Testable Code

Testing Testable Code Is Easy

” So you decided to finally give this testing thing a try. But somehow you just can't figure out how to write a unit test for your class. Well, there are no tricks to writing tests, **there are only tricks to writing testable code**.

If I gave you testable code you would have no problems writing a test for it. But, somehow you look at your code and you say, *"I understand how to write tests for your code, but my code is different"*. Well your code is different because you violated one or more of the following things.

http://googletesting.blogspot.com/2008/08/by-miko-hevery-so-you-decided-to.html

Things That Make Code Hard to Test: Complex Constructors

- Mixing object graph construction with application logic
  - If the code under test creates its own collaborators with `new`, it won't be possible to strategically replace them with test doubles.
- Ask for things, Don't look for things (aka Dependency Injection / Law of Demeter)
  - A class should ask for its direct dependencies as constructor parameters, and not ask for something else which is then used to locate the direct dependencies.
- Doing work in constructor
  - Anything in the constructor must be executed on every test. If it does complex things (like read a config file), it complicates the setup of every test that uses the class.

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http://googletesting.blogspot.com/2008/11/guide-to-writing-testable-code.html

Things That Make Code Hard to Test: Global Variables

- Global State
  - In production the application is instantiated only once, but in tests each test is a small instantiation of the application. Global mutable state creates dependencies between tests and causes undefined behaviour.
- Singletons (global state in sheep's clothing)
  - The static singleton antipattern [GoF] is the same as global variables. All internal objects of the singleton are global as well, recursively.

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http://googletesting.blogspot.com/2008/11/guide-to-writing-testable-code.html

Things That Make Code Hard to Test: No Polymorphism

- Static methods (or living in a procedural world)
  - Prodecural programs have no seams, or polymorphism (i.e. at compile-time the method you are calling can not be determined). Inserting test doubles to isolate the system under test is not possible. (Simple leaf methods such as `Math.abs()` are good, if they stay simple, but the `main` method can not be tested in isolation!)
- Favor composition over inheritance
  - Inheritance can not be changed at runtime – can not use test doubles. Using inheritance for code reuse is *wrong*.
- Favor polymorphism over conditionals
  - If you see a `swich` statement or a repeated `if` condition, think about polymorphism. Using polymorphism creates smaller classes, which in turn are easier to test.

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http://googletesting.blogspot.com/2008/11/guide-to-writing-testable-code.html
http://www.javaworld.com/javaworld/jw-08-2003/jw-0801-toolbox.html

Things That Make Code Hard to Test: Badly Structured Classes

- Mixing Service Objects with Value Objects
  - *Value-objects* do not refer to service-objects, can be created with new, are never mocked, are often immutable.
    - Examples: LinkedList, EmailAddress, CreditCard.
  - *Service-objects* collaborate with other service-objects, are never created with new, are good candidates for mocking.
    - Examples: MailServer, CreditCardProcessor.
  - Mixing the two creates a hybrid which has no advantages of value-objects and all the baggage of service-objects.
- Class has multiple responsibilities
  - If a class does more than one thing (*Single Responsibility Principle*), in reality it has multiple objects hiding in itself and you will not be able to test each of them in isolation.

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http://googletesting.blogspot.com/2008/11/guide-to-writing-testable-code.html
http://www.infoq.com/minibooks/domain-driven-design-quickly
http://butunclebob.com/ArticleS.UncleBob.PrinciplesOfOod

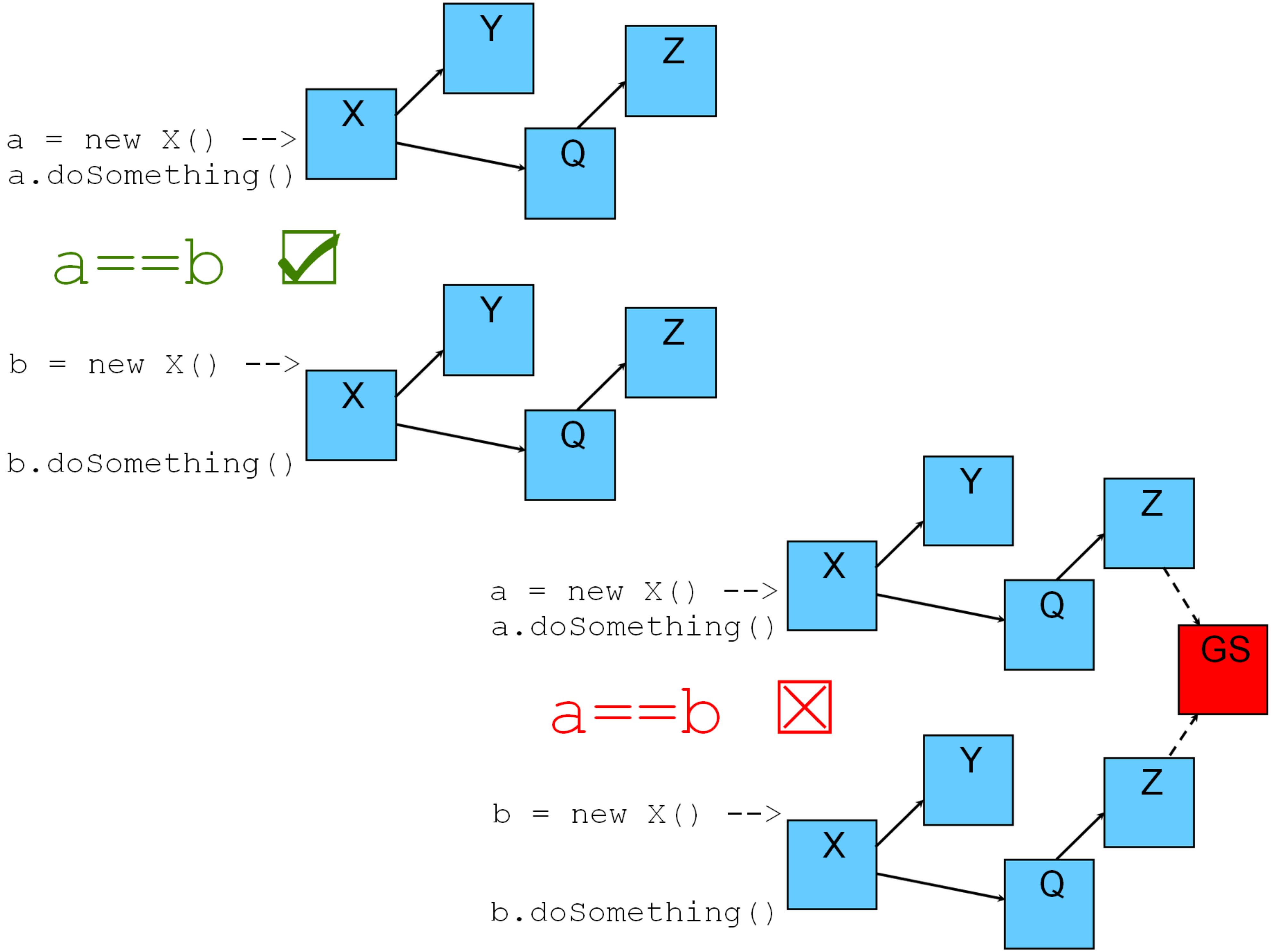
Global State

insanity *noun*

- Repeating the same thing and expecting a different result.

```
int a = new X().doSomething();
int b = new X().doSomething();
```

- Does: `a == b` or `a != b`



```
a = new X() -->
a.doSomething()
```

```
b = new X() -->

b.doSomething()
```

```
a = new X() -->
a.doSomething()
```

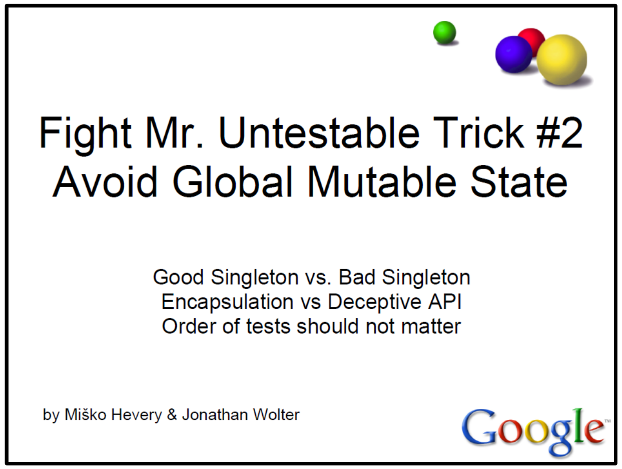
```
b = new X() -->

b.doSomething()
```

http://googletesting.blogspot.com/2008/11/clean-code-talks-global-state-and.html

Singletons and Global State

- The static singleton pattern is evil
  - Only one instance per JVM (or ClassLoader), but *JVM scope* != *Application scope*. Especially each test needs a new application instance.
- Creating just one instance is good
  - Create one instance of the class when the application starts, and pass it using dependency injection to all who need it.
- Presentation:
  (54 min)



Fight Mr. Untestable Trick #2
Avoid Global Mutable State

Good Singleton vs. Bad Singleton
Encapsulation vs Deceptive API
Order of tests should not matter

by Miško Hevery & Jonathan Wolter

Google

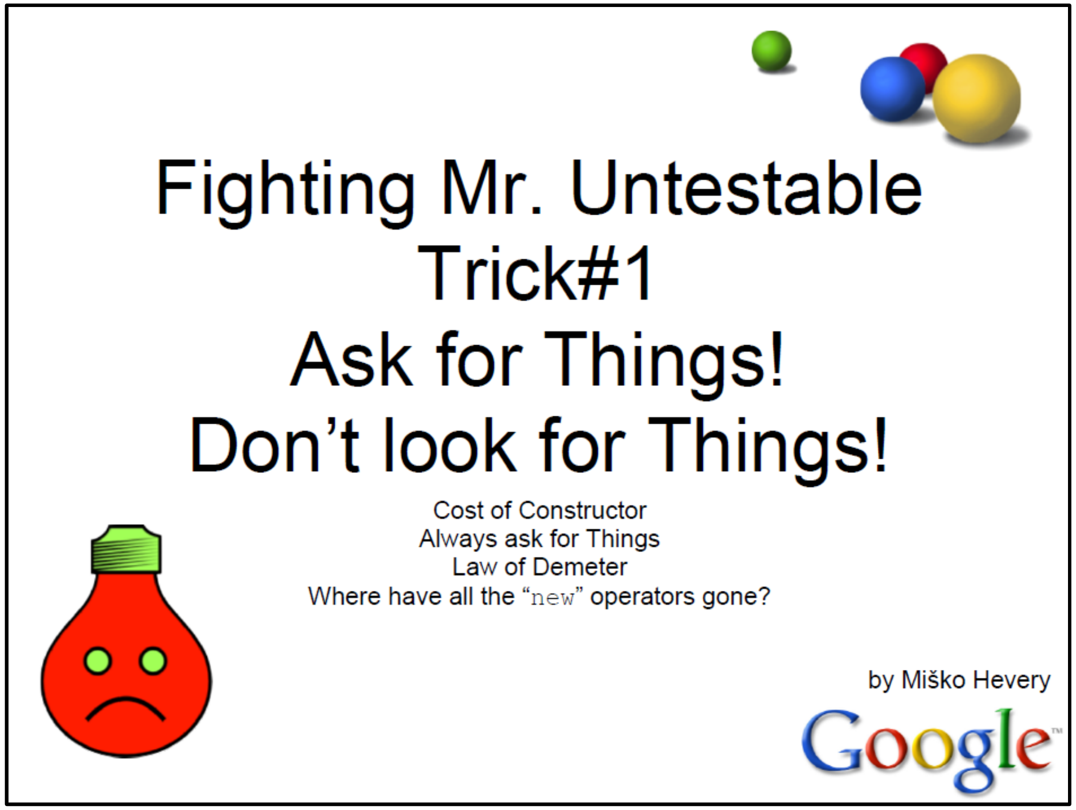
http://googletesting.blogspot.com/2008/11/clean-code-talks-global-state-and.html

Dependency Injection

- Do not construct collaborators with `new`. Receive them as constructor parameters.
  - `new` will be used only inside factories or a DI framework.
  - Separates behaviour from dependency resolution.
  - Makes the dependencies of a class explicit.
  - Makes testing easier, enables mocking the dependencies.
- DI is a design pattern – a framework is not needed.
  - In a small application you can write factories manually, or even put everything together in the `main` method.
  - With a medium to large application, using a DI framework removes much boilerplate code, provides scopes, AOP etc.
    - For example: Guice (http://code.google.com/p/google-guice/)

Dependency Injection

- Presentation:
  (38 min)



Fighting Mr. Untestable
Trick#1
Ask for Things!
Don't look for Things!

Cost of Constructor
Always ask for Things
Law of Demeter
Where have all the "`new`" operators gone?

by Miško Hevery

Google

http://googletesting.blogspot.com/2008/11/clean-code-talks-dependency-injection.html

Course Material

- http://googletesting.blogspot.com/2008/08/by-miko-hevery-so-you-decided-to.html
- http://misko.hevery.com/code-reviewers-guide/
  http://googletesting.blogspot.com/2008/11/guide-to-writing-testable-code.html
- http://googletesting.blogspot.com/2008/11/clean-code-talks-dependency-injection.html
- http://googletesting.blogspot.com/2008/11/clean-code-talks-global-state-and.html