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The 10 Best Ideas in Software Development

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Most Key Ideas Are Not New

Q: What are the most exciting/promising software engineering ideas or techniques on the horizon?

A: I don't think that the most promising ideas are on the horizon. They are already here and have been here for years but are not being used properly.

— David L. Parnas

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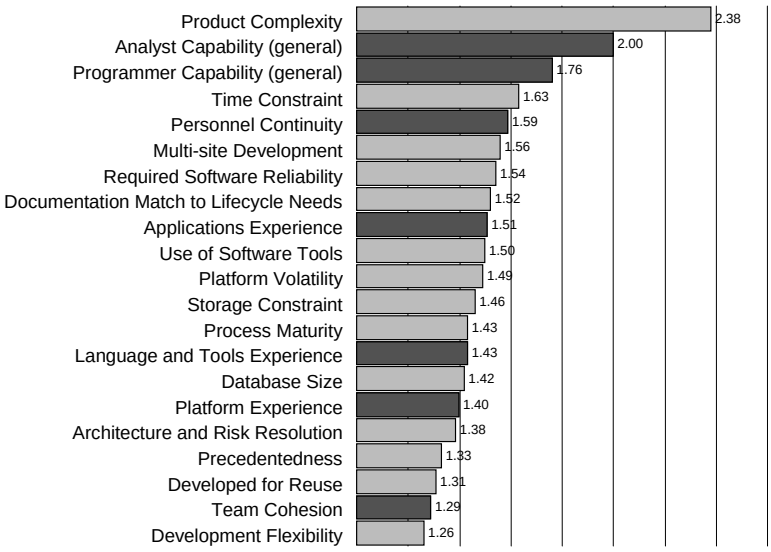
#1

Software Development Work is Performed by Human Beings

Cocomo II's View of Software Project Influences



Importance of Human Influences

- Human Influences make a 14x difference in total project effort & cost, according to Cocomo II
- Capability factors alone make a 3.5x difference
- Experience factors alone make a 3.0x difference
- Consensus of studies is that similarly-experienced developers vary by about 20x in productivity and quality of work

Where do Variations Exist?

Researchers have found 20:1 variations 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
- Teamwork
- Etc.

Some Implications

- Success of Google, Amazon, Microsoft, etc.
- Matching workers and workstyles
- Value of retention programs
- Importance of staff development

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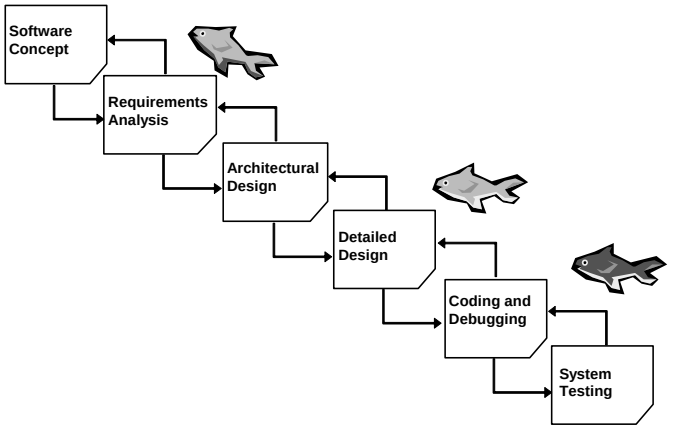
Creating software practices based on the assumption that developers are omniscient…

… i.e., the Waterfall Model



What About This?

From the Agile Manifesto

We value individuals and interactions over processes and tools.

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#2

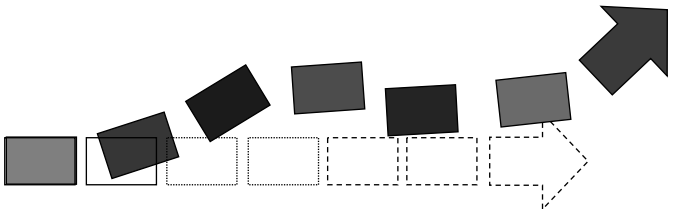
Iteration & Incrementalism are Essential

Incrementalism

- Definition: “The use of a series of regular additions or contributions”
- An “incremental” approach is one that is done a little bit at a time.
- The final result may be completely mapped out in advance

Iteration

- Definition: “Recital or performance a second time; repetition”
- An “iterative” approach is one that converges to a solution a little bit at a time
- The result is not known in advance



Iteration & Incrementalism

- Iterative approaches are incremental
- Incremental approaches are not necessarily iterative
- The waterfall model is neither incremental nor iterative
- Staged delivery is incremental but not iterative
- Evolutionary prototyping is both incremental and iterative
- Some practices derive their power from iteration, some from incrementalism, and some from both

Examples of Iteration & Incrementalism

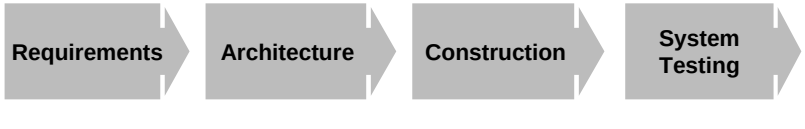
Iterative Approaches

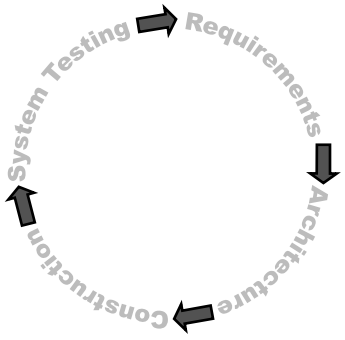
- Short development cycles (e.g., XP, Scrum)
- UI prototyping
- Evolutionary prototyping
- Requirements reviews
- Design reviews
- Project estimation
- Project planning

Incremental Approaches

- Staged delivery
- Design to schedule
- Incremental integration
- Daily builds
- Project planning

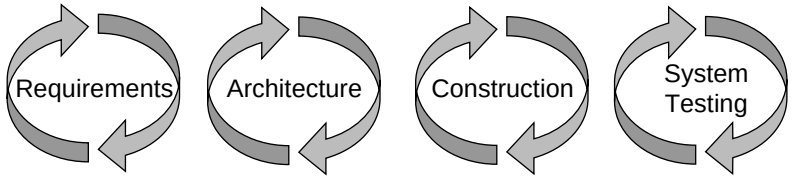
The only two development options in existence are "Iterate Everything" and "Iterate Nothing" (i.e., the Waterfall Model).





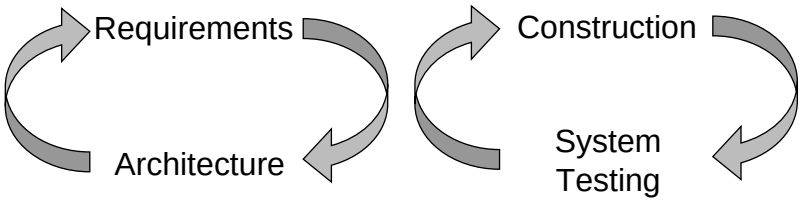
Iteration is a More Flexible Concept

- You can iterate *within* phases...



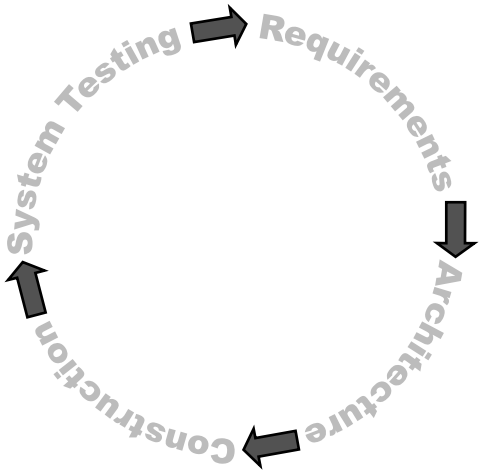
Iteration is a More Flexible Concept

- You can iterate *across* phases...



Iteration is a More Flexible Concept

- You can iterate across *entire dev cycles*



Iteration Applies Both in the Large and in the Small

- The degree of iteration can vary from practically 0-100% either *within* or *across* activities

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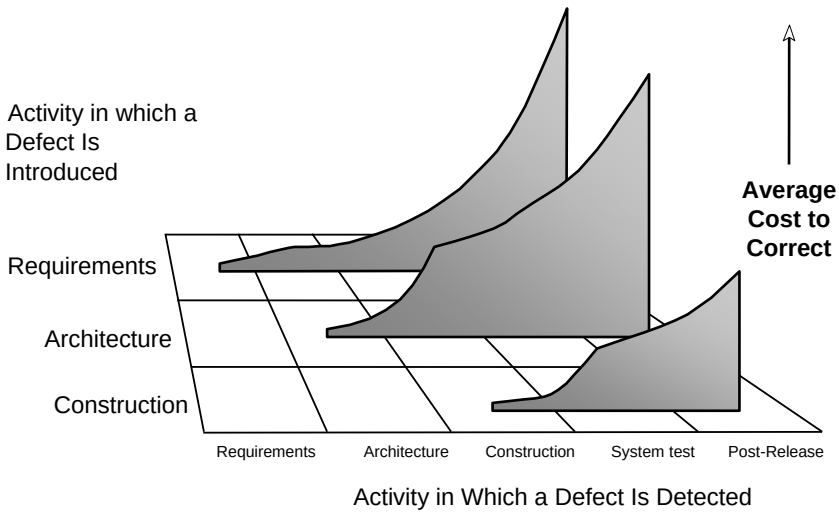
#3

The Cost To Fix A Defect Increases Over Time

Defect Cost Increase (DCI)



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Agile projects are immune to DCI dynamics.

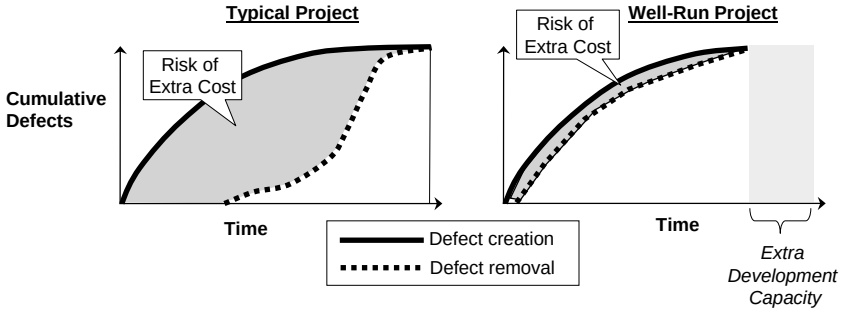
Fortunately, Some Agile Advocates Recognize DCI

"DCI is one of the few empirically verified truths about software development: the sooner you find a defect, the cheaper it is to fix."

–Kent Beck,
Creator of Extreme Programming

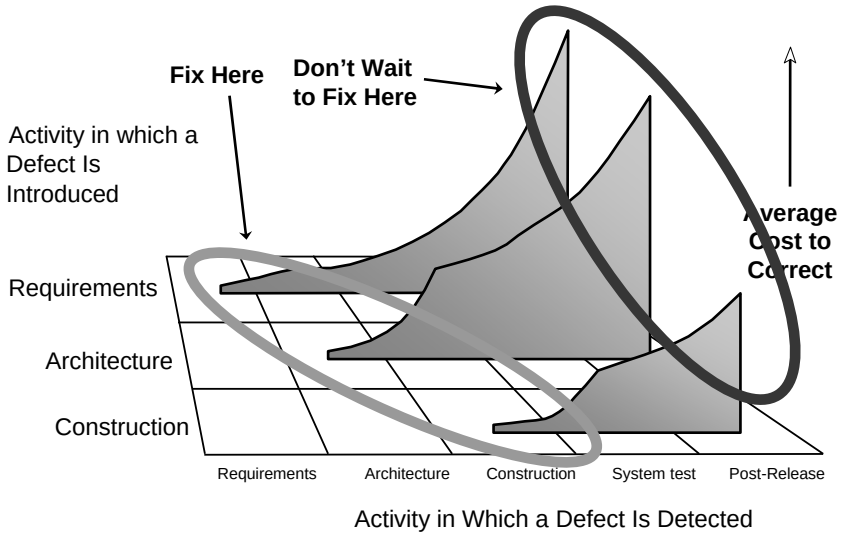
General Principle

- Defect creation is a function of effort
- Defect detection is a function of QA activities
- Goal is to minimize gap between defect insertion and defect detection/correction

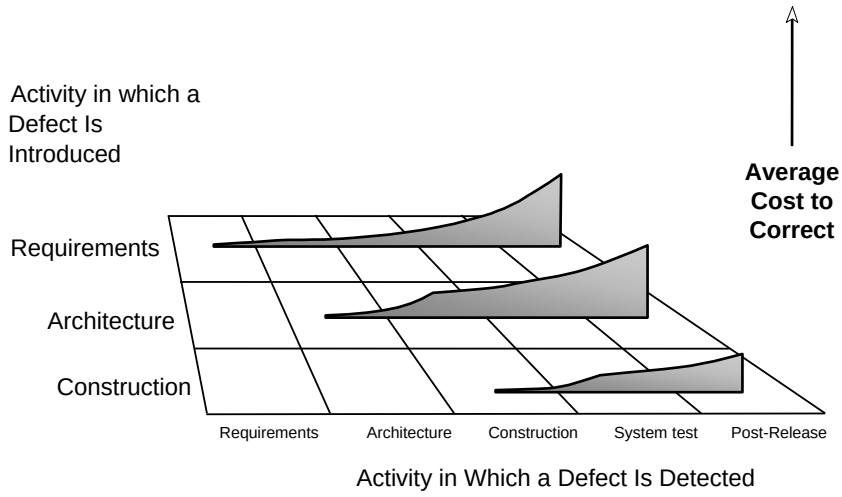


One Solution:

Fix Defects Earlier!



Another Solution:
Reduce Defect Cost Increase!



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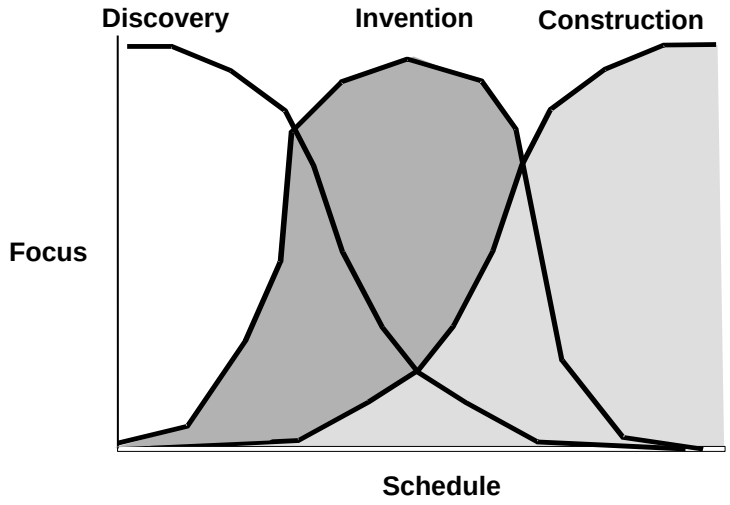
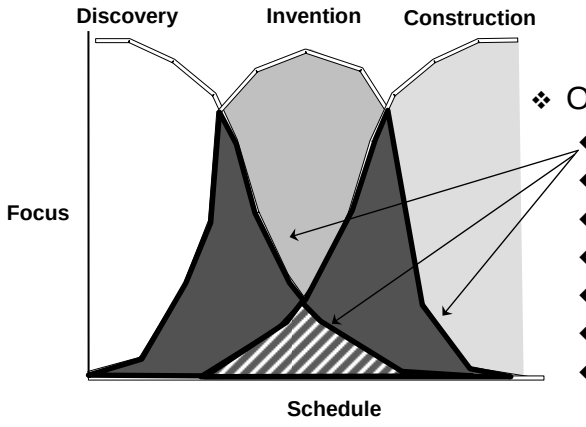
#4

Software Projects Tend to Follow a Predictable Intellectual Flow (Intellectual Phases)

Intellectual Phases



Cost of Overlapping Intellectual Phases



- Overlap =
  - Dependencies
  - Uncertainty
  - Risk
  - Rework
  - Higher costs
  - Longer schedules
  - Lower quality

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Since software projects are "wicked problems," we just have to accept that wickedness.

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Requirements are always changing, and our development practices should be based on the inevitablity of change.

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Requirements can be "gathered" (or they just drop out of the sky like manna from heaven)

A Successful Approach to Requirements

- Active approaches to requirements are *active* not passive
  - "Elicitation"
  - "Discovery"
  - "Investigation"
- The fact that it is possible to discover good requirements does not mean that it's *easy*

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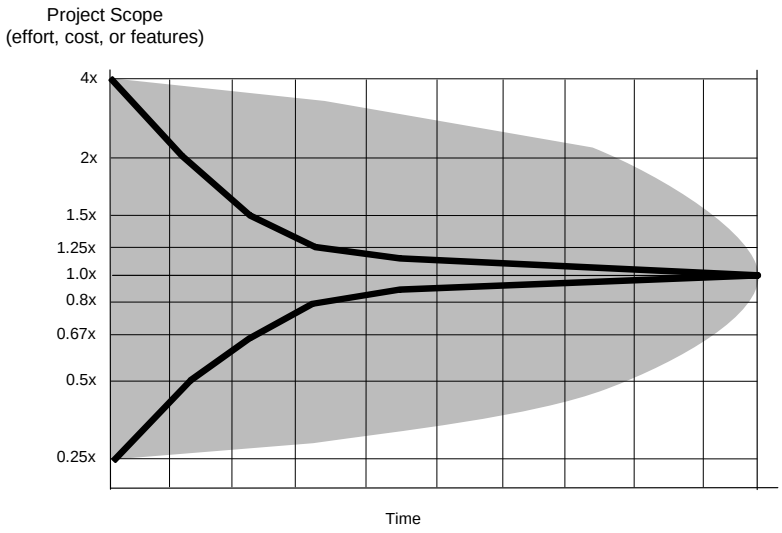
#5

Ability to Create Accurate Software Estimates Can be Improved Over Time (The Cone Of Uncertainty)

Cone of Uncertainty



Implications of the Cone of Uncertainty

- Estimation must be iterative
- Project planning must be incremental
- Estimates should contain descriptions of their inaccuracy

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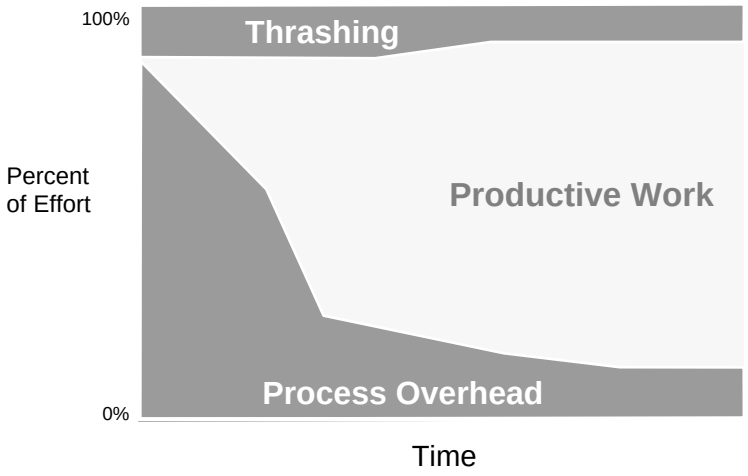
#6

The Most Powerful Form of Reuse is *Full* Reuse

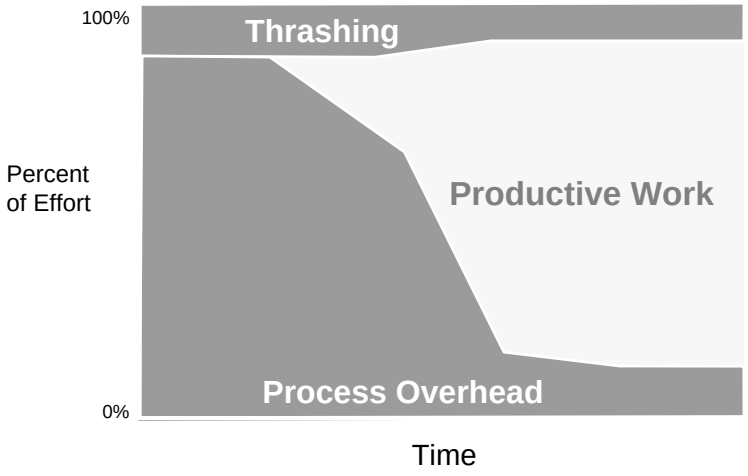
History of Reuse

- First idea was to reuse code
- Later idea was to reuse code + design
- Current idea is to reuse as much as possible, including processes and plans

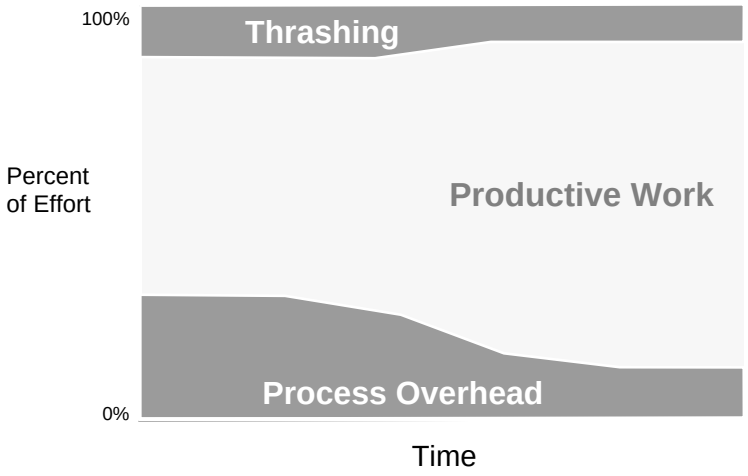
Effect of Adding Process the First Time (What I Wrote in *Software Project Survival Guide*)



Effect of Adding Process the First Time (What I Think Now)



Effect of Adding <u>Reused</u> Processes



What All Can Be Reused?

- Coding standards
- Change control policies
- Estimation procedures
- Formats & outlines of project plan, requirements doc, design docs, QA plan, test plan, etc.
- Checklists for plans, estimates, change control, inspections, QA, etc.
- Roles & responsibilities
- Training
- What are the most prominent current examples of *process* reuse?

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#7

Risk Management Provides Critical Insights into Many Core Software Development Issues

Risk Management Type 1: Extrinsic

- Added on to the project primarily for purposes of risk management
- Examples of Extrinsic Risk Management
  - Top 10 Risks list
  - Risk management plans
  - Risk officer
  - Etc.

Risk Management Type 2: Intrinsic

- Built into the project for other reasons; risk reduction is an additional benefit
- Examples of intrinsic risk management
  - Active project tracking
  - UI Prototyping
  - End-user involvement
  - Incremental delivery
  - Upstream technical reviews
  - Etc.

Risk Insights

- Risk is the key to many tough decisions in project management:
  - What is the best lifecycle model?
  - How much requirements work is enough?
  - How much design work is enough?
  - Can you use junior staff instead of senior staff?
  - Should you do design reviews? Code reviews?
  - How much schedule buffer do you need?

A View of Software Risk Reduction

Typical Relationship between Planned Work and Variable Work:

Planned Work | **Unplanned, Variable Work (typically >50% of total)**

Better Relationship:

Planned Work | **Planned "Overhead"** | **Unplanned, Variable Work**

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Entrepreneurial companies can't be afraid of risk.

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#8

Different Kinds of *Software* Call For Different Kinds of *Software Development* (The "Toolbox")

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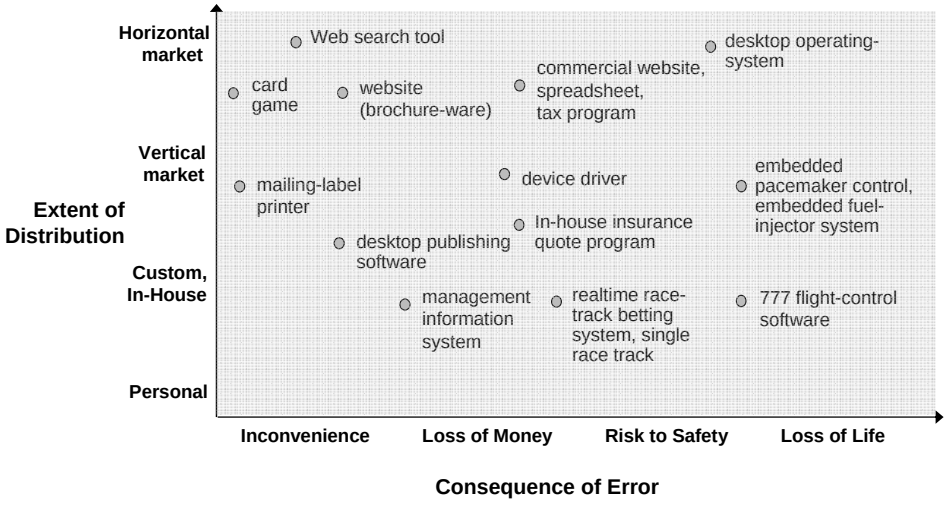
There is one single development approach that will work best for all projects.

How Could Any One Development Approach Possibly Work?



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#9

Software Engineering Body of Knowledge (SWEBOK)

The SWEBOK
(Software Engineering Body of Knowledge)

- Software Configuration Management
- Software Construction
- Software Design
- Software Engineering Management
- Software Engineering Process
- Software Maintenance
- Software Quality
- Software Requirements
- Software Testing
- Software Tools and Methods

What SWEBOK Supports

- Defined, reusable software development processes
- Academic curriculums
- Career development
- Professional certification
- Employment interviewing
- Technical skills inventory

And we're just getting started!

Is the SWEBOK the Ultimate Answer?

To organize something is to understand it.
– Aristotle

"Truth will sooner come out of error than from confusion."
– Francis Bacon

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Conclusions

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