Code Complete 2: Realities of Modern Software Construction

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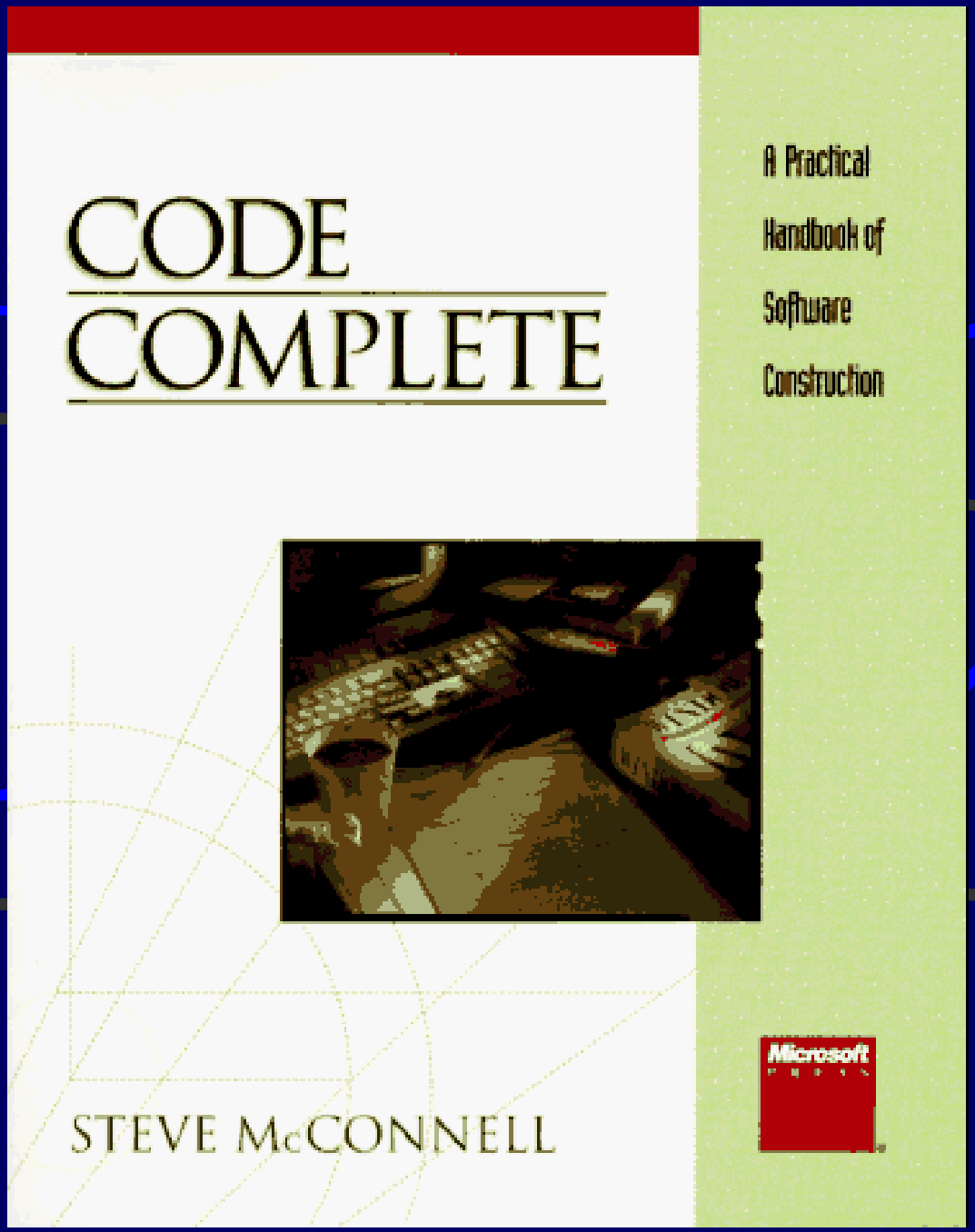
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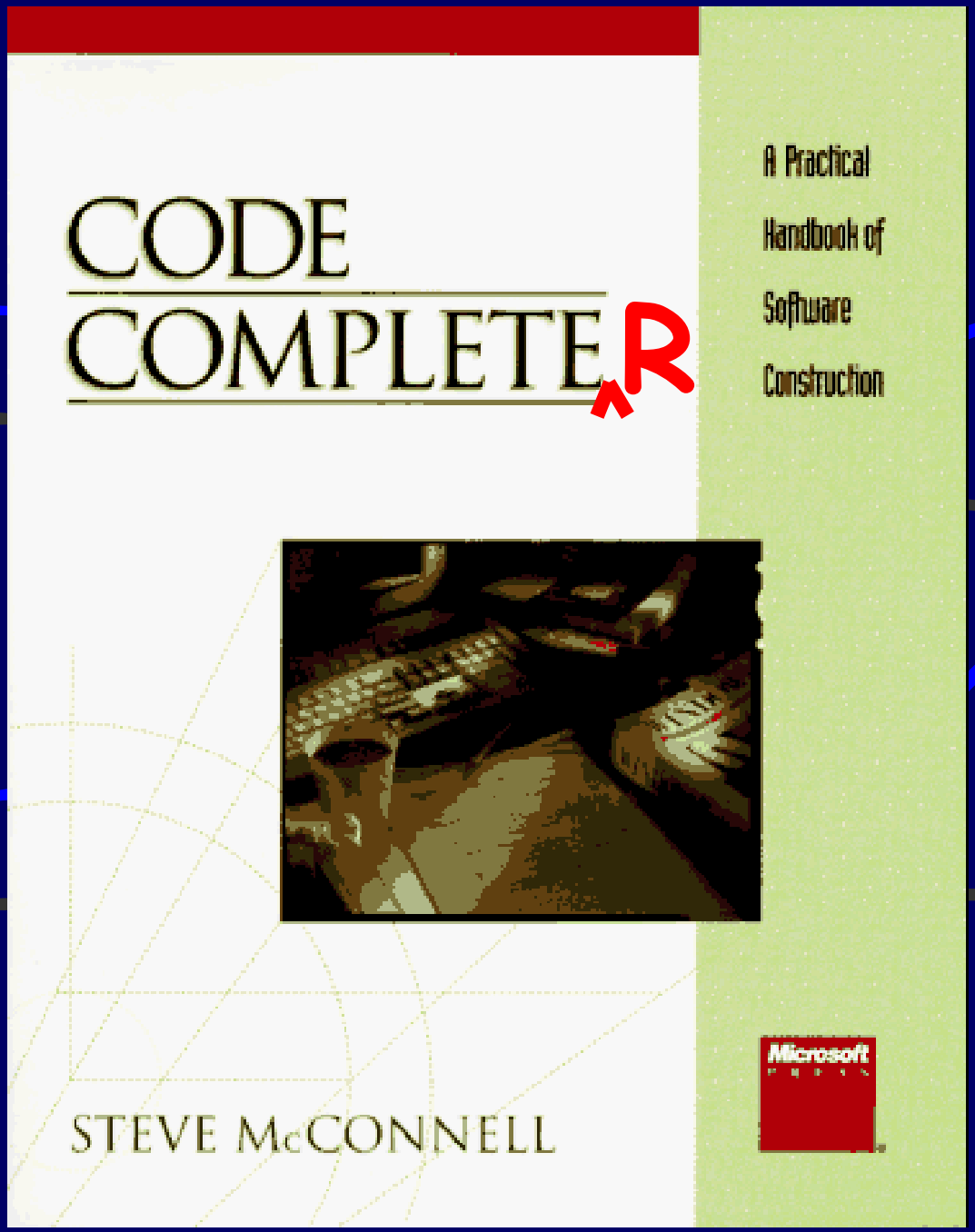
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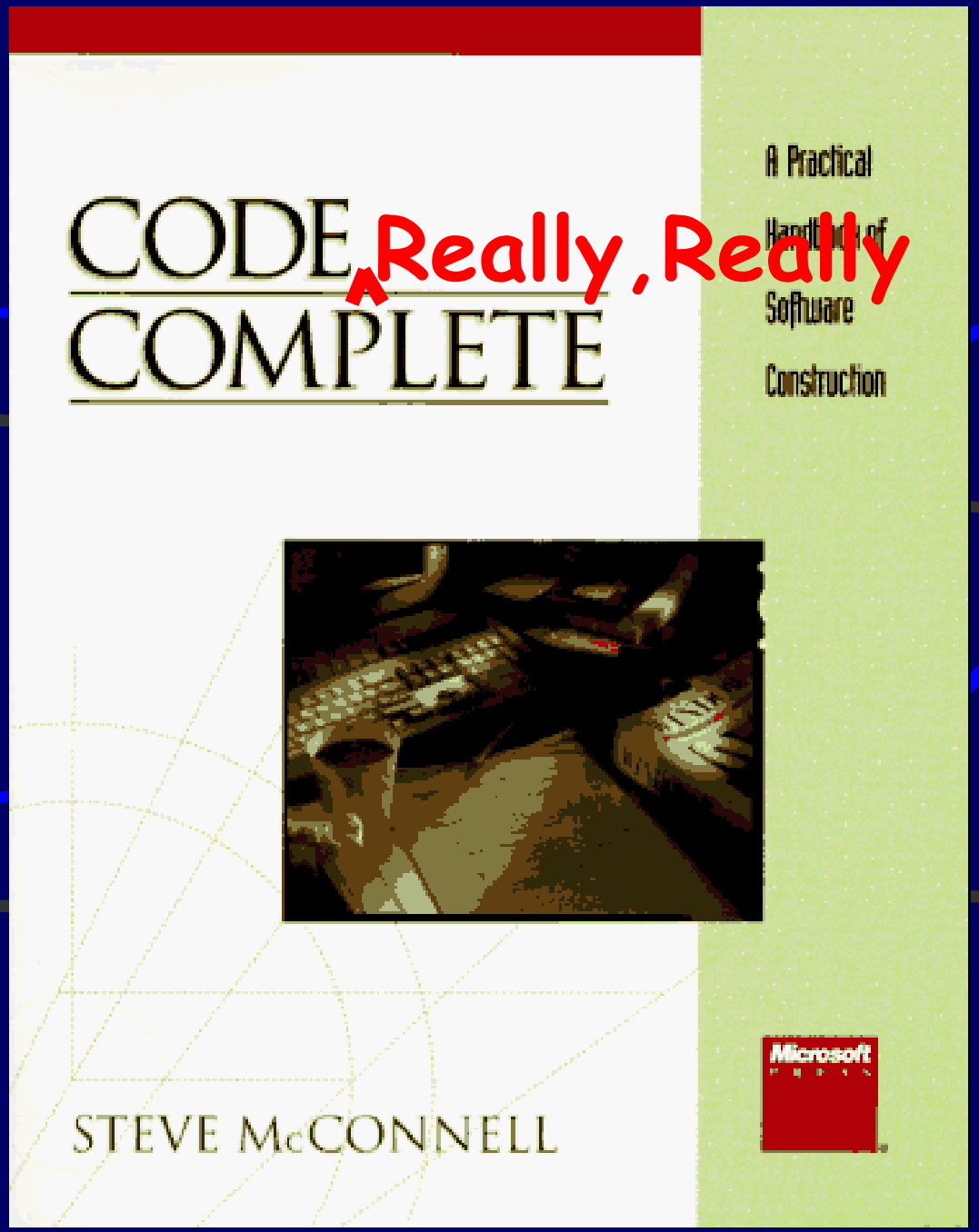
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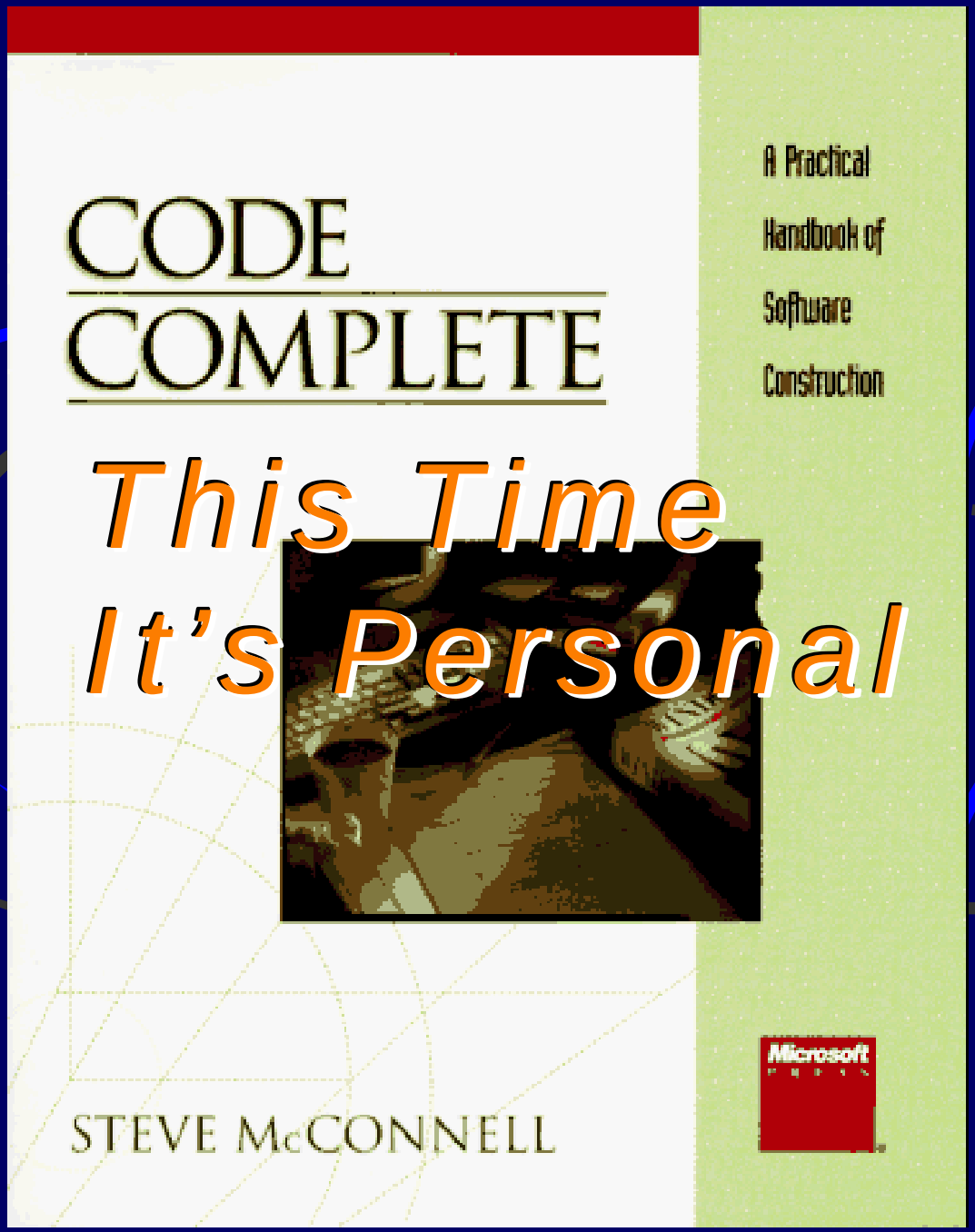
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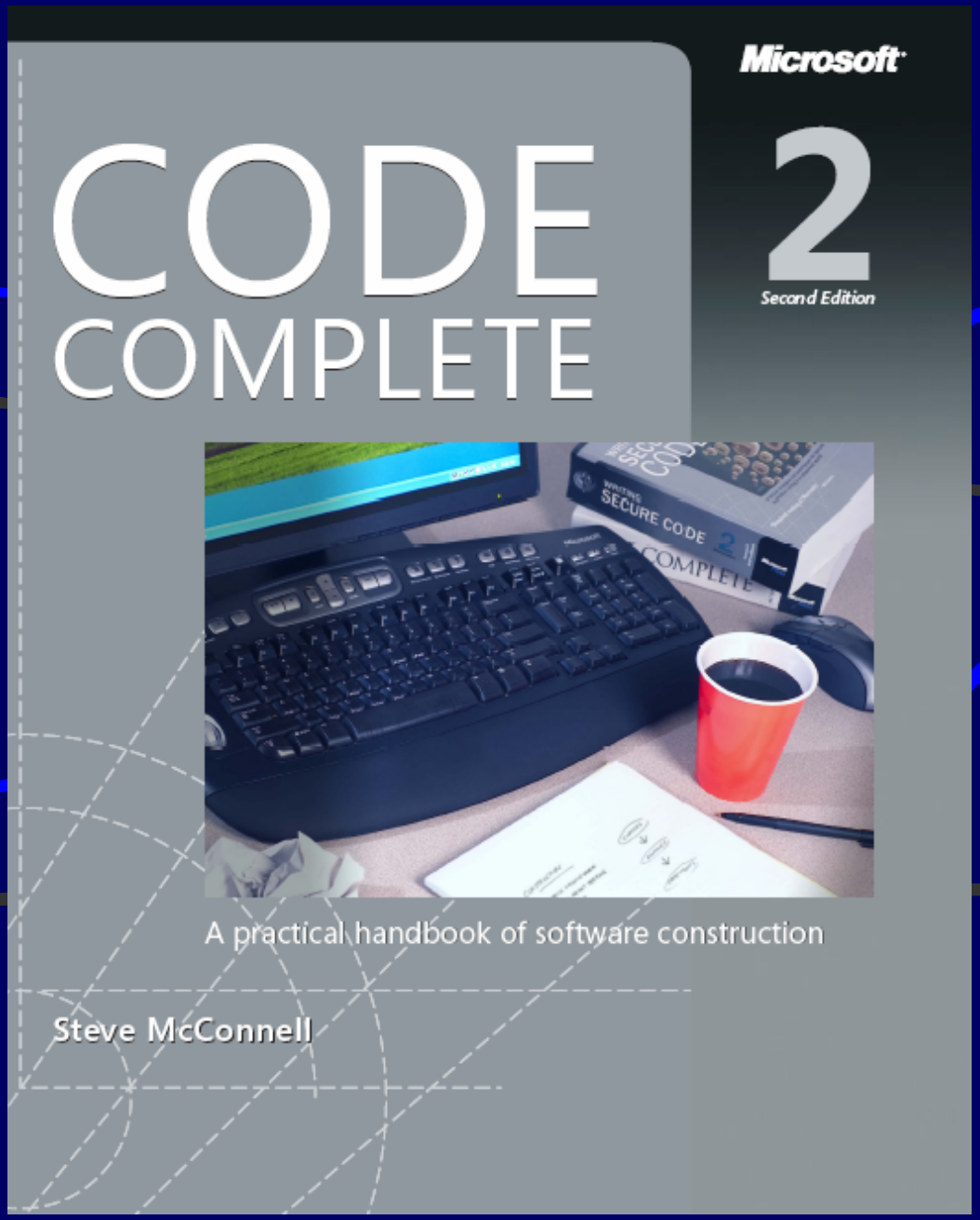
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CODE
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Second Edition
SECURE CODE
A practical handbook of software construction
Steve McConnell

Code Complete Mission

- Attempt in 1993 was to capture lasting knowledge of software construction
- I've asserted for many years that 95% of the content of CC1 is still relevant
- Was this true?

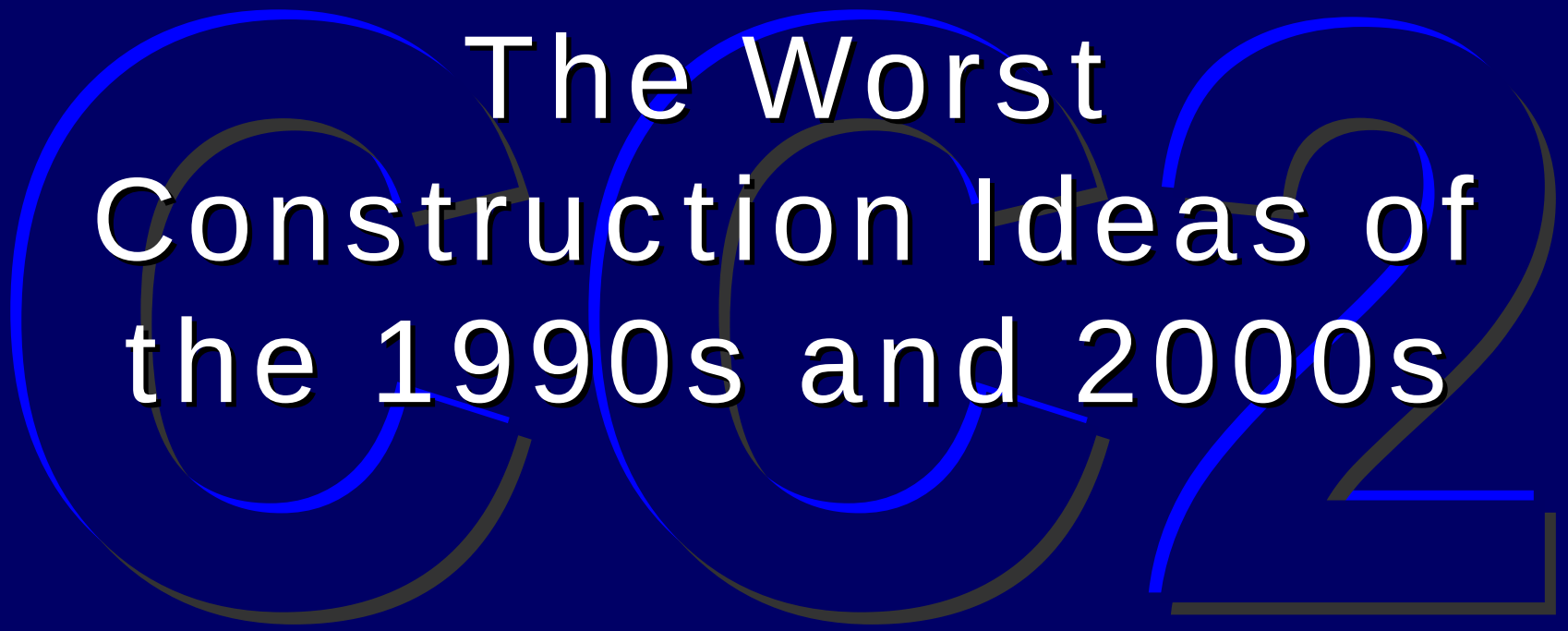
Scope of Work for CC2

- Formally inspected entire first edition
- ~500 programming examples updated to Java, VB, C++
- New chapters on Design, Classes, Defensive Programming, Collaborative Construction, Refactoring
- OO & web integrated throughout
- Further Reading updated throughout
- Numerous complementary resources on companion website cc2e.com

Overview of Talk

- The Worst Construction Ideas of the 1990s and 2000s
- A Decade of Advances in Software Construction
- Ten Realities of Modern Software Construction

The Worst Construction Ideas of the 1990s and 2000s



Some of the Worst Construction Ideas of 1990s

- Code & fix
- “All design up front” programming
- Design for speculative requirements
- Components will solve all our construction problems
- Automatic programming
- Uninformed use of the waterfall model
- Calling everything “object oriented”

Some of the Worst Construction Ideas of 2000s

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- Offshore outsourcing will solve all our construction problems
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Worst Ideas, 1990s vs. 2000s

1990s

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2000s

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A Decade of Advances in Software Construction

0. With the Theatrical Release of Lord of the Rings …

- ALL companies can have servers named Gandalf and Frodo

1. Design has Been Raised a Level

- Programming has advanced through ability to create larger code aggregations
  - Statements
  - Routines
  - Classes
  - Packages
- Real legacy of OO might well be larger aggregations

2. Daily Build and Smoke Test

- Institutionalizes incremental integration
- Minimizes serious integration problems that used to be common
- Lots of other benefits, too

3. Standard Libraries

- Good programmers have always used libraries
- Now provided with languages (Java, C++, .NET)

4. Visual Basic

- Visual programming innovation
- The first development environment to make widespread use of COTS components
- Only language to learn Ada's syntax lessons (case statements, control statements, etc.)
- Highly integrated environment

5. Open Source Software

- Great aid to programmers during development
- Reduced barriers to making code available
- Opportunity to learn from available code
- Improved ability to *read* code
- Nice “community” of programmers

6. The Web for Research

- FAQs
- Discussion groups
- Searchability in general

7. Widespread Use of Incremental Development

- **Concepts were well known in 1990s**
- **Practice is well established in 2000s**

From CC1:

"The word 'incremental' has never achieved the designer status of 'structured' or 'object-oriented,' so no one has ever written a book on 'incremental software engineering.' That's too bad because the collection of techniques in such a book would be exceptionally potent."

8. Test-First Development

- Shortens time to defect detection
- Increases personal discipline
- Complements daily build & smoke test

9. Refactoring as a Discipline

- Provides a discipline for making changes
  - Not so good as a total design strategy
- Good example of incrementalism

10. Faster Computers

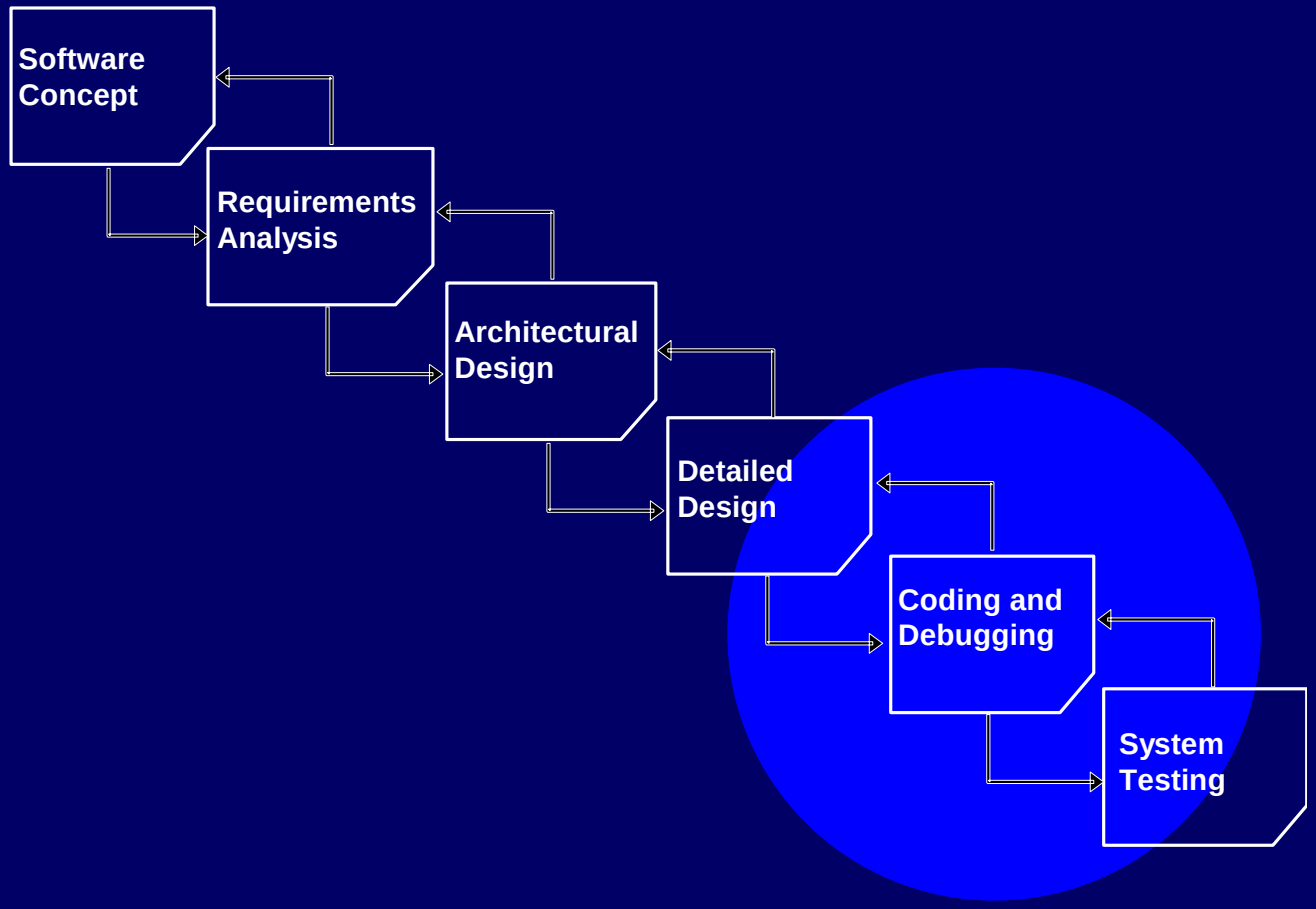
- Compare CC1 performance benchmarks to CC2 benchmarks
- Implications for optimization
- Implications for programming languages
- Implications for development

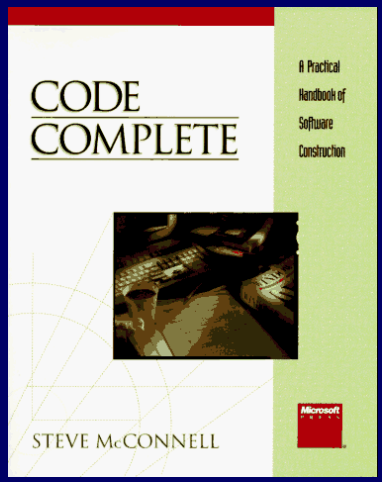
Ten Realities of Modern Software Construction

-1-

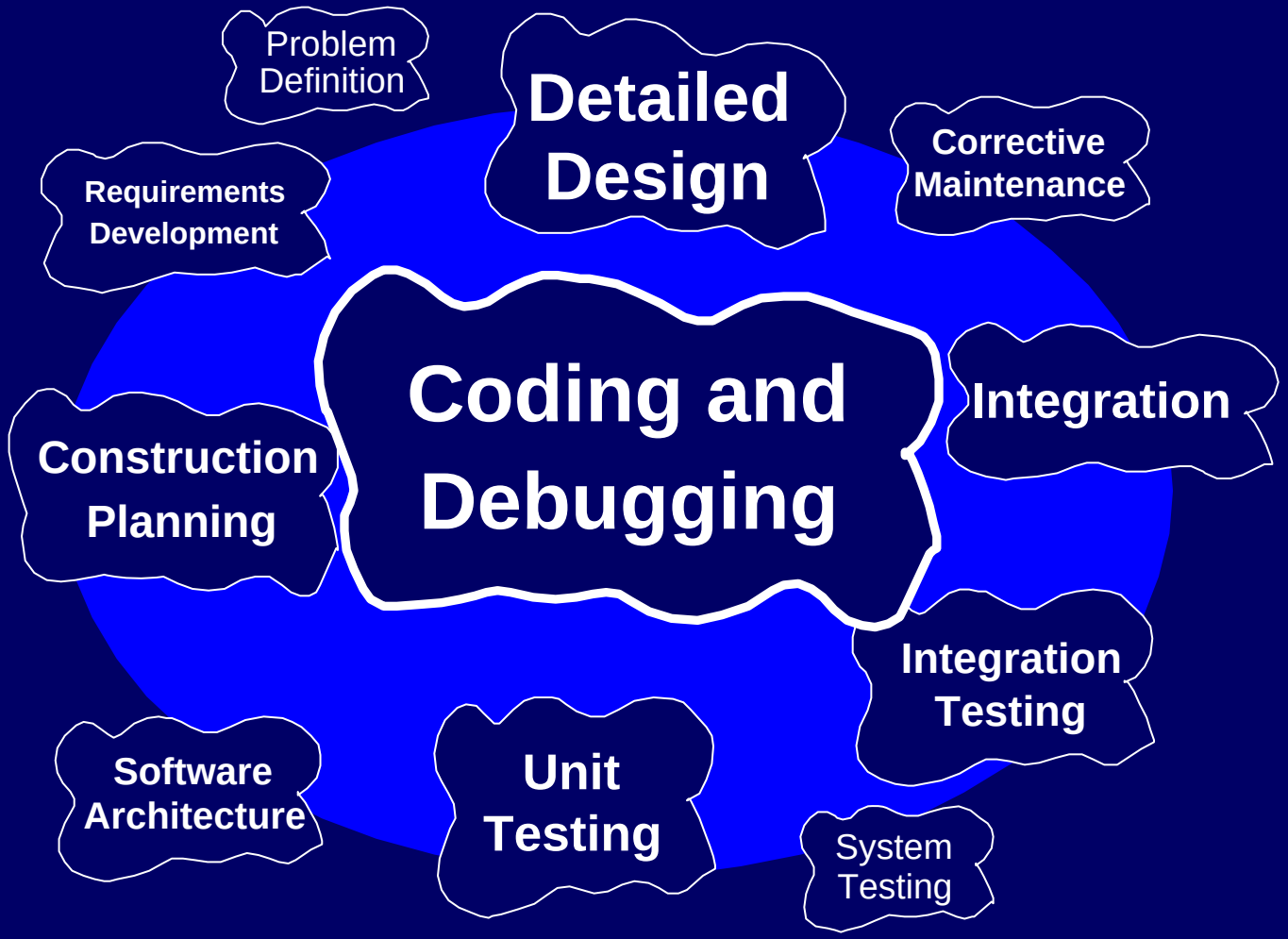
“Construction” is a Legitimate Topic

Software "Construction" – Used to Look Like This





Software "Construction" – Now Looks Like This



Distinction Between Activities and Phases

- Activity != Phase
- Talking about “Construction” as an activity does not imply a distinct phase
- Differentiating between kinds of activities is extremely helpful

-2-

Individual Variation Is Significant

Where do Variations Exist?

Researchers have found variations ranging from 10x to 28x in:

- **Coding speed**
- **Debugging speed**
- **Defect-finding speed**
- **Percentage of defects found**
- **Bad-fix injection rate**
- **Design quality**
- **Amount of code generated from a design**
- **Etc.**

Key Skills of an Expert Programmer

- Designing
- Flushing out errors and ambiguities in requirements
- Coding (naming, formatting, commenting)
- Reading & reviewing code
- Integration
- Debugging
- Unit testing
- Teamwork
- Using tools for all of the above

-3-

Personal Discipline Matters

Why Personal Discipline Matters

- Being realistic about predicting the future
- Areas where discipline matters
  - Refactoring
  - Prototyping
  - Optimization
  - Minimal-complexity designs specifically
  - Managing complexity generally
- Endpoints—Discipline and Courage
  - Humphrey on PSP
  - Beck on Extreme Programming

-4-

A Focus on Simplicity Works Better than a Focus on Complexity

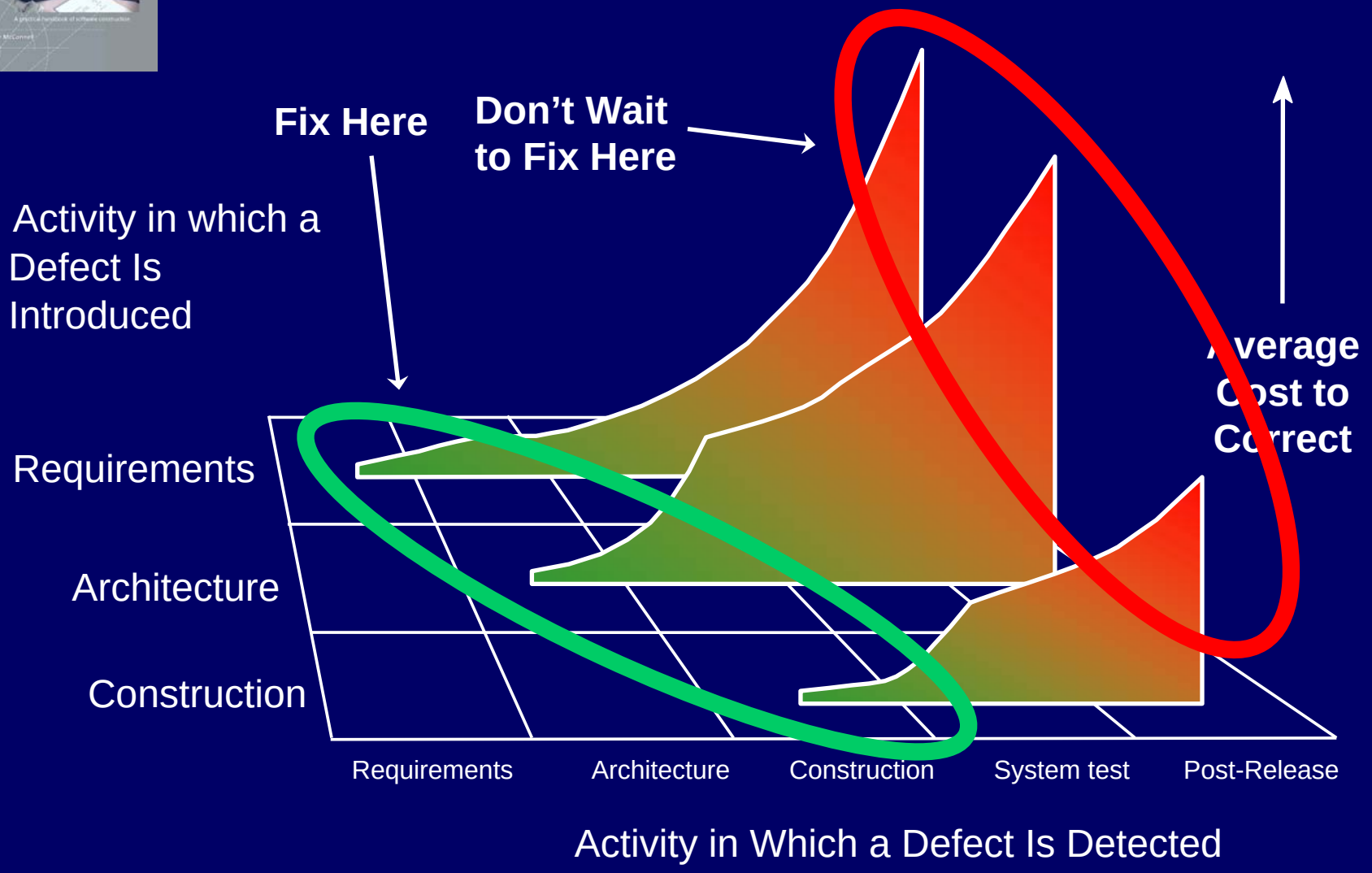
Simplicity vs. Complexity

- Why do projects fail?
- Focus on read-time convenience, not write-time convenience
- YAGNI and design for speculative requirements

-5-

Defect-Cost Increase is Alive and Well

Defect Cost Increase



Decades of Research Support Defect-Cost Increase

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CC2

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Design Is Important

Design Advice—What has Changed in 10 Years?

- In 1990s, design pundits wanted to dot every *i* and cross every *t* before writing any code
- In 2000s, design pundits say BDUF? YAGNI!
- There are lots of valid points on the "no design"—"all design" continuum
- The only 2 points guaranteed to be wrong are the two that have been advocated!

General Point: Extremes are Usually Not Productive

- All design up front vs. no design up front
- Entirely planned vs. entirely improvised
- Pure iterative vs. straight sequential
- All structure vs. all creative
- Document everything vs. document nothing

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Technology Waves Affect Construction Practices

Effect of Technology Waves on Construction

- Definition of "technology wave"
  - Early-wave characteristics
  - Mature-wave characteristics
  - Late-wave characteristics
- Construction is affected by technology—more than I thought (doh!)
- Technology can be addressed in terms of general principles


-8-
Incremental
Approaches Work Best
CO2

Perspective on Incrementalism

- The pure waterfall model is not at all incremental or iterative—which is why it hasn't worked very well
- Spiral development is highly incremental and iterative, which is part of why it does work well
- All projects will experience iteration at some point
- Think about *where* and *when* in your project you will get your incrementalism—cheaply, or expensively?

-9-
The Toolbox Metaphor Continues to be Illuminating

Toolbox Metaphor

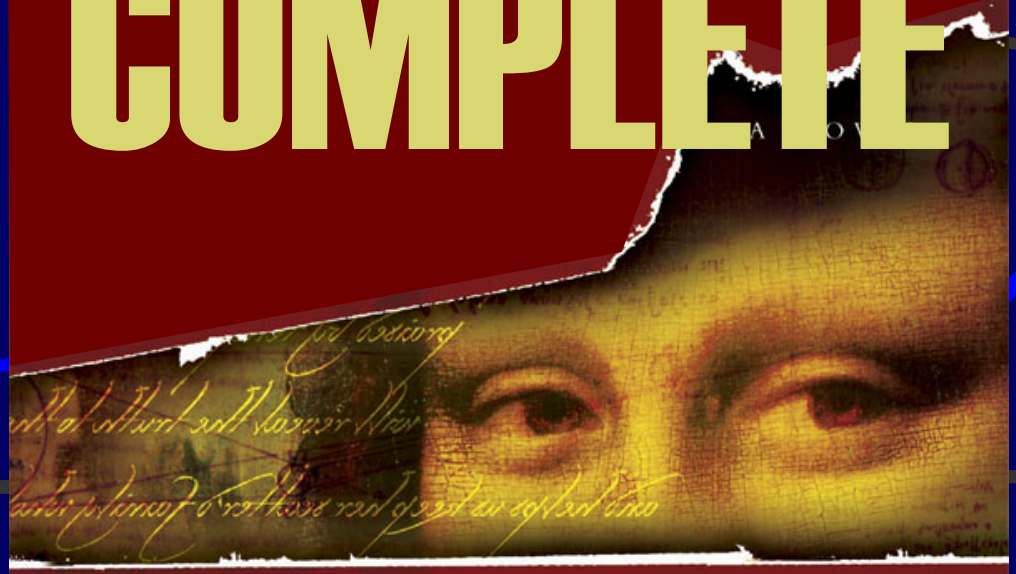
- What's best? Agile? XP? Scrum? DSDM? CMM?
- Toolbox explains there's no one right tool for every job
- Different industry segments will have different tools and even different toolboxes
- What's in the Software Engineering Toolbox?
  - Best practices
  - Lifecycle models
  - Templates, checklists, patterns, examples
  - Software tools

-10-
Software's Essential Tensions Remain

Software's Essential Tensions

- Software's essential tensions have remained unchanged for years:
  - Rigid plans vs. Improvisation
  - Planning vs. Fortune Telling
  - Creativity vs. Structure
  - Discipline vs. Flexibility
  - Quantitative vs. Qualitative
  - Process vs. Product
  - Optimizing vs. Satisficing
- Balance wavers, but basic tensions are constants

TALK COMPLETE



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