



# How Program Size Affects Construction

Stefan Ast

# Motivation

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- The bigger a software development project is the more planning and organization work is needed
  - 10x larger project usually needs 30x the effort
  - Only 25% of this increase is construction work
  - Rest is planning, architecture and testing work
  - 10x larger project usually has 15x more errors
- To handle this extra effort formal methods are used

# Content

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- Project Size
  - Communication
  - Errors
  - Productivity
  - Coding vs. other Activities
- Formal Methods
- Agile Methods
- Key Points

# Project Size

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- Small projects usually use casual and instinctive methods
- Large projects usually use formal and carefully planned methods
- It is important to find the right balance of casual and formal methods that fits the project size

# Project Size

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- Project size can be determined by
  - Team size
  - Lines of code
  - Quality/Complexity
- Simple program is a smaller project than a well documented and tested software system.

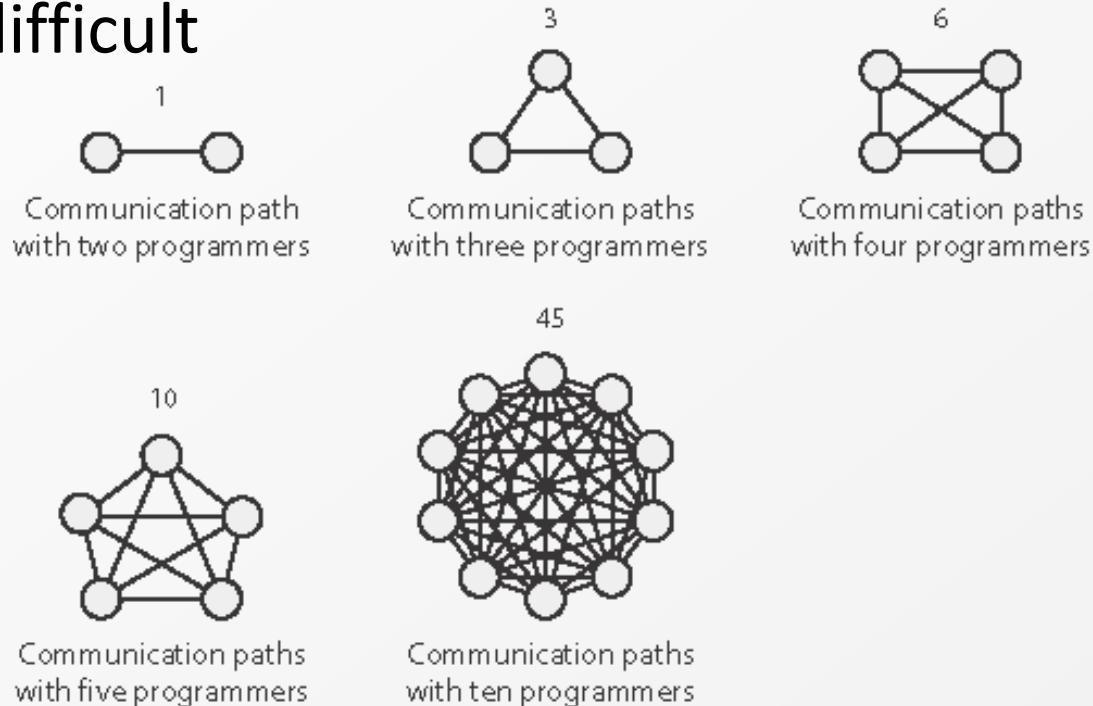
# Project Size

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- Kinds of software
  - Simple program
  - Software product
  - Software system
  - System product

# Communication

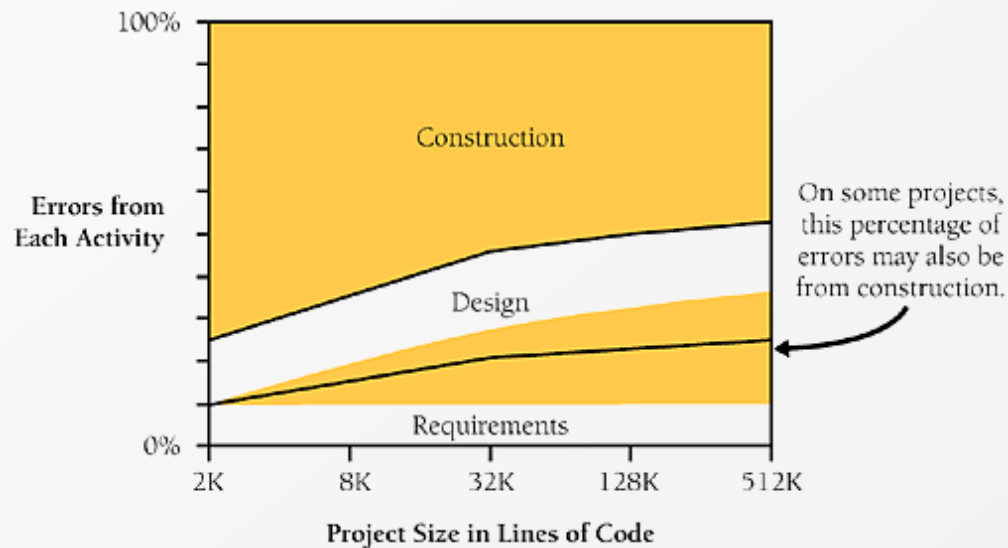
- As project size increases, communication becomes more difficult



Source: Steve McConnell. Code Complete, Second Edition. Microsoft Press, 2004, p. 650

# Errors

- As project size increases there is a
  - smaller amount of construction errors
  - greater amount of design and requirement errors

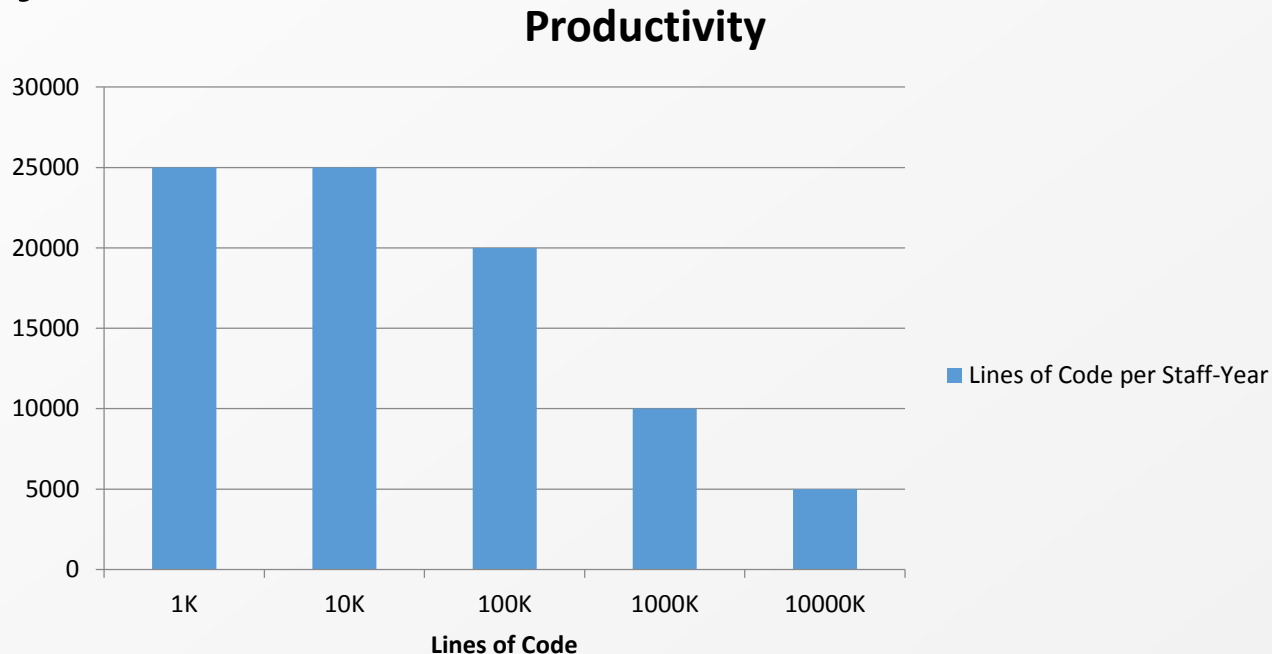


Source: Steve McConnell. Code Complete, Second Edition. Microsoft Press, 2004, p. 652



# Productivity

- On big projects productivity is lower than on small projects.



Source: Steve McConnell. Code Complete, Second Edition. Microsoft Press, 2004, p. 653

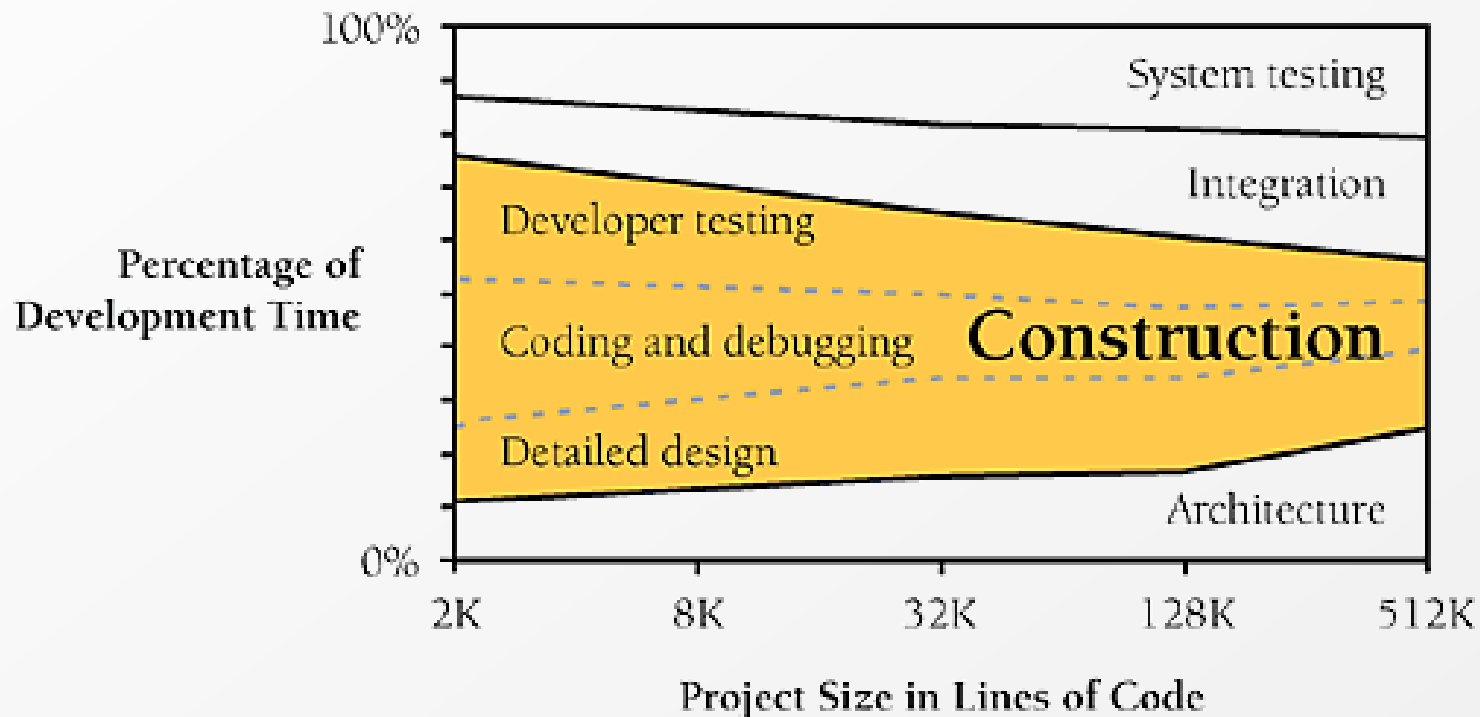
# Productivity

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- But all other things being equal productivity can also be influenced by
  - the kind of software
  - personnel quality
  - programming language
  - product complexity,
  - ...

# Coding vs. other Activities

- Larger projects need more architecture, integration and system testing work

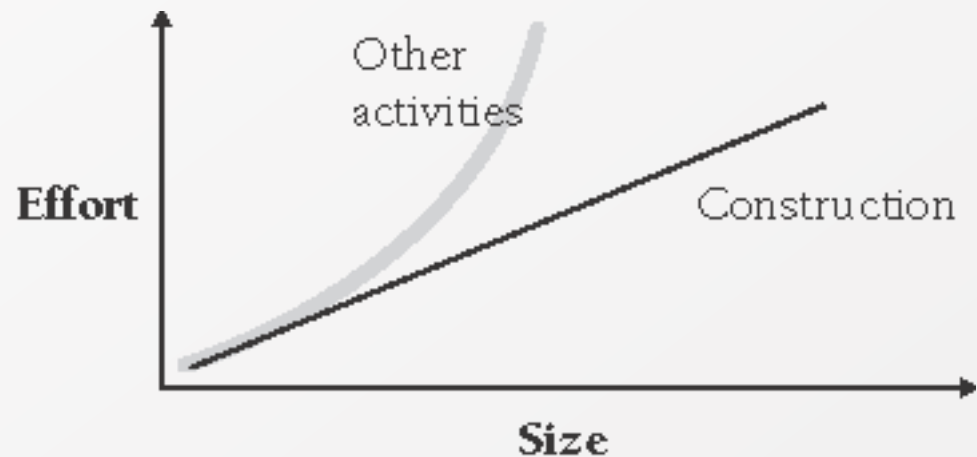


Source: Steve McConnell. Code Complete, Second Edition. Microsoft Press, 2004, p. 654

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# Coding vs. other Activities

- Construction work scales up proportionately
  - Detailed design
  - Coding
  - Debugging
  - Unit testing
- Other activities scale up faster
  - Communication
  - Documentation
  - Management
  - Interface design
  - System testing
  - ...



Source: Steve McConnell. Code Complete, Second Edition. Microsoft Press, 2004, p. 655

# Formal Methods

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- Large projects need formal methods
  - Very complex systems
  - Safety-critical systems
  - Systems which have to be highly reliable
- They focus on
  - defined requirements
  - standardized process management
  - thorough documentation (detailed plans, activities, workflow, roles and responsibilities)

# Formal Methods

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- Preconditions of formal methods
  - Requirements have to be stable
  - Environment has to be predictable
- Example
  - Waterfall model (sequential design process)
    - Progress flows steadily downwards through different phases
- Advantages
  - personnel can be moved quickly
  - loss of key personnel can be absorbed

# Formal Methods

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- Disadvantages
  - Innovation might be blocked
  - Additional effort is needed for managing and controlling
  - the focus can shift from the product to the process
- This can lead to spending more time writing documents than producing software.

# Agile Methods

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- Therefore agile methods have been developed
  - Fulfilling user expectations is more important than well-written code and documentation.
- They focus on
  - flexibility and speed
  - self-organizing teams
  - Close relationship with users/customers
  - programming as a craft and not as an industrial process.
  - no delivery of the entire product at once (several iteration cycles)



# Agile Methods

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- Agile methods are used when there are
  - smaller teams
  - more volatile requirements and environments
  - close relationship with customers and users
- Requirements
  - Highly motivated team members who have to be willing to work closely with other programmers
- Example
  - Scrum
    - Agile method framework with 30 day work intervals and daily 15 min Scrum meetings

# Key Points

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- As project size increase communication gets more difficult and has to be formalized in documents
- All other things equal a large project will have
  - more errors
  - lower productivity
- As project size increases construction activities become less predominant
- Scaling up agile methods works better than scaling down formal methods.
- Most effective to find the right balance of methods

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Thanks!