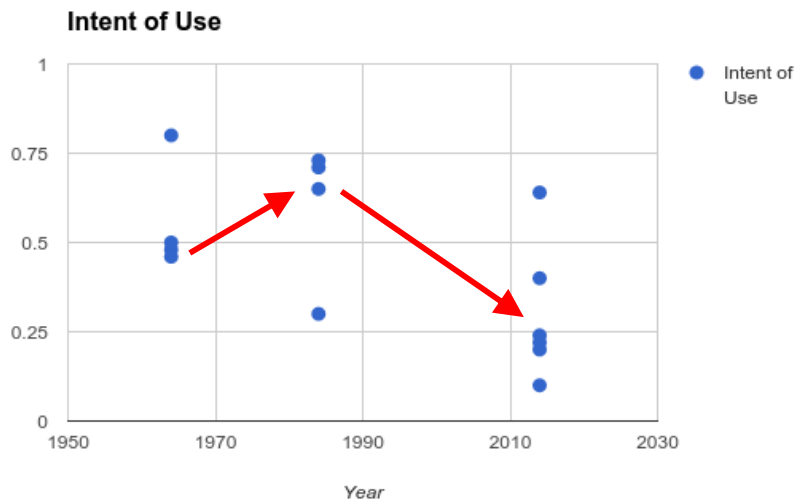
From 1995 onwards, this ratio is closer to 1:1.

Theory is more disconnected from practice today

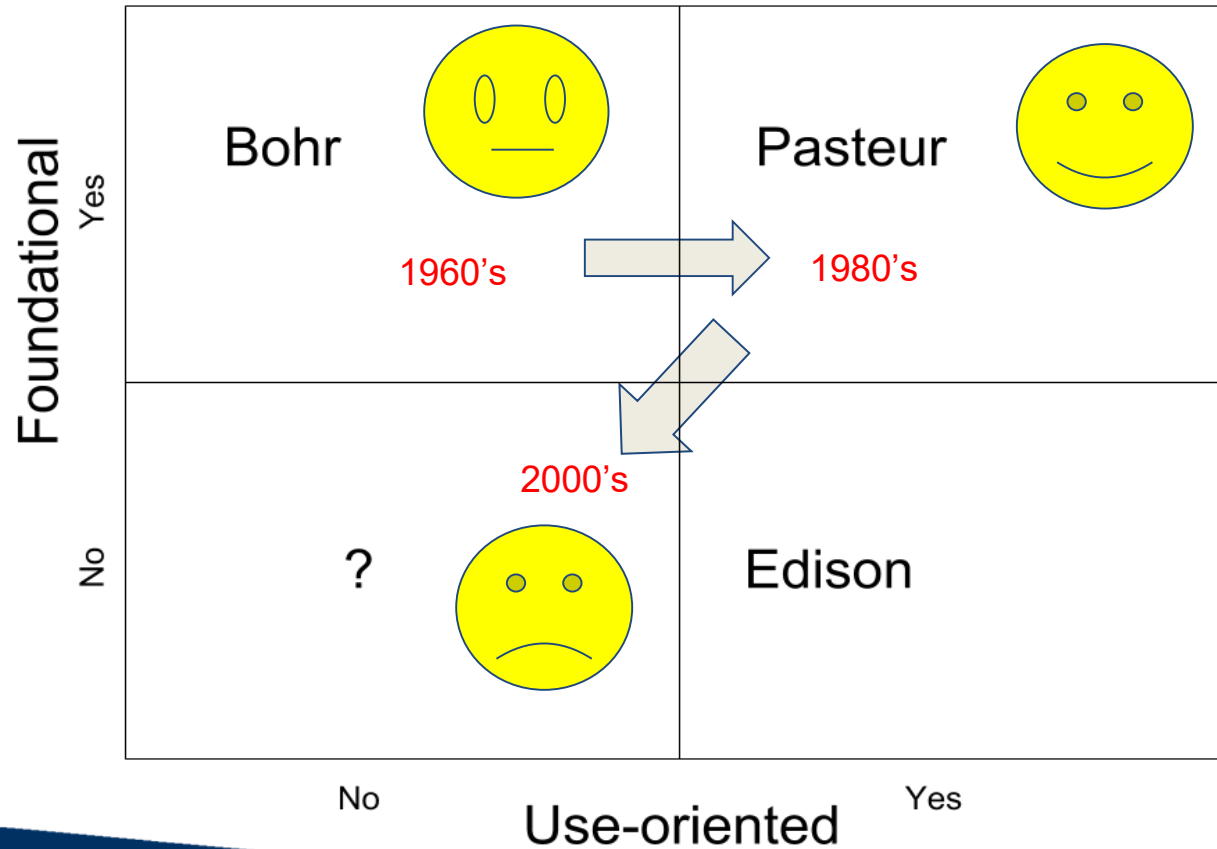
Stratified Sampling

J. ACM is the premier CS theory journal

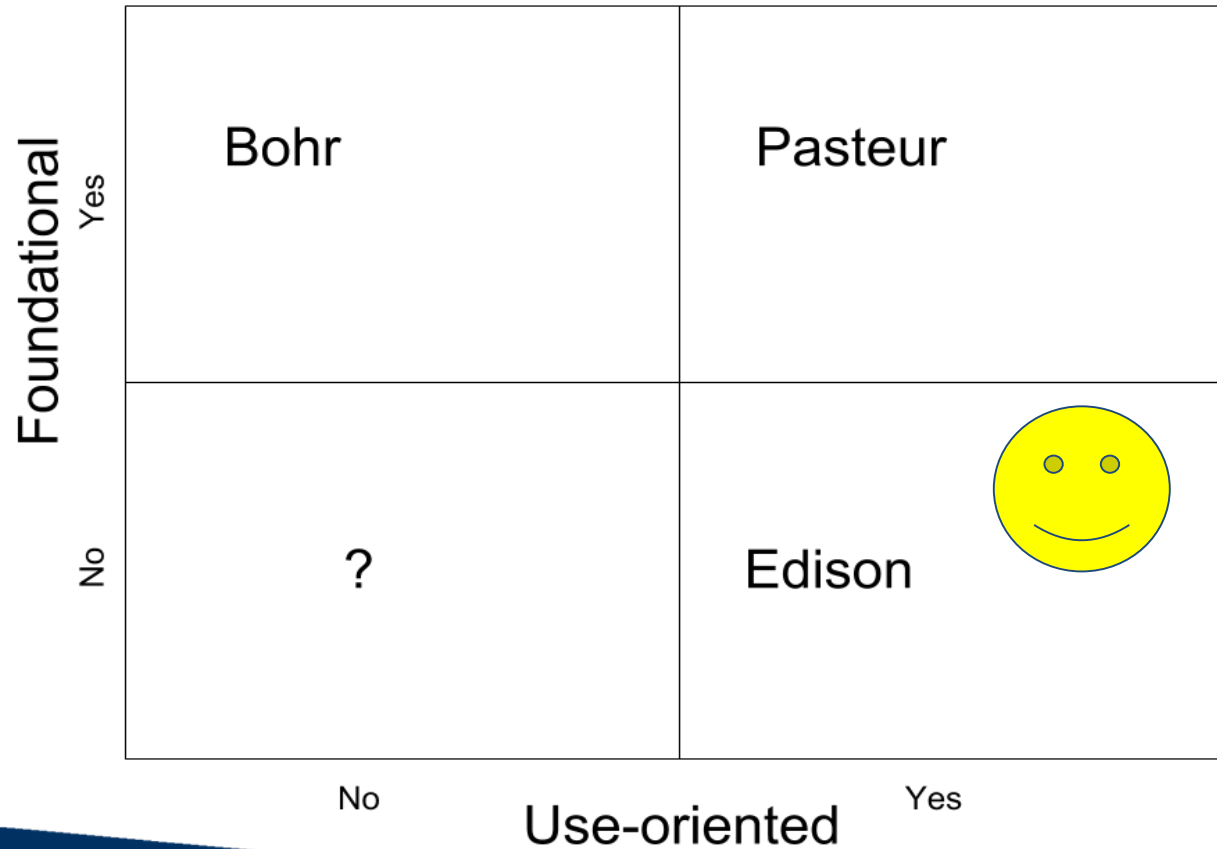
- Sample articles from 1964(4), 1984(4), 2014(6)
- Score manually for fundamentalness, intent of use

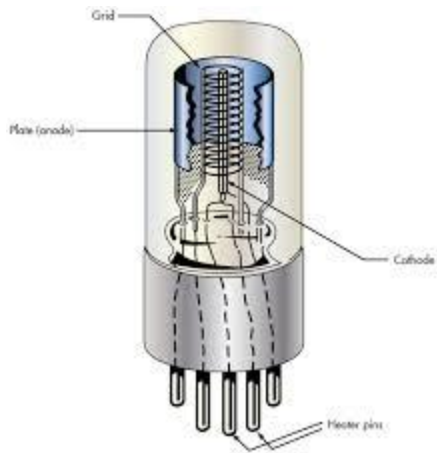


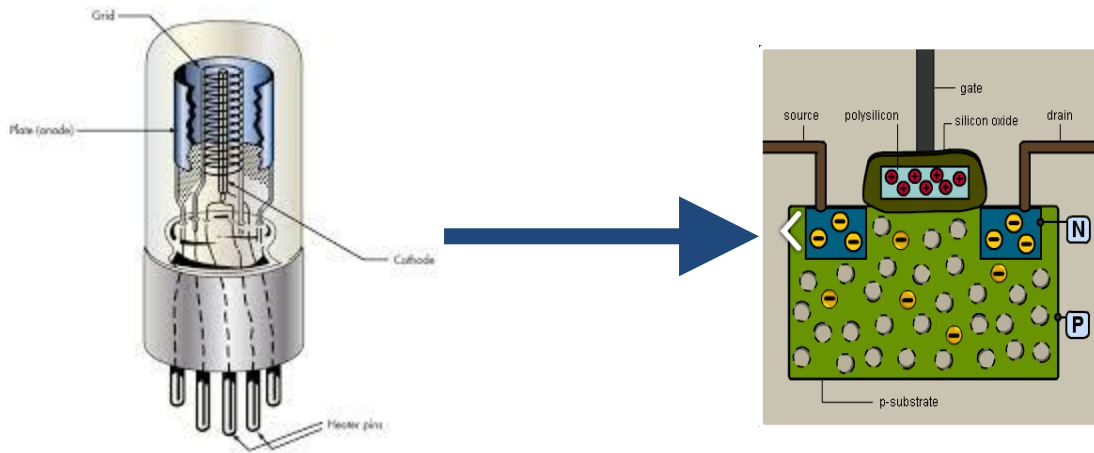
Theory Papers

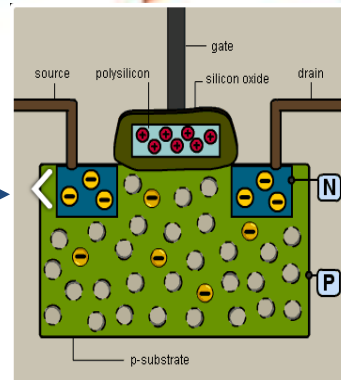
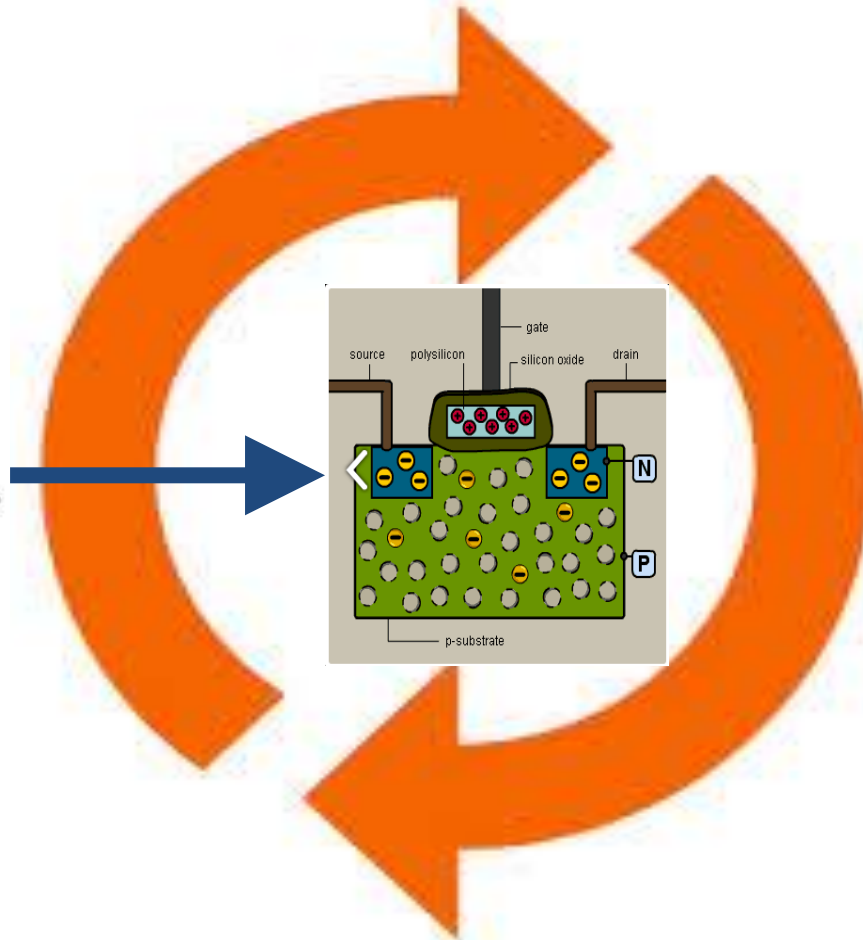
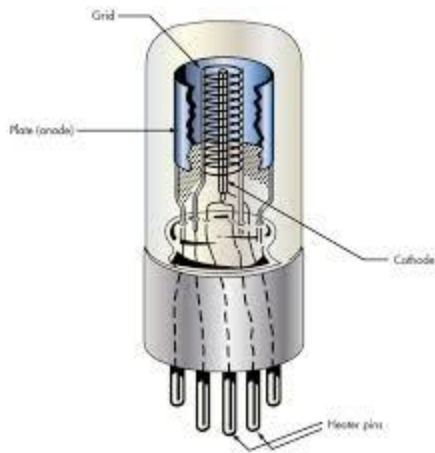


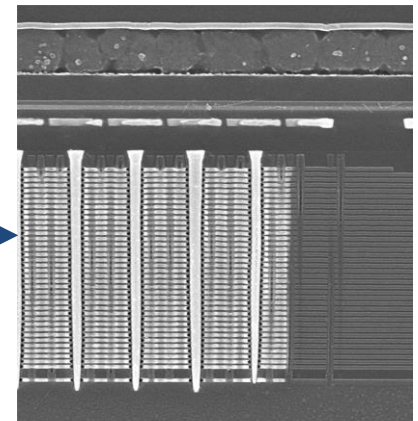
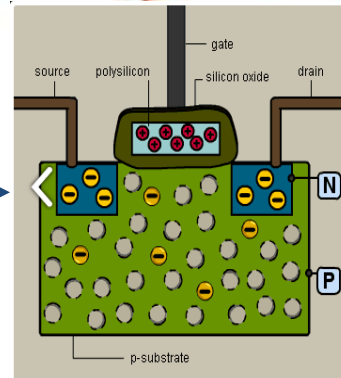
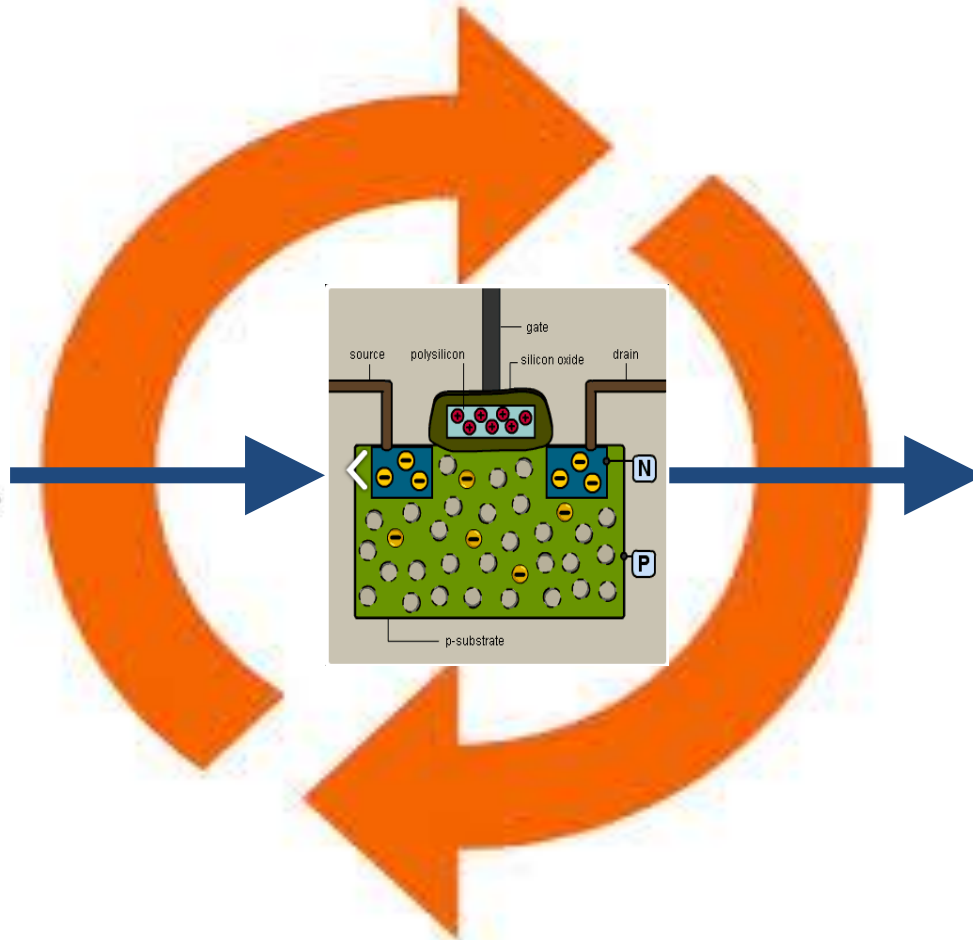
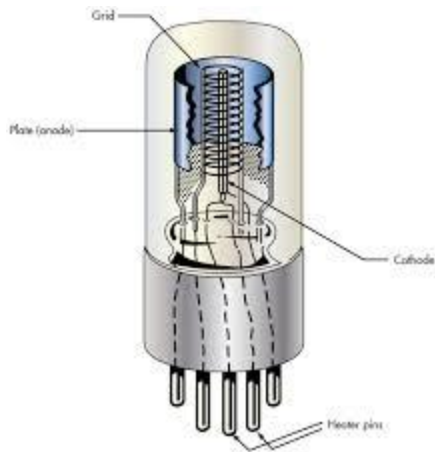
Practice Papers











Closer look at the edge of V-NAND flash array

Who is a Pasteur?

Excellent Technical Skills + Excellent understanding of the world's problems

Amplifying Technical Skills

- For many problems in NLP, data supplants theoretical models
 - [The unreasonable effectiveness of Data](#)
- Deep Learning extends this to image processing, [speech](#)
 - e.g. [Identifying dog breeds automatically](#)
 - e.g. [Identifying street numbers](#)
- Experience this yourself: [Torch tutorial](#)
 - 60 mins
 - recognize images in objects!!

Amplify Problem Understanding

- Analyze data
- Get quick feedback
 - Validating Learning (Lean Startup)
 - Experiment frameworks
 - large-scale traffic experiments on FB, Google, Bing
- Focus on feedback, not process!

Discussion

Image credit:

- Slide 2: <http://www.telcomhistory.org/vm/heroesBell.shtml>; *Bell's workshop (AT&T file photo)*
- Slide 3: <https://lebbeuswoods.wordpress.com/2012/02/27/saarinens-last-experiment/>