



Studies on Reading Techniques

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Reading Motivation

Reading is a key technical activity
for analyzing and constructing software documents

We need to evolve reading technology
by improving the analysis of all kinds of software documents

What is software reading?
the individual analysis of a textual software product
e.g., requirements, design, code, test plans
to achieve the understanding needed for a particular task
e.g., defect detection, reuse, maintenance

We have evolved our understanding of reading technology in the SEL
via a series of experiments
from the early reading vs. testing experiments
to various Cleanroom experiments
to the development of new reading techniques currently under study



Reading Research

What is a reading technique?

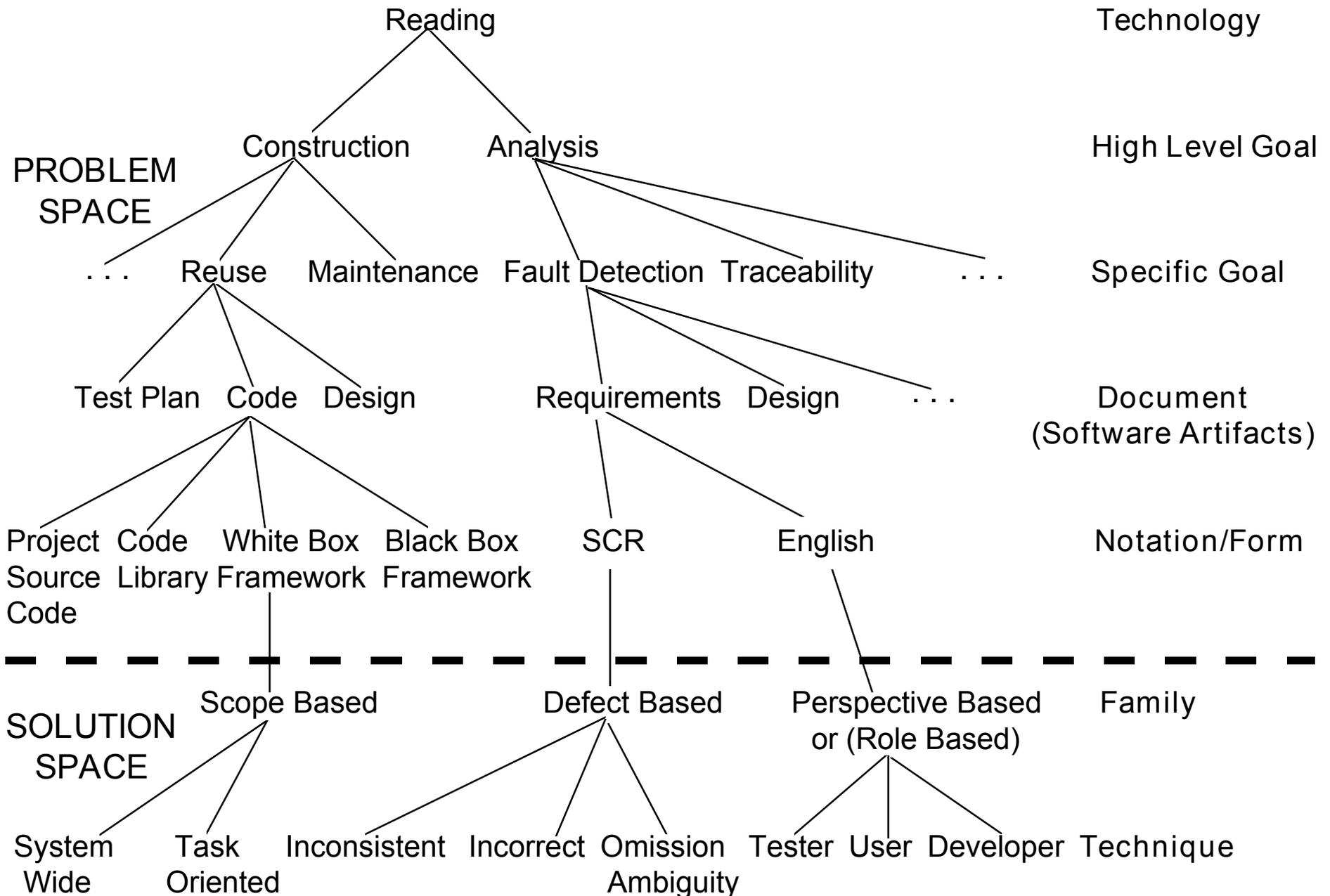
a concrete set of instructions given to the reader
saying how to read and what to look for in a software product

Our current research efforts are to
develop families of reading techniques
based on empirical evaluation
parameterized for use in different contexts
evaluated for those contexts

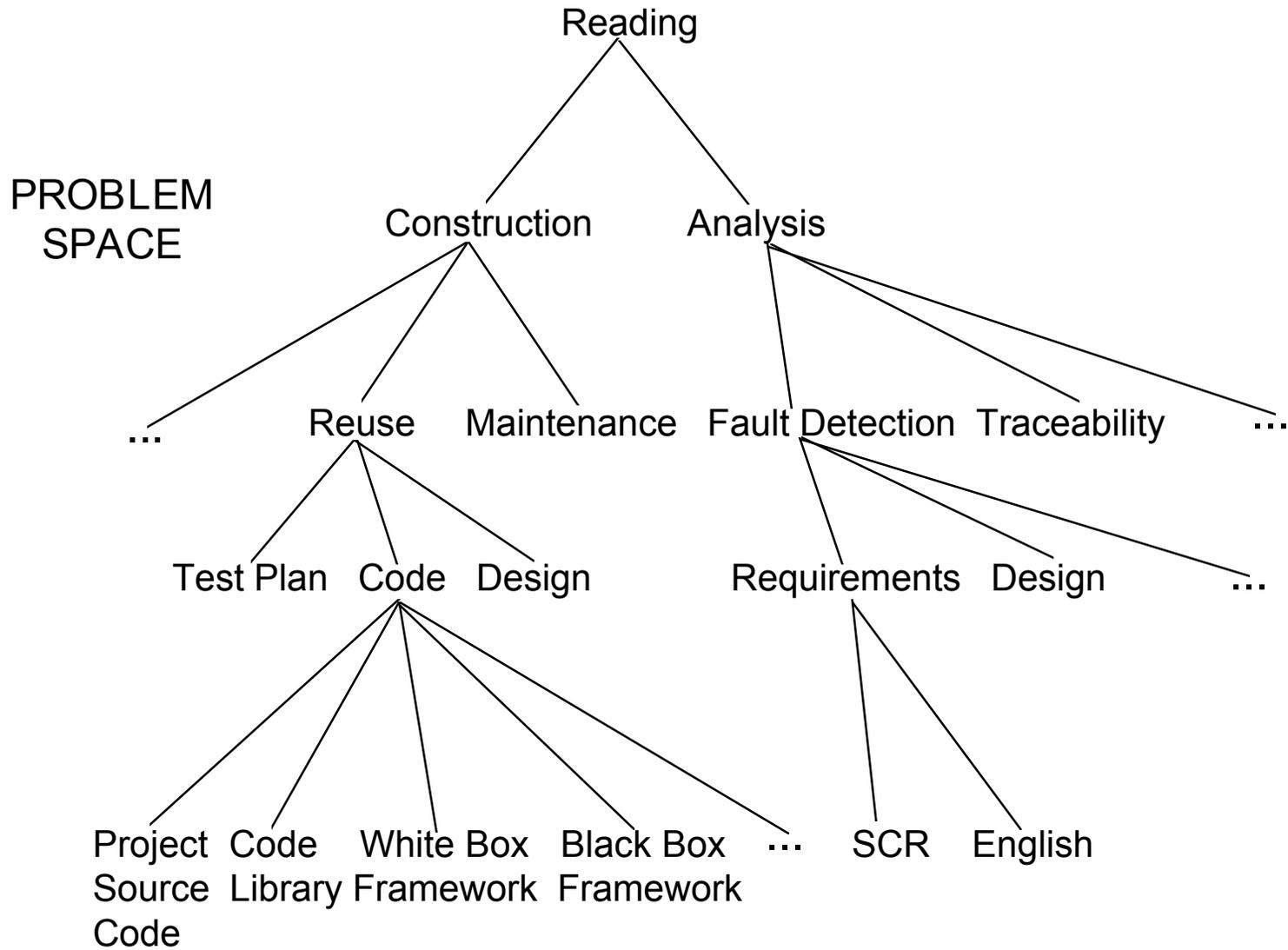
In this talk we discuss
a taxonomy of reading families
specific techniques and experimental evaluations
where we are going in our research program



Families of Reading Techniques



Families of Reading Techniques



High Level Reading Goals

We differentiate two goals for reading techniques:

Reading for analysis:
Given a document,
how do I assess
various qualities
and characteristics?

Assess for
product quality
defect detection
...

Useful for
quality control,
insights into development
...

Reading for construction :
Given a system,
how do I understand
how to use it as part
of my new system?

Understand
what a system does
what capabilities do and do not exist
...

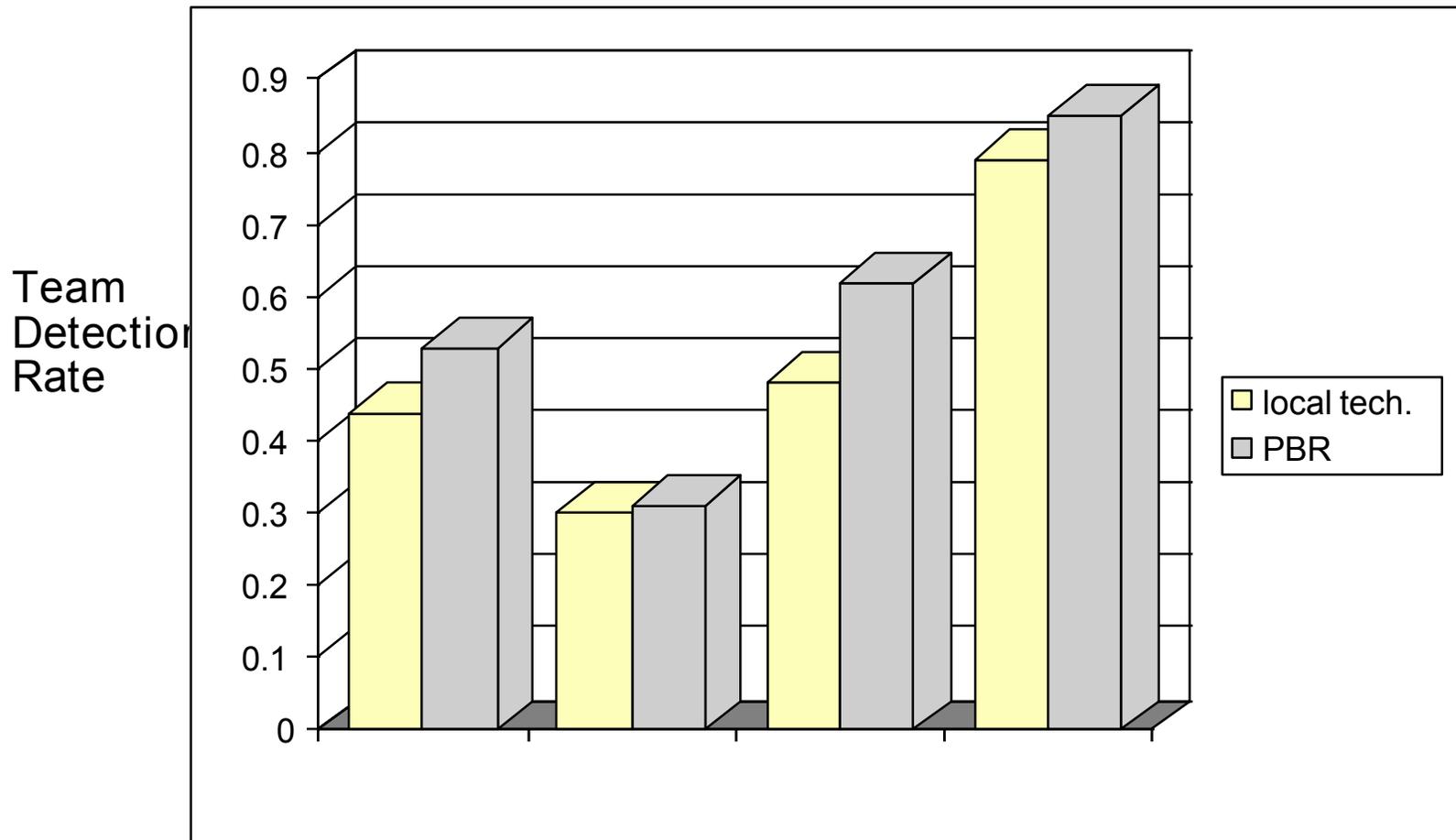
Useful for
maintenance
building systems from reuse
...



Reading for Analysis: Perspective-Based Reading Experiment

Goal of Perspective-Based Reading (PBR):
detect defects in a requirements document
focus on product consumers

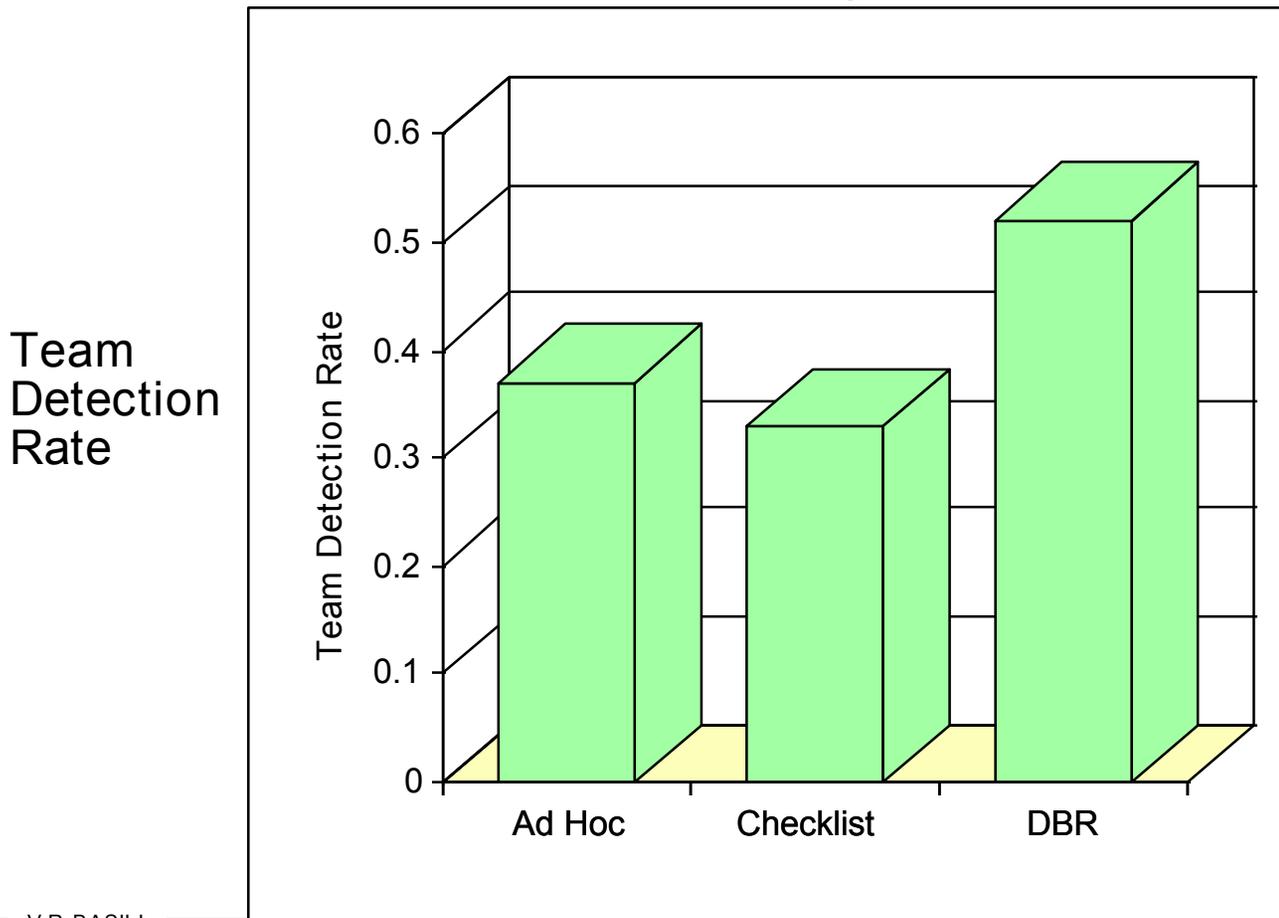
Controlled experiment run twice with NASA professionals:



Reading for Analysis: Defect-Based Reading Experiment

Goal of Defect-Based Reading (DBR):
detect defects in a requirements document
focus on defect classes

Controlled experiment run twice with UMD graduate students:



Experiments with Reading for Analysis

More Results from the PBR Analysis

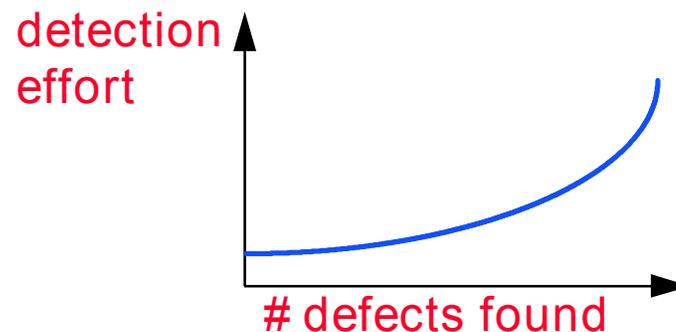
Generic Domain at the Individual Level:

PBR found more defects than the local Reading Technique

PBR took more time than the local Reading Technique

And the average cost for finding a defect is the same for both methods

Assuming that cost of finding a defect increases as more defects are found



Might imply: PBR is more productive than the local Reading Technique



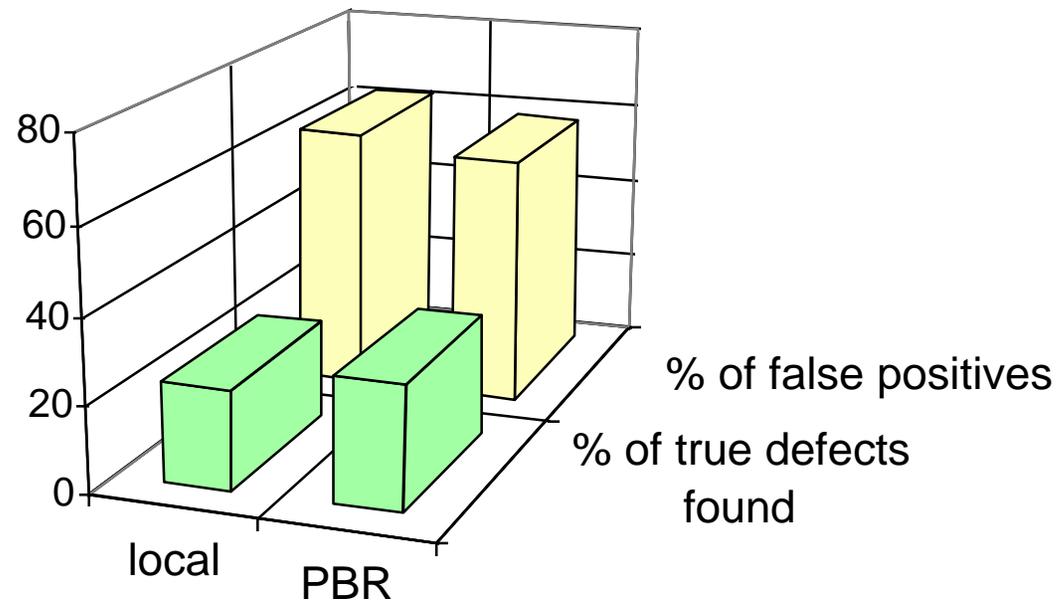
Experiments with Reading for Analysis

More Results from the PBR Analysis

Generic Domain at the Individual Level:

PBR found more defects than the local Reading Technique

The percentage of false positives for both methods is about the same



Might imply: Relative effort spent fixing defects later is better for PBR



Reading for Construction

Interested in reading techniques

to minimize the effort to learn a new tool or existing system
for a specific application development

Framework

A set of classes augmented with a built-in model for defining how
classes interact

to reuse domain concepts

to encapsulate implementation details

Framework
(domain specific)

Custom Software
(application specific)

Two approaches:

White-box frameworks - extend and modify classes

Black-box frameworks - select and configure ready-made classes



Experiments with Reading for Construction

White-Box Frameworks

We proposed two reading techniques emphasizing different facets of the framework:

System-wide technique:

- study classes
- gain a broad knowledge of the framework design
- build system by choosing appropriate classes

Task-oriented technique:

- study examples
- gain a specialized knowledge of directly relevant system parts
- build system by modifying examples

Experimental design :

Repeated project - 45 subjects - 15 three person teams

Environment:

University of Maryland upper-level software engineering course

Project: developing an OMT diagram editor - GUI framework ET++



Experiments with Reading for Construction

Preliminary Results: White-Box Framework Experiment

Students demonstrated an overhead in learning the framework

- High levels of frustration in the early weeks,
investment in time doesn't yield immediate payoff in programming
- Even a relatively well-designed* framework presents many difficulties
*(but poorly documented)

Learning curve seems worse for system-wide technique

- More difficult to know which areas of framework to concentrate on first
- Learning appears more difficult without example-based learning

Questions:

How prescriptive should the technique be?

How do we evolve these techniques?



Experiments with Reading for Construction

Experiment with Black-Box Frameworks (GSS)

We need to support analysts ability to understand and use GSS

We hope to learn more about

understanding and using black box frameworks to configure new systems based upon our studies with white box frameworks

For example:

Do analysts learn differently from developers?

Would analysts do better configuring systems based on:

system-wide approach :

learning specifications/categories
to gain broad knowledge configuring
new systems based on the specifications
and categories

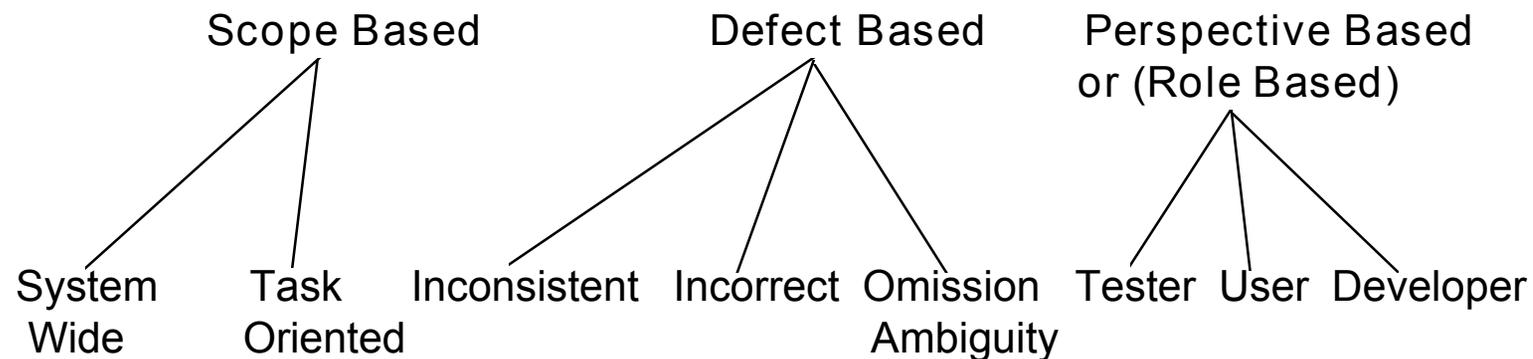
task-oriented approach :

taking examples
(e.g., past similar systems)
modifying the specification of
the old system



Conclusion

We have developed three families of reading techniques parameterized for use in different contexts and evaluated experimentally in those contexts



Long Range Research Plan

We need to

Develop better empirical evaluation methods to study these techniques in the laboratory and in industrial settings

Provide an Experience Base of technology evaluations that can be added to by other researchers and practitioners based upon their experiences with the technologies

Develop other families of reading techniques

and then

Develop families of other techniques

based on empirical evaluation

parameterized for use in different contexts

evaluated for those contexts

