Why Don’t Those Dunderheads Agree With Us?

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Who am I?
Those academics just play games and develop theories. No real work!

Those people in industry focus on short term profits and don’t prepare for the long term.
Symptoms
Gedanken Experiment

An experiment you perform in your mind because to actually perform the experiment would be impossible or excessively costly
Experiment 1 - The Pumpkin Vendor

- The Problem: Pumpkins are Too Pale This Year

- The Need: Spray the Pumpkins to Make them a Deeper Shade of Orange
Lessons Learned

Acting Too Soon can lead to Disaster

Understanding Principles is Important
Experiment 2 - The Wright Brothers

We can make a machine that will fly!

Wilbur

Orville

SMU
Experiment 2 - The Wright Brothers

We can make a machine that will fly!

But we must prove the software is correct!

Loop Invariant: 

Wilbur

Orville

SMU
Lessons Learned

Sometimes We Must Take Risks

Doing Things is a Catalyst that Forces Us to Understand the Principles
Problems
Problem 1 - The State of Software Engineering

Today

- Tool with no State
- Standards Needed
- Method based on theory
- Inadequate Theory
- Tools Needed
- De facto Standard
- Methodology Needed
- Unused Theory
- Tool Based on Est. Standard
- Established Standard
- Method without foundation
- Theory Needed

Goal

- Tools
- Standards
- Methodologies
- Theory & Principles
## Problem 2 - Technology Transfer

<table>
<thead>
<tr>
<th><strong>Universities</strong></th>
<th><strong>Companies</strong></th>
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<tbody>
<tr>
<td>• Brilliant New Concepts</td>
<td>• Thousands of employees who want advanced education</td>
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<tr>
<td>• Taught Mainly to PhD Students</td>
<td>• Subsidized Masters Degrees</td>
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<tr>
<td>• Masters Degrees Prepare You for the PhD Program</td>
<td>• Many other forms of subsidized continuing education</td>
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<tr>
<td>• Terminal or “Service” Masters Degrees are unimportant</td>
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<td>• Practical application of advanced concepts is left as an exercise for the student</td>
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Problem 2A - Technology Transfer

**Universities**
- Struggling to simulate real work environments with inadequate laboratories
- Collecting data from unrealistic experiments
- Seeking but rarely finding opportunities for sabbaticals and summer jobs in industry

**Companies**
- Many new developments that really work well
- Many projects with much data
- Employees not encouraged to take the time to write papers
- Key advances are kept hidden because they are proprietary
Why Does This Happen?
Academics and Specialists Probe Nature and Focus to Develop New Knowledge

Managers and Industry Harvest Knowledge and Transform It Into Useful Products

Our Values and our Reward Systems Focus on the Extremes
“The Well Educated Person”
A Broad Range of Knowledge in Many Areas of Discourse
“Academics Learn More and More about Less and Less until They Know Absolutely Everything about Nothing”
“Managers Learn Less and Less about More and More until They Know Absolutely Nothing about Everything”
The Middle Ground is Sometimes Not Valued or Rewarded

- The benefits are long term
- But the costs are immediate
Towards a Solution
Three Elements of Improvement

- Work Together
- Change Rewards
- Change Values
Industry and Academia both want to improve society
  - Their methods are different - but complementary
They both have much to learn from each other
  - And much to give to each other
Many of the barriers to cooperation are cultural
  - “us” vs “them”
  - this is human nature, but it is destructive
Experience shows the value of working together
  - Graphics User Interfaces
  - Ada
  - many other advances in the computing field
Change Rewards

- For many years both industry and academia have built up reward systems that pull them apart
  - Academics reward research
  - Industry rewards short term results
- The economics of these systems encourage the current reward systems
  - So they must change the economics!
  - This takes bold initiatives
    - New funding paradigms for research grants
    - New models of investment and reward for businesses
Change Values

• Human nature says one should value the similar and distrust the different
• Values are influenced by culture
  – Universities are ranked by their research faculty, not by their teaching and effective knowledge transfer
  – Companies are ranked by their stock prices, not their long term contributions to society
• Change happens in either of two ways:
  a enlightened leadership, or
  b unbearable pain
Are We as Smart as we Think We Are?

“...whereas Newton could say, ‘If I have seen a little farther than others it is because I have stood on the shoulders of giants,’

I am forced to say [that in computer science], ‘Today we stand on each other’s feet.’”

Let’s Prove Hamming Wrong!
END
Outline

• The Symptoms
  – My Background - Industry and Academia
    • In industry, I am viewed as impeding progress
    • In academia, I am viewed as lacking depth
  – Gedanken Experiments - budget limits prevent real experiments
    • pumpkins - why we need to understand the foundations
      – moving too soon can lead to disaster (pumpkins)
    • airplanes - why we need to take risky action

• The Problem and the Need
  – Software Engineering as an illustration
  – Technology Transfer as an illustration
Outline (continued)

• The Causes
  – Academics and Specialists Probe and Focus
    • But on Different Things
    • More and More about Less and Less
  – Managers and Industry Types Integrate
    • But They Harvest, not Plant
    • Less and Less about More and More
  – The Middle ground is Not Rewarded
    • Benefits are long term but costs are immediate
Outline (continued)

• Toward a Solution
  – Common Ground (goals and objectives)