Spreadsheets and "Enhanced Tool" Research

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Why do these spreadsheets look so different?

Newman had one ET pro-forma
An enhanced tool is described for the design of <artifact-type> based on <model/strategy>. Examples are provided confirming the effectiveness of its support for <model/strategy>.

Although similarities exist, ET plays out differently in industry versus academia.
Difference in paradigm => Differences in question / results / validation

Spreadsheet research highlights this.
Most of my examples will come from spreadsheet research.

"Enhanced Tool" (ET) research differs between industry and academia.

Industrial ET is more utilitarian than Academic ET.

<table>
<thead>
<tr>
<th>Industrial ET</th>
<th>Academic ET</th>
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</thead>
<tbody>
<tr>
<td>Questions: Need-driven</td>
<td>Questions: Theory-driven</td>
</tr>
<tr>
<td>Results: Profit-oriented</td>
<td>Results: Truth-oriented</td>
</tr>
<tr>
<td>Validation: Sales-minded</td>
<td>Validation: Proof-minded</td>
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Some research successfully blends the two!

Note #1: All statements in this presentation are generalizations, not rules/laws.
Note #2: These two ET paradigms are complementary. Neither is universally “better.”
### Industrial Questions

**Method of development**
- "How can we automate X?"
- "Is it possible to do X at all?"

**Selection:** Need-driven

**Examples**
- VisiCalc
  - Can we automate ledger calculation?
- Lotus 1-2-3
  - Can we boost performance and give more features (e.g.: macros)?

### Academic Questions

**Often the same on the surface!**

**Selection:** Theory-driven

**Examples**
- Forms/3
  - Can we give useful features (e.g.: abstraction, graphics, animation) without breaking the "first-order declarative evaluation model"?
- Excel
- NIST ATP Grants
  - Every example is a specific solution!

### Industrial Results

**Tool**
- "Tool embodies model or technique"?

**Specific Solution**
- "Solution to application problem"?

**Selection:** Profit-oriented

**Examples**
- Excel
- Print Preview
- NIST ATP Grants

### Academic Results

**Selection:** Truth-oriented

**Examples**
- Forms/3
- Designed around cognitive dimensions
- JEDI
- Conscious blend of event-oriented and distributed architectures

### Industrial Validation

**Experience**
- "Used on real examples"
- "We thought hard and believe..."

**Persuasion**

**Selection:** Sales-minded

**Examples**
- Benchmarks
- Compatibility / Standards
- Testimonials
- Everybody’s marketing material

### Academic Validation

**Analysis or Experience**
- "Experiment; real examples"
- "Here’s an example of how it works"

**Selection:** Proof-minded

**Examples**
- Forms/3
- Speed & bug studies, + toy examples
- JEDI
  - Implementation of example: QPS workflow management system

### Some projects attempt to blend ET paradigms.

**InterViews, C32, Druid**

- Question: How can we simplify user interface design?
  - HCI nuances; but also "we aim to put our technologies to use in the real world"
- Result: Specific tools
  - HCI results (e.g.: glyphs and PBD); but also "features which are not research"
- Validation: Lots of experience
  - HCI methods (code and user studies); but also benchmarks & suites

**MEAD**

- Question: Can we provide real-time fault-tolerance middleware?
  - ECE nuances; but also phrased in the context of Corba
- Result: Specific tools
  - ECE results (e.g.: proactive recovery); but also industrial apps + reduction in jitter
- Validation: Lots of experience
  - ECE methods (lots of experiments); but also incorporation into standards
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But we can leverage their complementarity.

Software engineering sits at the crossroads of Engineering and Computer Science.

“In many other engineering fields, the results of research are reported in ‘how to’ papers.”
— David Parnas

“Life is good for only two things, discovering mathematics and teaching mathematics.”
— Siméon Poisson

What is magical about “Research”?

“If we knew what we were doing, we wouldn’t call it ‘research.’”
—Einstein

“Research is a state of mind.”
—Taylor (a more recent Nobel laureate)

Research: “Scholarly or scientific investigation or inquiry; Close, careful study”
—American Heritage Dictionary

Development: “Determination of the best techniques for applying a new device or process to production of goods or services”
—American Heritage Dictionary