



Technical Development and Empirical Studies

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Contents

Contents

- 1 Basil's work in empirical studies
- 2 Building a body of knowledge
- 3 Current work

Outline

- A slice of Vic's work
- A brief synopsis of the body of work building upon Vic's contribution
- Visualizing the "study space": some lessons learned across studies
- Current applied research / tech transfer applying these lessons

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Overview of Empirical Studies Papers

Contents

- 1 Basili's work in empirical studies
- 2 Building a body of knowledge
- 3 Current work

- Book contains a selection of 5 journal articles over 16 year period [1981-1997]
- Common themes in methodology:
 - Goal-based objectives
 - Correlation between process and product
 - Mix of quantitative and qualitative data collection
 - Careful conclusions limited to scope of study

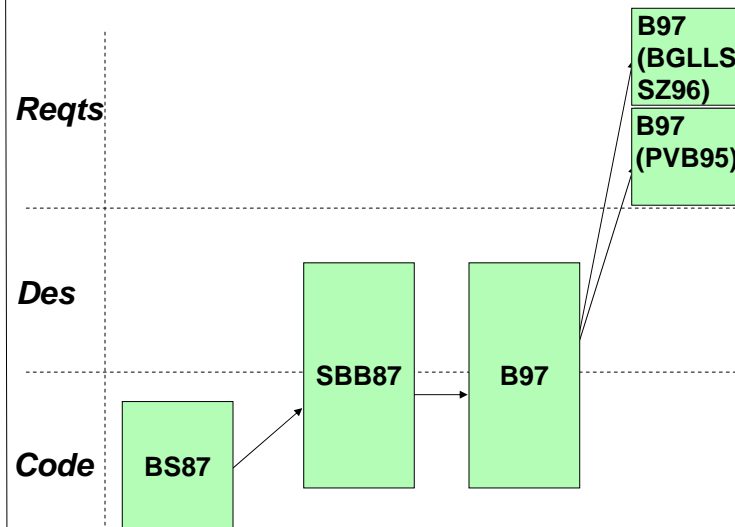
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A slice of Basili's empirical studies

Contents

- 1 Basili's work in empirical studies
- 2 Building a body of knowledge
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A slice of Basili's empirical studies

Reqs

- For professionals, code reading > functional or struct test
- For students, code reading was no improvement

Des

Code


BS87 → SBB87 → B97

-897
 BGLLS
 (Z96)
 -897
 PVB95)

Manual "reading" is an effective means of defect removal for software.
Developers need to be motivated to read better.

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A slice of Basili's empirical studies

Reqs

- Cleanroom teams met functional reqts more completely.
- More Cleanroom teams met intermediate deadlines.
- 86% of Cleanroom developers missed program execution.

Des

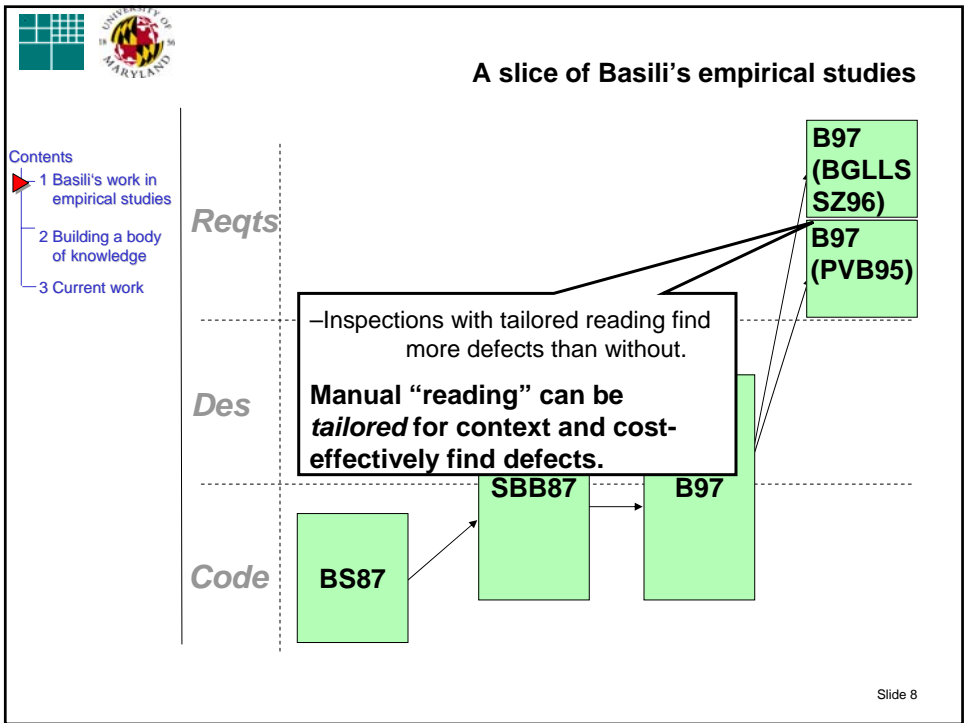
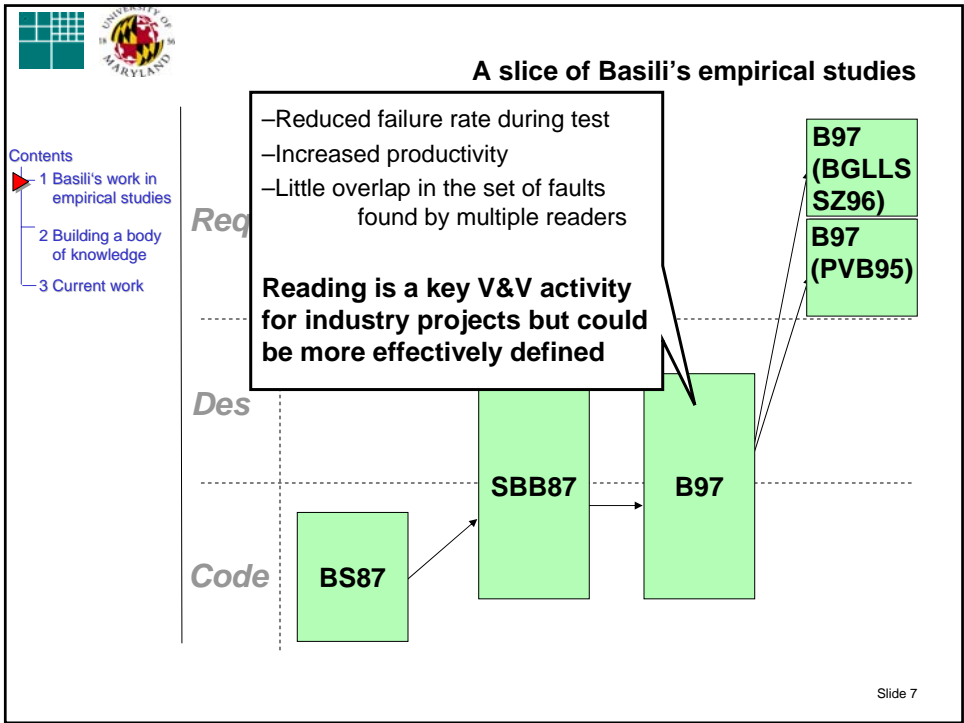
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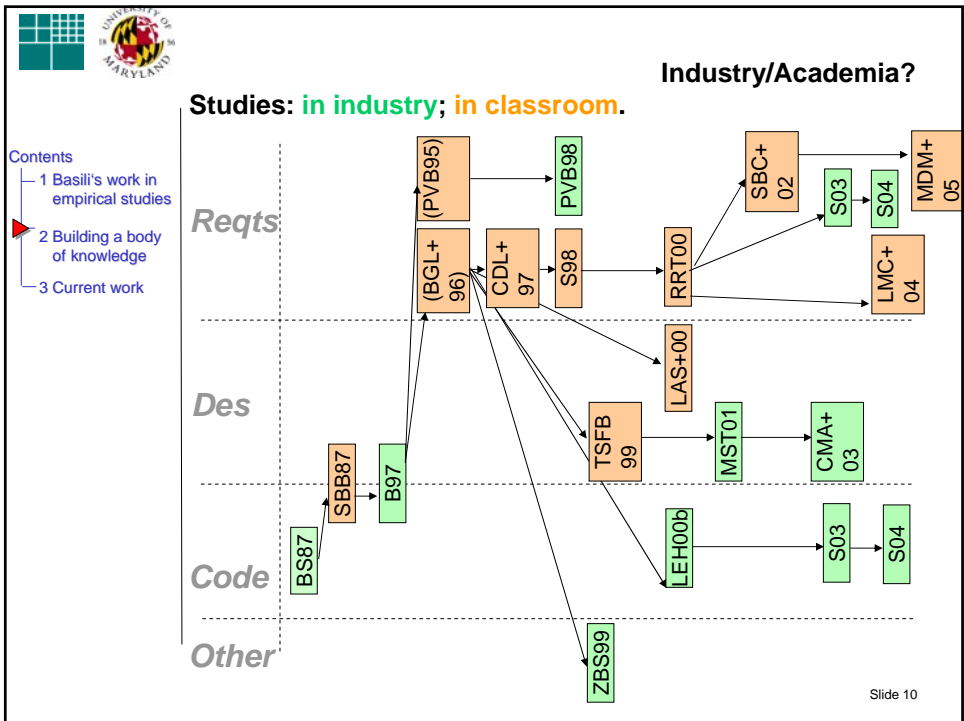
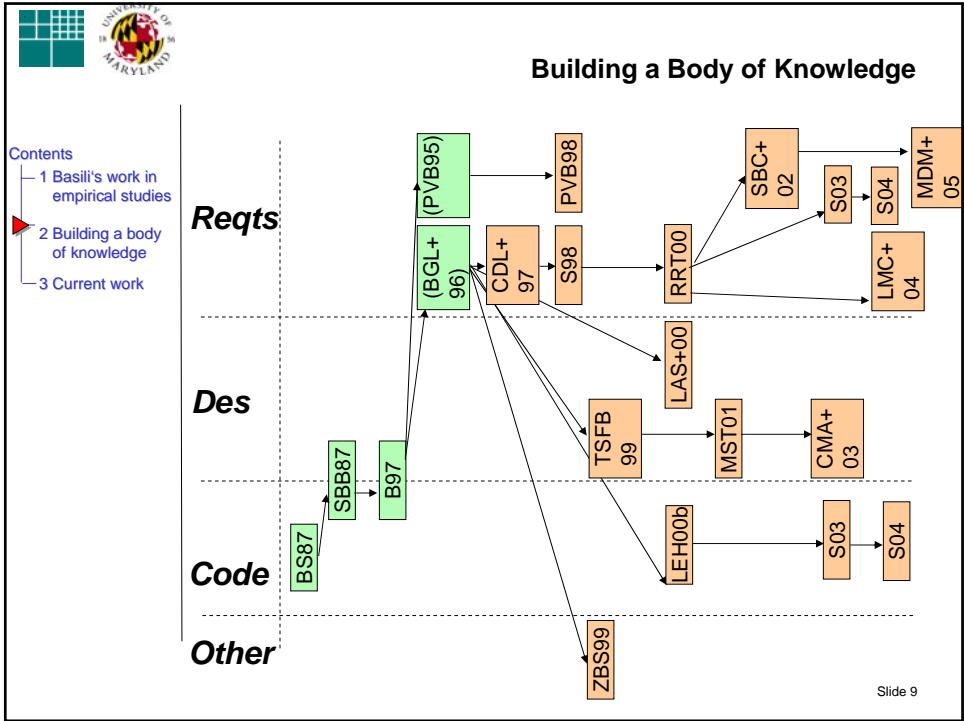
BS87 → SBB87 → B97

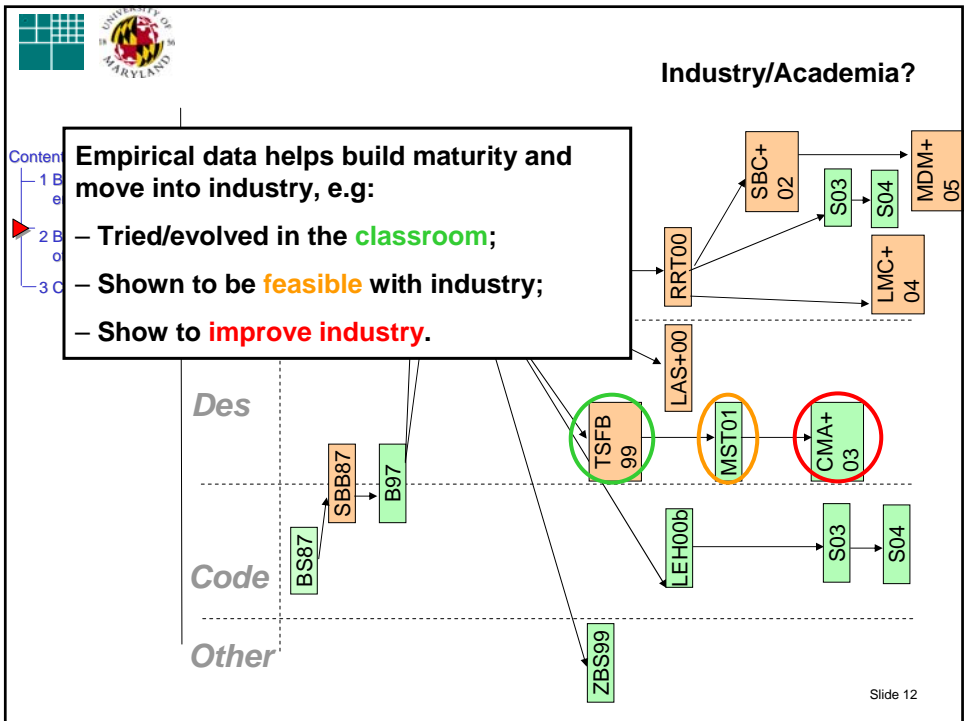
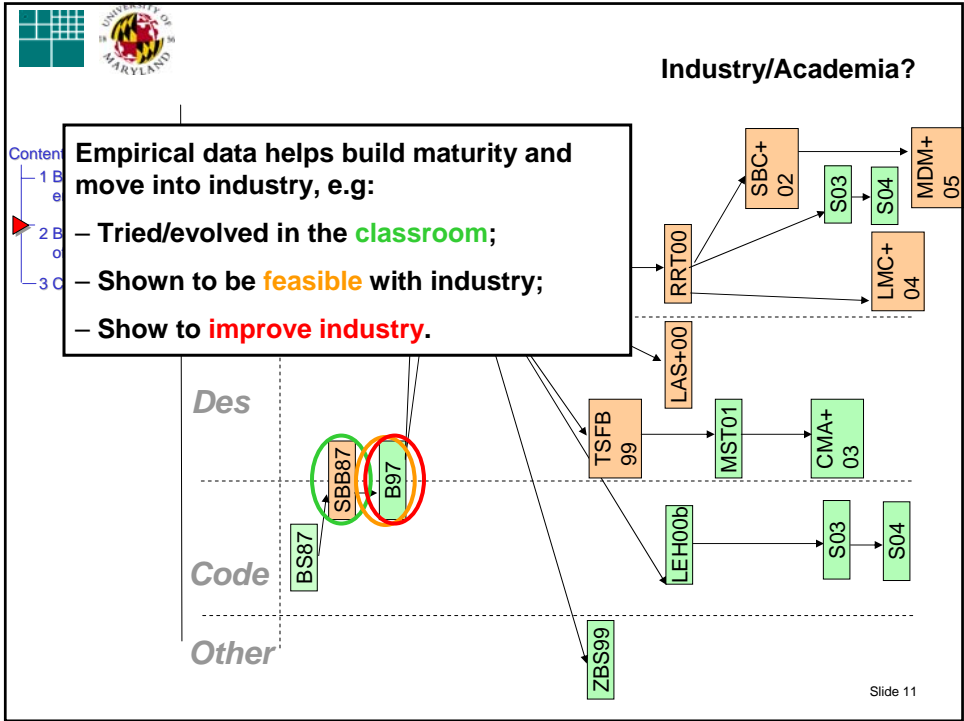
Software assurance through reading requires a culture shift but produces high-quality code and a better assessment of code quality.

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Industry/Academia?

Contents

- 1 Basili's work in empirical studies
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Reqs

Des

Empirical data helps build maturity and move into industry, e.g:

- Tried/evolved in the **classroom**;
- Shown to be **feasible** with industry;
- Show to **improve industry**.

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Evolving Hypotheses

Contents

- 1 Basili's work in empirical studies
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Reqs

Des

An effective framework for reading consists of:

- **Active review**
- **Different perspectives (quality foci) for different users**
- **A defined defect taxonomy**

Do perspectives catch unique subsets of defects? (No)

Do perspectives catch unique subsets of defects? (Yes)
And, overall reading approach was effective.

Are inspections with active review more effective than without? (No)

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Lessons Learned

Contents

- 1 Basili's work in empirical studies
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- Empirical study can and does yield useful results for practice.
- This example shows:
 - An empirically-evolved technology has been taken into industrial environments and made a measurable difference
 - Useful communication between industry and university
 - University as a laboratory for industry
 - Industry for focusing and constraining university work
- What was needed to accomplish this?
 - A body of knowledge built over several studies
 - Information from different contexts that allowed influencing factors to be found *bottom-up* and *opportunisticly*

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Lessons Learned

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- 1 Basili's work in empirical studies
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- But also some problems are observed:
 - Hard to abstract a result useful for decision support
 - Hard to predict results in a given context
 - Very long-term process
- Ongoing work at FCMD has focused on:
 - How do we support the process of abstracting conclusions from Bodies of Knowledge?
 - How do we provide practical, empirically-based decision support?
 - How do we better communicate to customers the role of empirical study in software technology *selection* and *development*?

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Current Project: USDOD

Acquisition Best Practices Clearinghouse

Contents

- 1 Basili's work in empirical studies
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- Collaboration among: FC-MD, DAU, NG, CSC, NDIA/INCOSE, ARDEC, many others
- Goals:
 - Primary source for practice information in the DoD and industry
 - Recommendations to be built based on evidence
 - Domains include:
 - Software acquisition
 - Systems engineering
 - Software engineering
- Clearinghouse content **starts** with practices recommended by government and industry experts
- But *trustable* and *contextualized* content requires making empirical basis more explicit

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Empirically-Based Decision Support

BPCh recommendations based on **empirical evidence** from real programs.

Evidence

- **Source:** *How trustable?*
- **Context:** *Used by a safety critical program? In a commercial environment? By a distributed team?*
- **Results:** *Did it increase or reduce cost, quality, and schedule?*



Evidence 1

Source
Context
Results



Evidence 2

Source
Context
Results



Evidence 3

Source
Context
Results



Evidence 4

Source
Context
Results



Empirically-Based Decision Support

Summary

Summaries written (initially based on *weighted vote counting*) to address:

- **Where** the practice was used successfully
- **What** were benefits/costs
- **Where to find info and resources**



Evidence 1

Source
Context
Results



Evidence 2

Source
Context
Results



Evidence 3

Source
Context
Results



Evidence 4

Source
Context
Results



Empirically-Based Decision Support

Summary

All BPCh content is vetted by a team of experts and prospective users for

- **Accuracy** of the recommendations
- **Usefulness** to users



Evidence 1

Source
Context
Results



Evidence 2

Source
Context
Results



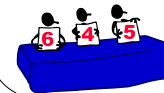
Evidence 3

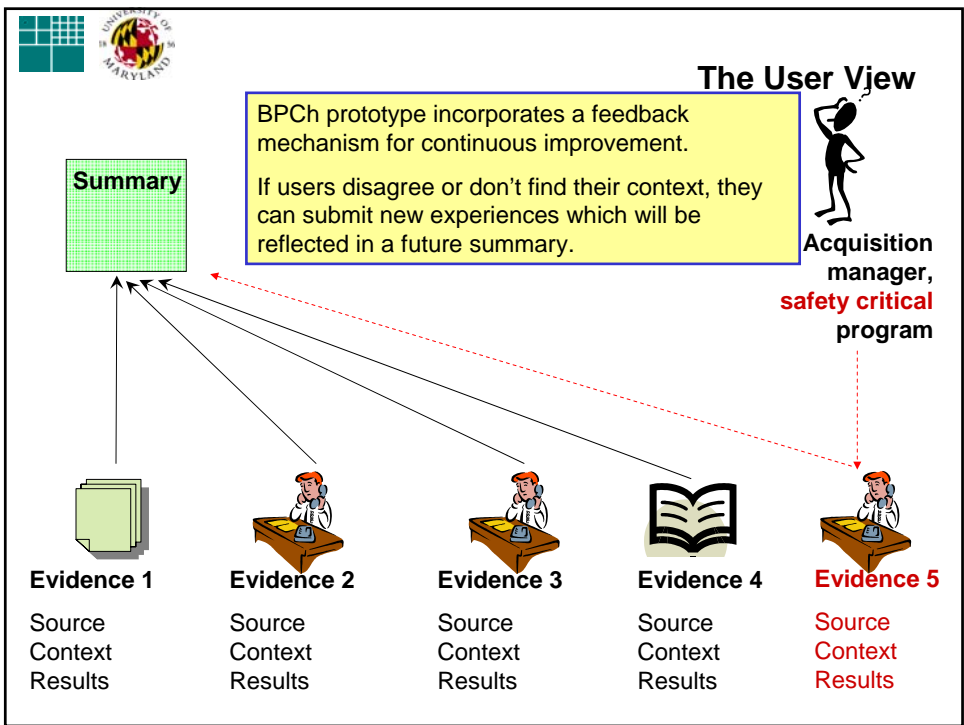
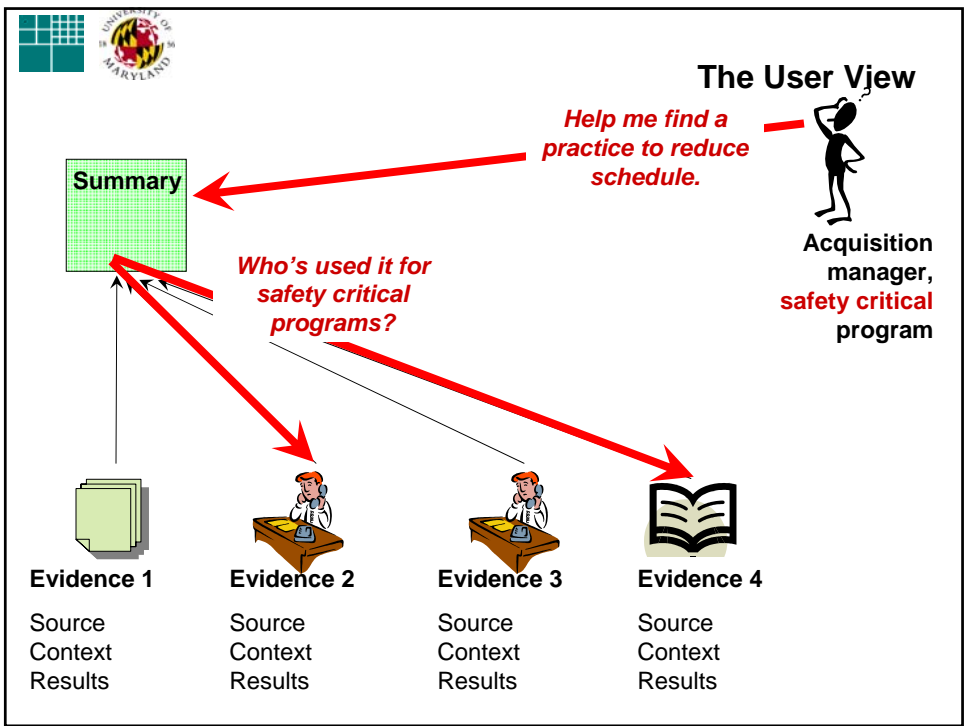
Source
Context
Results



Evidence 4

Source
Context
Results







Conclusions

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- Vic's work has shown the usefulness and practicality of the empirical approach.
- It has also shown that a single source of empirical data cannot address important questions at the level needed
- FCMD is instantiating a program that
 - Incorporates these and other lessons learned from the body of work that is building upon Vic's studies
 - Makes the empirical basis of developing decision-making explicit.
- BPCh prototype is online:
 - <http://fc-md.umd.edu/bpch/>
- We welcome comments and feedback

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References

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