Software Engineering Research Strategy – Combining Experimental and Explorative Research (EER)

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Contents of presentation

• Introduction & Background
• Experimental explorative research paradigm
• Conclusions
A shaman with a vision...

A legend from Lapland...

• “A shaman used the witch drum as a magical device, which he implemented in order to induce himself into a mystical "trance", and to seek wisdom only obtainable far beyond the realm of day-to-day reality

• All the markings in the witch drum – and their combination, as well – have a definite meaning

• The witch drum helped the shaman to:
  • gain knowledge of events taking place elsewhere - even in locations at very great distances;
  • find out whether plans for the future will succeed or not
  • to acquire wisdom as to what sort of offering would please the gods and demons”
A legend from Maryland...

- "A professor used the experiment as a magical device, which he implemented in order to induce himself into a mystical "trance", and to seek wisdom only obtainable far beyond the realm of day-to-day software engineering"
- All the observations in the experiment – and their combination, as well – have a definite meaning
- The experiment helped the professor to:
  - gain knowledge of events taking place elsewhere - even in locations at very great distances;
  - find out whether plans for the future will succeed or not
  - to acquire wisdom as to what sort of offering would please the industry and research”
A professor with a vision
Vic Basili

- A man with a vision of experimental software engineering at least as early as in early 1980’s...
- My personal experience
  - A visit at the University of Maryland in 1990-91
    - Hosted by Prof. Vic Basili
  - The most influential period of my professional life
  - Personally gratifying period
  - Once in a life-time experience for the whole family
  - Contributed to...
    - Re-focusing research direction and establishing a research group at VTT
    - Becoming a founding member or ISERN
    - Large national research projects in Finland
    - Introducing GQM in Finnish industry
    - New visiting positions (Schlumberger Paris 1994-95, Fraunhofer IESE Germany 1999-2000)
    - Several European projects including PROFES
    - PROFES conference
    - ...

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Research strategies

- **Research in software engineering**
  - **Scientific method**: observe the world and build a model (propose and validate)
  - **Engineering method**: current solutions are studied and changes are proposed & evaluated
  - **Empirical method**: model is proposed and evaluated
  - **Analytical method**: formal theory is proposed and compared with empirical observations

- **Mobile Technologies and Applications Research**
  - **Explorative research**
    - Current situation is evaluated
    - New technological visions are proposed
    - New ideas, concepts, technological platforms and frameworks are explored
    - New applications are proposed and explored
  - **Prototypes and demonstration systems**
    - Near industry settings and large applications
    - Professional researchers and developers
  - **Success: demonstrate the feasibility of the technology - but not much more**
    - No evidence of the effectiveness of the development methods for that particular technology
    - No convincing empirical evidence of the excellence of the technology itself.

- **Empirical Research**
  - Surveys, Post-mortem
  - Case Studies
  - Experiments

- **Need for real applications**
- **Need for systematic experimentation**

- **Explorative and Experimental Research (EER)**

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-Basili 92-
Explorative research

• **MIS** (Banville and Landry)
  - **Simon:** “Science, like all creative activity, is exploration, gambling, and adventure. It does not lend itself very well to neat blueprints, detailed road maps, and central planning.”

• **Explorative Psychology** (rediscovered, Kleining & Witt 2002, 2001)
  - Discoveries rather than description and/or interpretation
  - Hamburg Approach with four rules

• Widely used in **Social Research** (Govender 2003)
  - New insights into a phenomenon rather than to collect and replicate data

• **Marketing research** (Skopos 2003)
  - Search for the dimensions of a question or the possible causes of facts

• Important in **physics**
  - Einstein & Infeld: explorative use of though experiments
  - Research process that lead to the discovery of Double Helix (Watson 1968)
Research as Laboratory: Complementary approach
EER strategy

Experimental Project

Experimetalists

Experiment or Case Study

Subjects

Objects

Communication

Communication

Communication

Communication

New category of subjects

Research as Laboratory: Explorative Experimental Project

Subjects

Objects

Experimentalists

Large scale objects

Any vested interests or links between the technology researchers and experimentalists should be made clear and taken into account in the experiment.

Constant communication

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Conclusions

- **Increase external validity**
  - Better experimental control over the target project
  - Realistic large scale objects
  - Professional researchers and industrial developers as subjects
  - Avoid scale-up problems of student subjects
- **Easier to motivate the use of new software engineering technologies** than in industrial case studies
- **Improved data collection** capability
- **Improved capability to interpret data** with data providers
  - Avoid pitfalls of “ivory tower” statistical analysis
- Create **baseline for first industrial applications**
- **Eat your own medicine** (not just wait practitioners to use what ever we offer)
Congratulations and Many Thanks to Prof. Vic Basili!

A man with a vision...