Presentation:

Issues in Testing Object Oriented Systems

by

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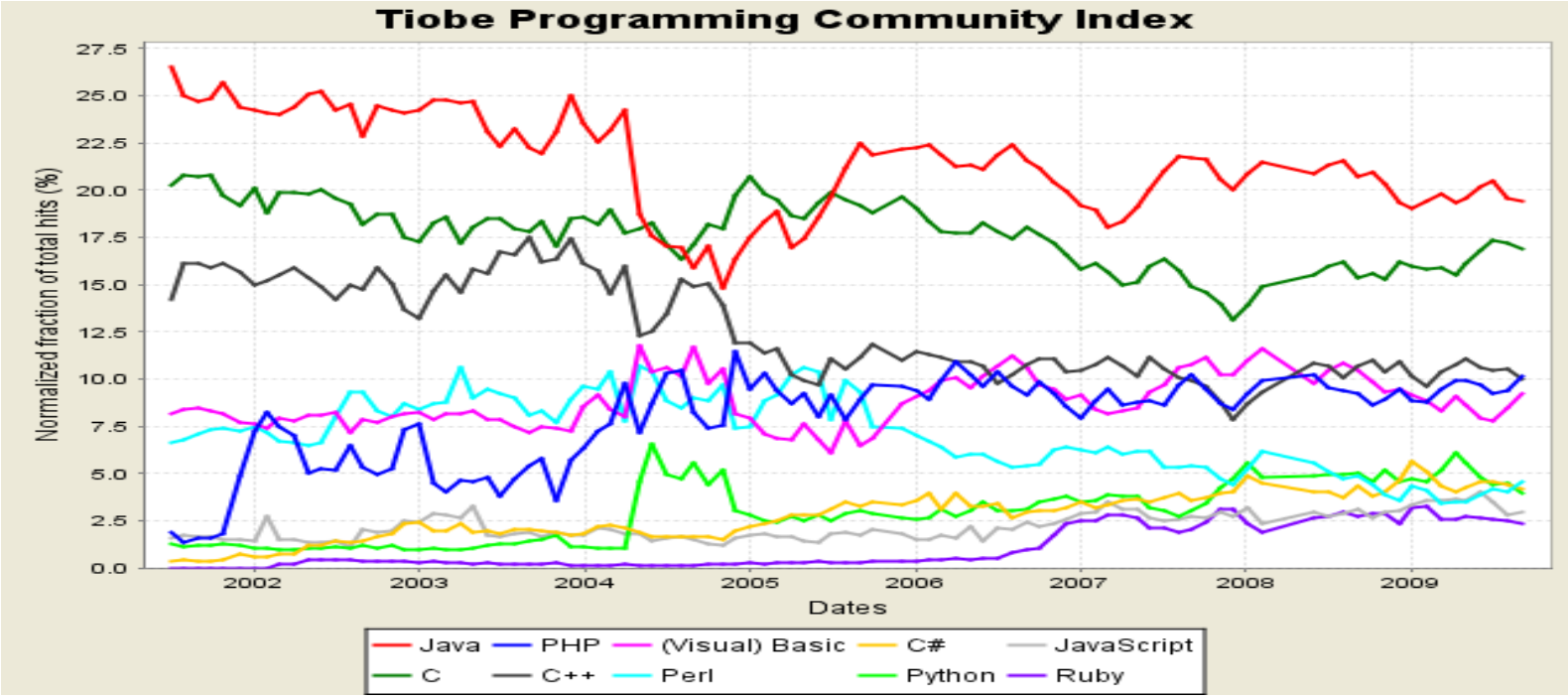
Outline

- Introduction
  - Motivation
  - Testing Types
- Overview on Object-Oriented Paradigm
- Issues on Testing
  - Testing Levels in OO Systems
  - Testing Concerns in OO Systems

Motivation

- Testing Achievements
  - Guarantee
  - Identification



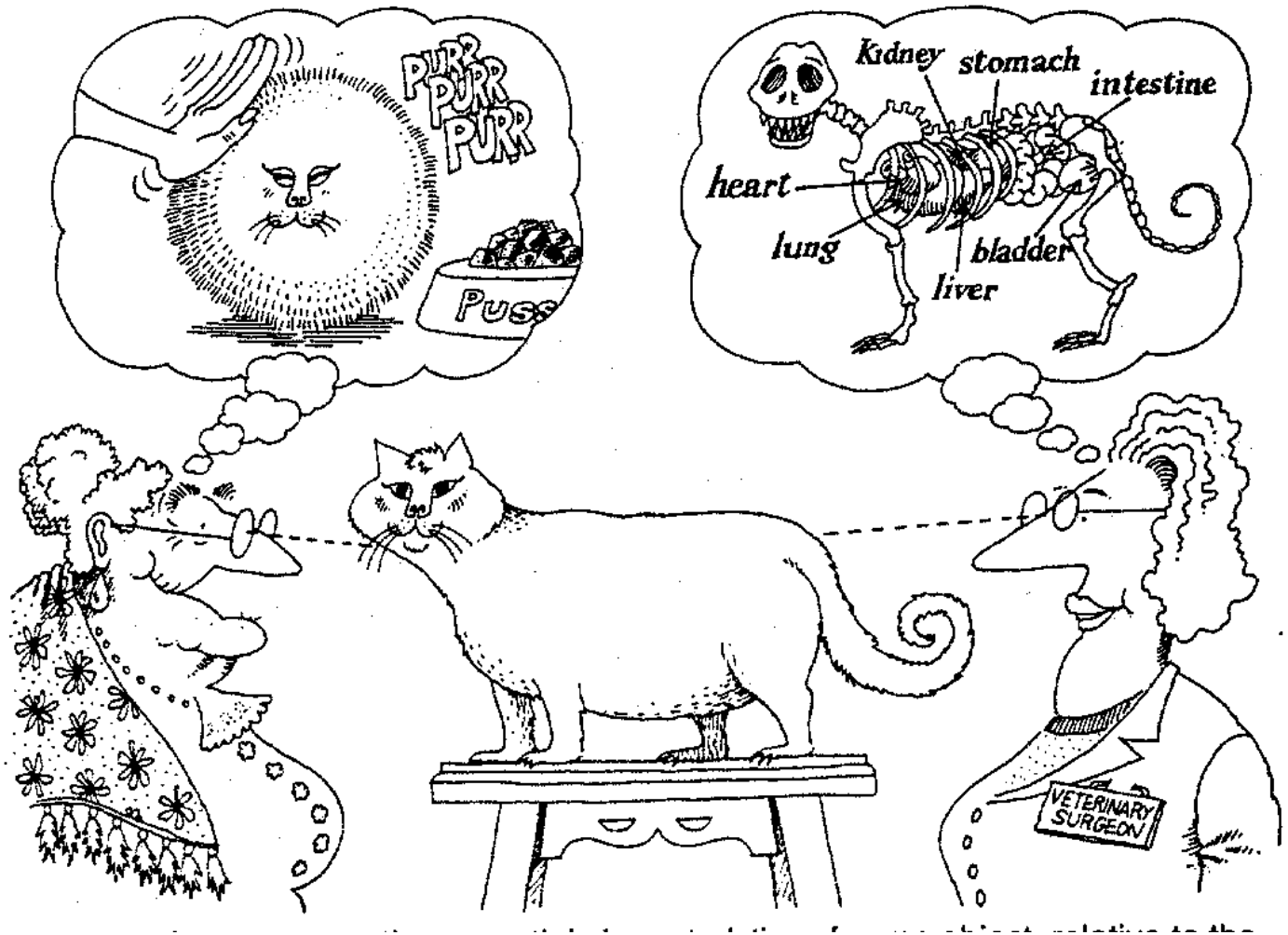
Types of Testing

- Functional Testing
  - Black-box Testing
  - Inputs vs. Outputs
- Structural Testing
  - White-box Testing
  - Level of Code Coverage
- Which one?

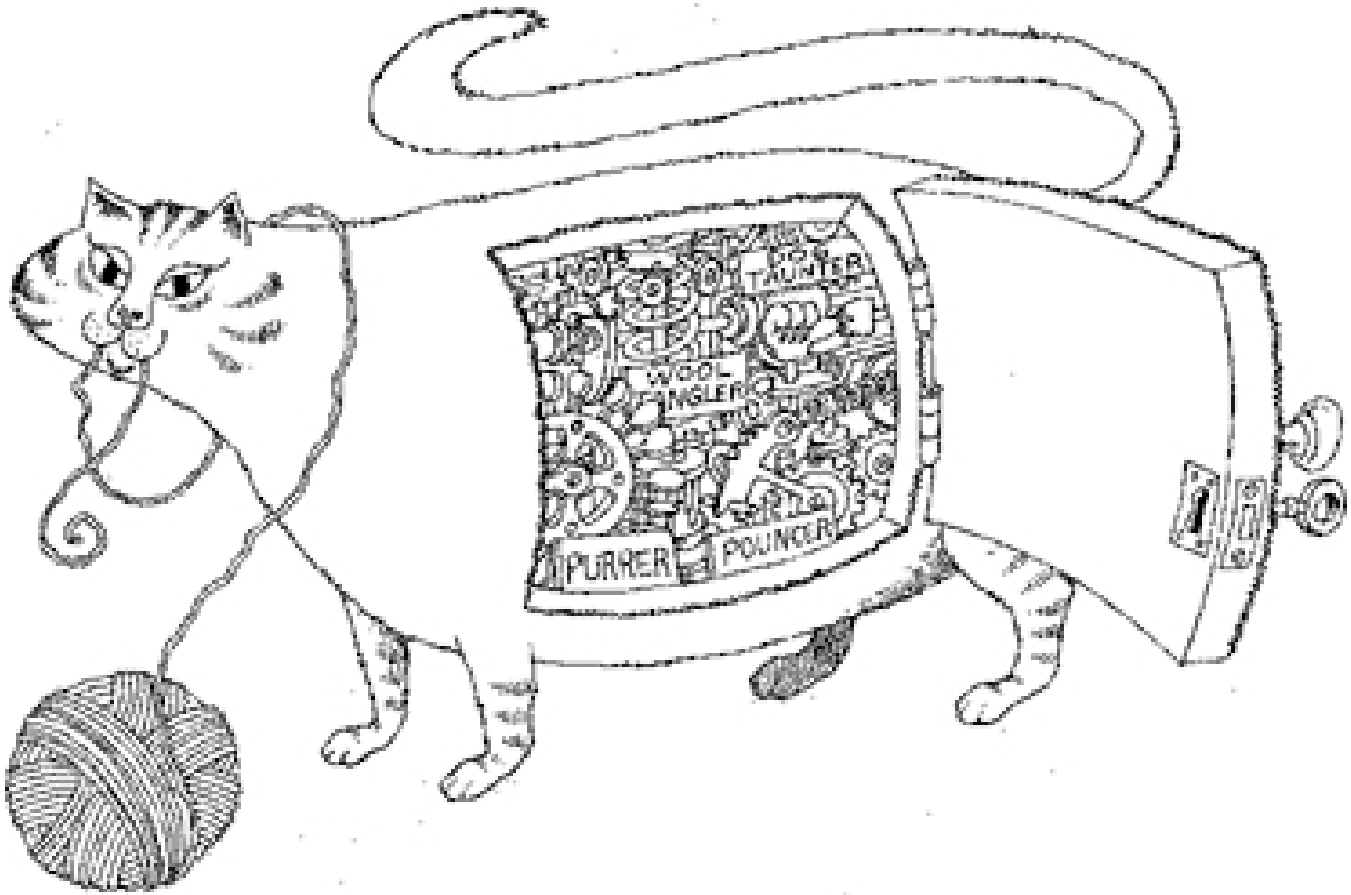
Object-Oriented Paradigm

- Data Abstraction
- Encapsulation
- Inheritance
- Polymorphism

Data Abstraction

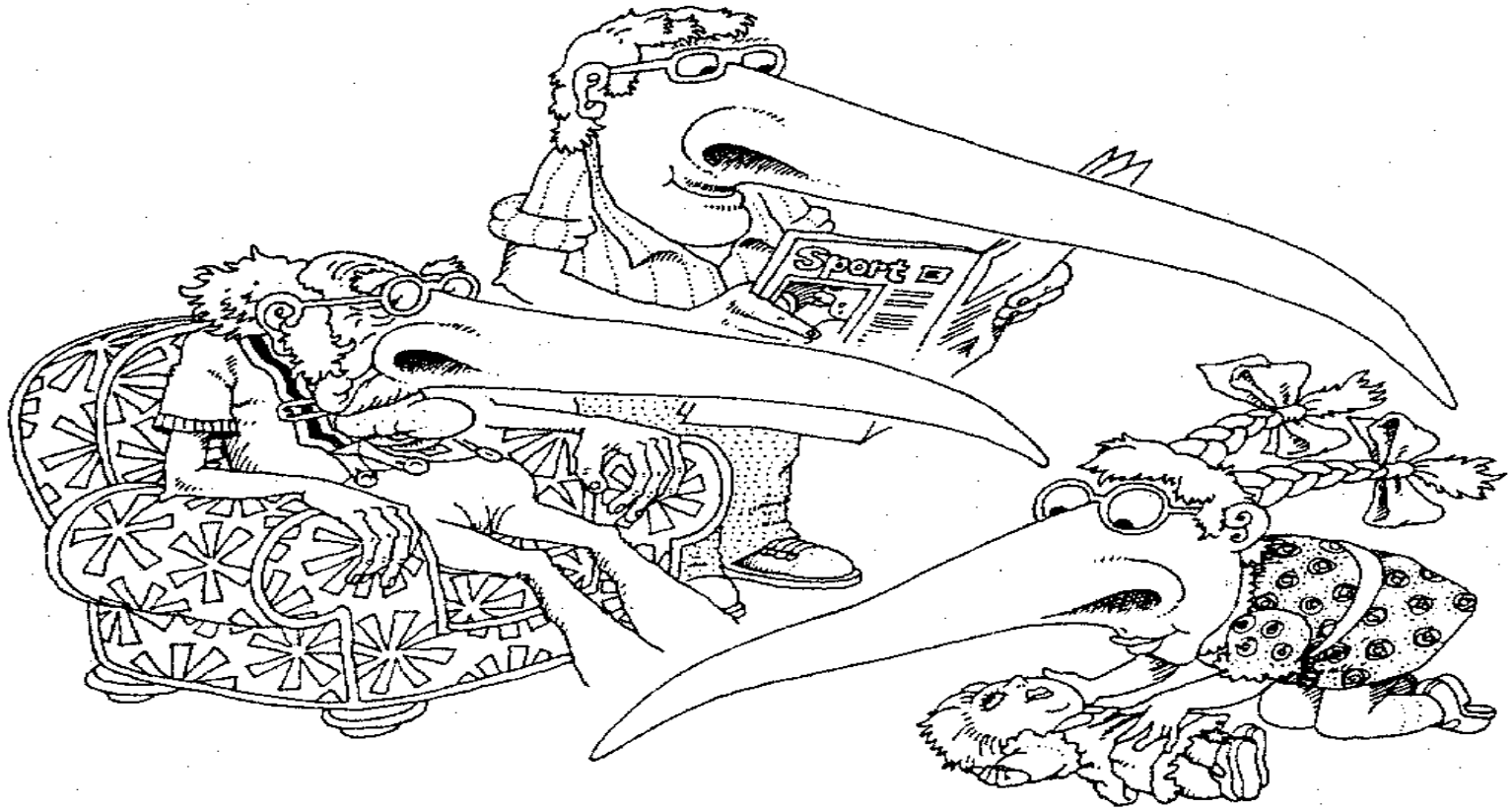


Encapsulation



- Interface
- Implementation

Inheritance



- Composite Inheritance
- Multiple Inheritance

Polymorphism

- Static Binding
- Dynamic Binding

Overriding

```
object is triangle
Area is 48

object is rectangle
Area is 100

object is rectangle
Area is 40

object is triangle
Area is 24.5

object is generic
Error: area() must be overridden.
Area is 0
```


- Complete an incomplete behavior
- Specialize previous (upper) behavior

Testing Levels

- Method Testing
- Class Testing
- Integration Testing
- System Testing

Method Testing

- Method Functional Specification
- Methods' Dependency
- Stubs

Class Testing

- Object Instantiation Testing
- Methods as a whole
- Intra-class Testing: Method Interaction
- Other classes
- Stubs

Integration Testing

- Class Communication Concerns: Faults
- Inter-class Testing: Class Interaction
- Strategies:
  - Big Bang
  - Bottom Up
  - Top Down

System Testing

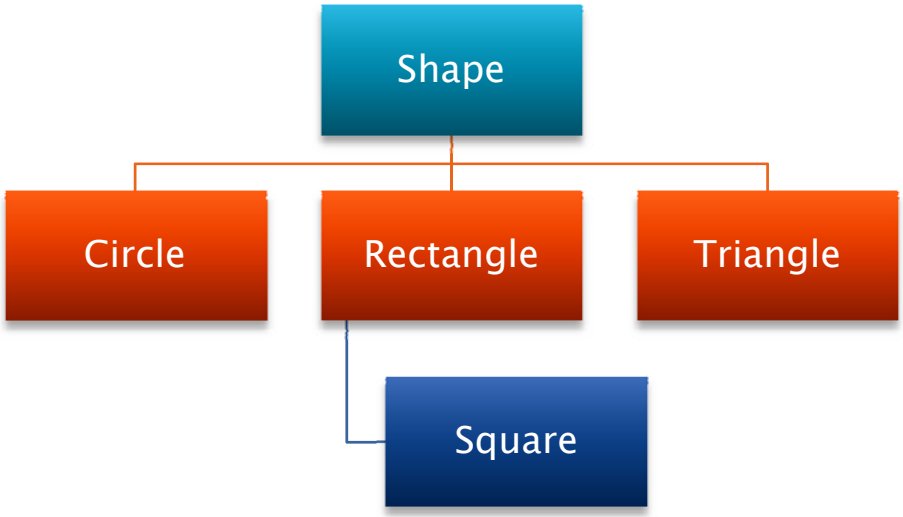
- Program as a whole
- Specifications of the program
- Functional Testing Criteria

Concerns: Encapsulation

- Access Control Challenges
- Risks in Changing Object States

Concerns: Inheritance

- Actual Features in Class Hierarchy
- Testing Hierarchy: Re-testability, Re-usability,
- Testing Axioms: Anti-extensionality, Anti-decomposition, Anti-composition
- Class Flattening



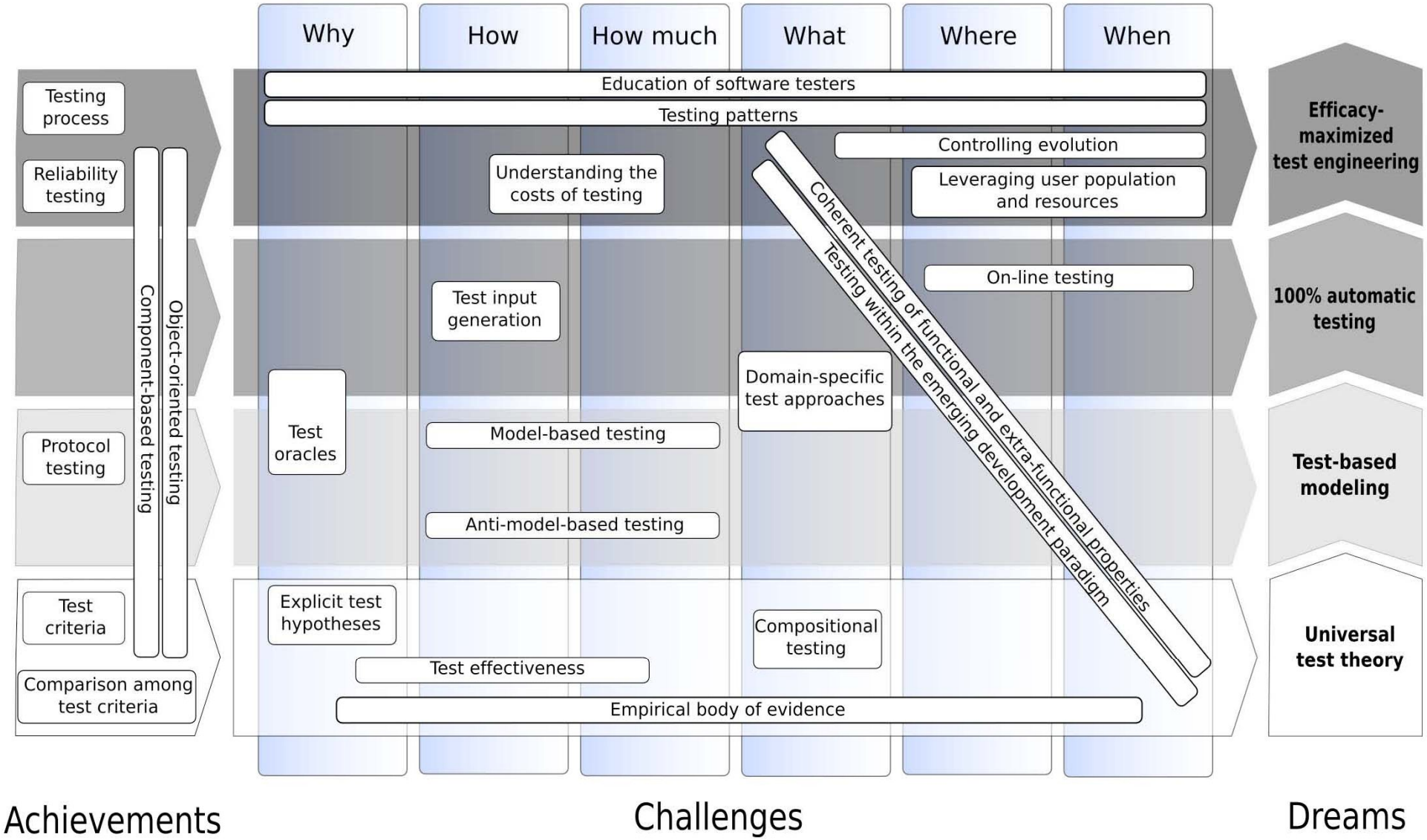
Concerns: Polymorphism

- Safety Testing Goals:
  - Complete Branch Coverage
  - Dynamically-Bound Methods
  - External Polymorphic Objects

Research Areas

- **Automation**: Test Case Extraction, Test Case Generation, Test Suite Framework, Test Oracles
- **Algorithms**: Method Call Sequence Generation: Evolutionary Algorithms
- **Methodology-oriented Testing**

Software testing research roadmap



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